BLOCK-1

Foundation

MODULE RATIONALE

The dental students need to master competencies that align their knowledge and skills, and prepare them for the dynamics of their profession. The foundation module lays the groundwork on which the integrated dental curriculum stands strong to uphold the sound practices of the dental profession. The foundation module has been designed to introduce the dental students to the concepts of dentistry and explain the molecular, genetic, anatomical, physiological and pathological mechanisms essential for body functions. Cell is the structural and functional unit of life and this module. Using a constructivist approach this module gives an orientation to the dental students on which they are prepared for the upcoming modules.

MODULE OUTCOMES

- Classify human dentition.
- Identify and describe the anatomical landmarks of tooth using models and diagrams.
- Interpret different tooth numbering systems.
- Describe the structure and function of cellular organelles.
- Classify the different types of bones with examples.
- Describe the microscopic structure of various tissues (bone, muscles etc).
- Explain homeostasis and discuss the role of control system in maintaining homeostasis.
- Compare the prokaryotic and eukaryotic cells.
- Describe the significance, sources and functions of essential fatty acids.
- Describe the mechanism of cell injury.
- Explain the structure of bacteria.
- Discuss the different methods of sterilization.
- Discuss the various routes of drug administration.
- Explain the clinical significance of plasma half-life.
- Describe the drug clearance mechanism

SUBJECTS INTEGRATED IN THE MODULE

- Anatomy
- Physiology

- Biochemistry
- Oral Biology
- Pharmacology & Dental Therapeutics
- Microbiology
- Community Dentistry & Public Health
- Behavioral Science
- General Pathology


SYLLABUS

THEORY			
GENERAL ANATOMY			
CODE	SPECIFIC LEARNING OUTCOMES	Total hours = 10	
		INTEGRATING DISCIPLINE	TOPIC
F-A-001	Define different branches of Anatomy		Introduction to Human Anatomy: Definitions, Terminology, and Planes
	Describe the "Anatomical Position"		
	Discuss the planes of body		
	Describe the terms related to position, movement and laterality		
F-A-002	Discuss the structural characteristics of compact and spongy bones		Osteology
	Classify bones based on region, size and shape providing examples of each, preferably from the head and neck		
	Describe the general characteristics of an adult typical long bone		
	Define ossification and briefly describe the process of intramembranous and endochondral ossification		
	Describe rule of ossification		
	Describe the blood supply of various types of bones		

	Describe the features of different views of skull (Anterior, Posterior, Superior, Inferior, Lateral)		
F-A-003	Describe the structural classification of Joints (fibrous, cartilaginous and synovial) along with their sub-classifications with examples of each		Joints
	Enlist the general characteristics of synovial joints		
	Enlist the factors stabilizing a synovial joint		
	Describe Hilton's Law		
F-A-004	Discuss and differentiate the gross features of hyaline, elastic and fibrocartilage		Cartilage
F-A-005	Describe the types of muscular tissue (skeletal, smooth and cardiac)		Myology
	Describe parts of a muscle		
	Classify and exemplify skeletal muscles on the basis of shape, fiber architecture and action		
F-A-006	Describe the two layers of skin (epidermis and dermis)		Integumentary System
HISTOLOGY			
CODE	**SPECIFIC LEARNING OUTCOMES**	**Total hours = 21**	
		INTEGRATING DISCIPLINE	**TOPIC**
F-A-007	Describe the electron microscopic structure and fluid mosaic model of plasma membrane		Cell
	List the membranous and non-membranous cellular organelles of cell		
	Describe the structure of the cellular organelles and correlate with their functions	Physiology	

	Describe the structure of different types of cell junctions	Oral Biology	
	Briefly describe the structure of nucleus		
F-A-008	Classify and exemplify the epithelia with their histological structure, locations, and functions		Epithelium
	Describe the electron microscopic structure & functions of the following apical cell surface specializations: i. Microvilli ii. Stereocilia iii. Cilia		
	Describe the structure of basement membrane		
	Classify and exemplify the exocrine glands on the basis of: Shape of secretory portions and ducts mode of secretion and types of secretion and Shape of secretory portions and ducts		
F-A-009	List the connective tissue cells along with their functions		Connective Tissue
	Describe the composition of ground substance of connective tissue		
	Describe the structure of fibers of connective tissue		
	Classify connective tissue along with their examples		
	Draw and label light microscopic diagram of different types of connective tissue		
F-A-010	Describe the microscopic and ultramicroscopic structure of all types of cartilages		Cartilages

	Draw and label light microscopic diagram of different types of cartilages		
F-A-011	List the bone cells along with their functions		Bones
	Describe the composition of bone matrix (organic, inorganic)		
	Describe the histology of compact and spongy bone		
	Draw and label light microscopic diagram of compact and spongy bones		
F-A-012	Describe the microscopic structure and ultramicroscopic structure of skeletal, cardiac, and smooth muscles		Muscles
F-A-013	Draw and label light microscopic diagram of muscles		Lymphoid System
	Describe the light microscopic structure of lymphoid organs		
	Draw and label light microscopic diagram of lymphoid organs		
F-A-014	Describe the composition of epidermis and dermis		Skin
	Draw and label light microscopic diagram of thick and thin skin		
PHYSIOLOGY			
CODE	**SPECIFIC LEARNING OUTCOMES**	**Total Hours: 21**	
		INTEGRATING DISCIPLINE	**TOPIC**
F-P-001	Define Homeostasis		Homeostasis: Control of Internal Environment
	Describe internal environment of the body		
	Differentiate between Extracellular and Intracellular Fluids (with special emphasis on comparing the		

	concentration of sodium, potassium, and calcium ions)		
F-P-002	Name control system of body by giving examples		Control Systems of the Body
	Explain the positive, negative, and feed-forward mechanisms with examples		
F-P-003	Discuss organization of the cell		Cell and its Organelles and their Functions
	Explain the structure and functions of the cell membrane		
	Enlist the functions of Glycocalyx		
	Name different proteins of the cell membrane with their functions		
	Enlist membranous and non-membranous organelles		
	Enlist the self-replicative organelles		
	Differentiate between the functions of smooth and rough endoplasmic reticulum		
	Explain the functions of Golgi apparatus		
	Explain the functions of lysosomes		
	Explain the functions of peroxisomes		
	Compare functions of lysosomes and peroxisomes		
	Enlist functions of mitochondria and ribosomes		
	Enumerate the components and functions of the cytoskeleton		
F-P-004	Define and enlist types of endocytosis		Functional Systems of Cell
	Explain the mechanism of pinocytosis		
F-P-005	Enlist different transport mechanisms		Transport of Substance through Cell Membrane
	Discuss the process of simple diffusion across the cell membrane		
	Explain the process of facilitated diffusion		
	Compare features of simple and facilitated diffusion with examples		
	Classify different types of active transport		

	Describe primary and secondary active transport with examples		
	Enlist and explain functions of Na-K pump		
F-P-006	Discuss the components of blood		Blood with Special Emphasis on Red Blood Cells, Anemia and Polycythemia
	Enlist the functions of blood		
	Enlist plasma proteins		
	Enumerate the different sites of erythropoiesis at different ages		
	Enlist the stages of erythropoiesis		
	Discuss characteristics of red cells		
	Give normal range of red cells in blood, also their shape and size		
	Define blood indices mentioned as: MCV (mean corpuscular volume), MCH (mean corpuscular hemoglobin), and MCHC (mean corpuscular hemoglobin concentration). Give their normal values & enumerate the conditions in which these values are disturbed		
	Discuss functions of red cells		
	Discuss the site and mechanism of production of erythropoietin and its role in erythropoiesis		
	Explain the significance of vitamin B12 and folic acid in maturation of red blood cells		
	Enumerate and elaborate role of factors/nutrients that are required and regulate erythropoiesis		
	Discuss components/structure of hemoglobin		
	Define sickle cell anemia		
	Discuss fate of red cells when they complete their life span		
	Define and classify anemia on the basis of morphology and cause.		
	Discuss the effects of anemia on circulation		
	Define and enlist types of polycythemias		

	Discuss the effects of polycythemias on circulation		

BIOCHEMISTRY			
CODE	SPECIFIC LEARNING OUTCOMES	TOTAL HOURS = 37	
		INTEGRATING DISCIPLINE	TOPIC
F.B. 001	Define carbohydrates and their general structure.		Carbohydrate
	Classify carbohydrates into monosaccharides, disaccharides, oligosaccharides, and polysaccharides and their biochemical importance		
	Define carbohydrate isomerism, differentiate between aldo-keto isomers, D & L isomers, epimers, and α & β anomers, and provide suitable examples of each relevant to dentistry (dental caries, salivary glycoproteins)		
	Differentiate between reducing and non-reducing sugars.		
	Define blood glucose levels and identify the normal ranges for fasting, random, and postprandial blood glucose measurements.		
	Define glycemic index and evaluate the impact of various dietary carbohydrates on blood sugar levels, highlighting their clinical significance.		
F.B. 002	Define amino acids and classify standard amino acids according to side chain and nutritional importance		Amino Acid & Protein Classification with Importance
	Define and classify proteins on the based on their functions and axial ratio along with their biological significance		
	Explain the levels of protein organization (primary, secondary, tertiary, and quaternary structures) and their relevance to protein function.		

F.B. 003	Define lipids and their Classification along with their biological importance		Lipids
F.B. 004	Define and classify vitamins based on their solubility.		vitamins.
	Briefly explain the active forms, sources, (RDA), biological roles, and associated deficiency disorders of Vitamin B-complex including B1, B2, B3, B6, B9, and B12, vitamin E and Vitamin C in relation to RBC's.		
F.B. 005	Define acids, bases, and pH in biological systems.		Acid, Base, pH & Buffers
	Explain the concept of pH scale and its importance in body fluids.		
	Enlist the buffer systems of the human body and their role in maintenance of homeostasis.		
	Describe the Henderson-Hasselbalch equation and its applications.		
F.B. 006	Define enzymes and their role in biological reactions.		Enzymes
	Classify enzymes with examples of each		
	Explain the properties and mechanism of enzyme		
	Describe the factors affecting enzyme activity and regulation of enzyme		
F.B. 007	Describe the fluid mosaic model of cell membrane		Cell
	Describe the role of cell organelles and describe the technique of subcellular fractionation for separation of cell organelles and enlist marker enzymes for various cell components.		
F.B. 008	Define and classify receptors.		

	Delineate the sequence of events in the signal transduction pathways involving Gs and Gq proteins.		Signal Transduction Pathways
F.B. 009	Differentiate between anabolism and catabolism, and list the metabolic pathways associated with each process.		Cell Energy Metabolism
	Outline the steps of glycolysis pathway including regulation of key enzymes with energetics		
	Differentiate between aerobic and anaerobic glycolysis, highlighting the fate of pyruvate in each condition		
F.B. 010	Describe the structure of Heme and briefly describe the steps of Heme synthesis with its regulation.		Hemoglobin Structure, Types, and Functions
	How does Heme combine with Globin to form Hemoglobin and Enlist the functions of Hemoglobin		
	Enlist the types of hemoglobin along with their percentage and chain composition.		
	Explain the significance of HbA1c		
	Define and explain the biochemical basis of porphyria along with its classification.		
	Describe the oral and dental manifestations of porphyria, including erythrodontia, photosensitivity, mucosal lesions, and delayed healing.	Oral Pathology	
F.B. 011	Describe and outline the steps in Hexose Monophosphate Pathway (HMP) and its significance in RBC's		Metabolic Pathways in Red Blood Cells
	Compare and contrast Glycolysis and the HMP Shunt		
	Explain hemolytic anemia due to pyruvate kinase and glucose 6 phosphate dehydrogenase deficiencies.		

F.B. 012	Understand the oxygen-binding mechanism of hemoglobin, including the concepts of cooperative binding and allosteric regulation.		Oxygen Dissociation Curve
	Explain and draw the oxygen-hemoglobin dissociation curve for hemoglobin.		
	Give biochemical explanation for abnormally high oxygen affinity of hemoglobin in the stored blood.		
F.B. 013	Describe the biochemical role of Selenium and Iron in RBC function, antioxidant defense, and erythropoiesis.		Biochemical Role of Selenium, Iron in RBC function

ORAL BIOLOGY			
CODE	SPECIFIC LEARNING OUTCOMES	TOTAL HOURS = 18	
		INTEGRATING DISCIPLINE	TOPIC
F-OB-001	The Tooth		Structure of Oral Tissues (A Brief Introduction)
	Supporting Tissues of the Tooth		
	Oral Mucosa		
	Salivary Glands		
	Bones of the Jaw		
	Temporomandibular Joint		
	Hard Tissue Formation		
	Mineralization		
	Hard Tissue Degradation		
	Enamel		
	Dentine		
	Cementum		
	Periodontal Ligament		
F-OB-002	Describe the structure, types, and functions of the cytoskeleton, including microfilaments, intermediate filaments, and microtubules, within oral tissues.		Cytoskeleton
F-OB-003	Classify and explain the functions of intercellular junctions, including tight junctions, adherents' junctions, desmosomes, and gap junctions, in oral epithelial tissues.	Histology (Anatomy)	Cell Junctions

	Illustrate the structural features and functions of desmosomes and hemidesmosomes in maintaining the integrity of oral epithelial tissues.		
F-OB-004	Describe the structure, secretory functions, and role of fibroblasts in the maintenance of the extracellular matrix in oral tissues		Fibroblast
	Explain the steps involved in collagen synthesis and assembly, highlighting its importance in oral connective tissue.		
F-OB-005	Discuss the composition, function, and degradation processes of the extracellular matrix, emphasizing its role in oral tissue integrity and repair.		Extracellular Matrix
F-OB-006	Name the three major functions of the human dentition	Tooth Morphology	Introduction and Nomenclature
	Describe various ways of classifying human dentition.		
	Define the three dentition periods (deciduous, mixed, permanent). Identify each period's approximate time intervals, initiation, and termination events		
	Describe the dental Formula for permeant and Deciduous dentition		
	Define "succedaneous" and identify succedaneous teeth		
	Describe the eruption pattern of primary and permanent dentition		
	Demonstrate understanding of various dental numbering systems (e.g., universal, FDI, Palmer).		
	Describe the anatomical surfaces and land marks of both anterior and posterior teeth, including the roots, using standardized dental terminology.		
	Identify and name tooth surfaces and thirds of tooth surfaces from diagrams or descriptions		

	Differentiate between the crown surfaces of teeth by matching them with their correct general shape (triangular, trapezoidal, or rhomboidal), or by relating theshape to the specific function of the tooth.		
	Identify and name line and point angles based on diagrams or descriptions.		
	Define elevations and depressions on the tooth surface.		
	Applications to the type of root structure necessary for proper the function of the different teeth, and the general rules regarding tooth roots and the normal number of branches.		
GENERAL PATHOLOGY			
CODE	**SPECIFIC LEARNING OUTCOMES**	**TOTAL HOURS = 07**	
		INTEGRATING DISCIPLINE	**TOPIC**
F-Pa-001	Define the terms: pathology, etiology & pathogenesis		Pathology
F-Pa-002	Discuss causes of cell injury		Cell Injury
	Describe the types and mechanism of cell injury		
	Identify different types of cellular adaptations to stress with examples		
	Discuss the mechanism of cellular adaptations to stress in detail		
F-Pa-003	Identify the two types of cell death		Cell death
	Enumerate the differences between them		

F-Pa-004	Define necrosis		Necrosis
	Identify its various types with examples		
F-Pa-005	Define apoptosis with examples		Apoptosis
	Describe its mechanism and pathways in detail		
F-Pa-006	Discuss mechanism & types of intracellular accumulations		Intracellular accumulations
F-Pa-007	Define pigmentation and identify various endogenous & exogenous pigments		Pigmentation
F-Pa-008	Define calcification and differentiate between dystrophic & metastatic calcification		Calcification
F-Pa-009	Explain the changes taking place due to aging at the cellular level	Oral Biology	Aging
MICROBIOLOGY			
CODE	**SPECIFIC LEARNING OUTCOMES**	**TOTAL HOURS = 20**	
		INTEGRATING DISCIPLINE	**TOPIC**
F-Pa-010	Enlist microbes that cause infectious diseases along with important features.		General Microbiology
	Differentiate between Eukaryotes & Prokaryotes.		
F-Pa-011	Discuss morphology, structure of bacteria including cell wall, cytoplasmic membrane, and cytoplasm of bacteria.		Bacteria
	Discuss important structures outside cell wall & bacterial spores.		

	Differentiate between gram positive & negative bacterial cell wall on the basis of staining.		
	Discuss bacterial growth curve.		
	Define anaerobic & aerobic growth and discuss fermentation of sugars and iron metabolism.		
	Define mutation and its different types and Define Recombination		
	Discuss transfer of DNA within and between bacterial cells including conjugation, transduction, and transformation.		
	Discuss classification of medically important bacteria.		
	Define normal flora, colonizer, dysbiosis, and elaborate significance of normal flora.		
	Discuss normal flora of different body sites including oral cavity, skin, respiratory tract, intestinal tract, etc.		
	Define pathogen, pathogenesis, virulence factors, ID50, LD50.		
	Discuss principles of pathogenesis.		
	Enlist different types of bacterial infections and Describe stages of bacterial pathogenesis.		
	Discuss determinants of bacterial pathogenesis that includes: • Transmission • Adherence to cell surfaces. • Invasion • Inflammation & intracellular survival • Toxin production • Immuno-pathogenesis		

	Enlist different strains of the same bacteria that can produce different diseases.		
	Mechanisms of Antimicrobial Drugs		
	Define typical stages of an infectious disease.		
	Discuss role of biofilm and glycocalyx in causing infection.		
	Tabulate the differences between sterilization and disinfection.		
F-Pa-012	Define sterilization and disinfection and describe the various methods of sterilization.		Sterilization and Disinfection
	Tabulate the differences between sterilization and disinfection.		
PHARMACOLOGY & DENTAL THERAPEUTICS			
CODE	**SPECIFIC LEARNING OUTCOMES**	**TOTAL HOURS = 17**	
		INTEGRATING DISCIPLINE	**TOPIC**
F-Ph-001	Students should be able to discuss General Concepts of Pharmacology		General Pharmacology
	Students should be able to define and describe Pharmacokinetics and Pharmacodynamics		
	Mechanisms of Drugs Transport/ Permeation		
F-Ph-002	Sources of Drugs/ Active Principles		Drugs Transport
	Enumerate advantages and disadvantages of various Routes of drug Administration		
	Define drug absorption & Bioavailability and factors affecting		
	Define and explain Distribution and Volume of Distribution		
	Define and explain Redistribution and Plasma Protein Binding		

	Explain the concept of Metabolism & Biotransformation		
F-Ph-003	Define Enzyme Induction & Enzyme Inhibition		Enzyme Induction & Enzyme Inhibition
	Describe the clinical significance of enzyme induction and enzyme inhibition with their examples		
	Define drug excretion		
F-Ph-004	Enlist routes of drug excretion		Drug excretion
	Describe processes of drug excretion through the kidneys		
	Describe factors affecting glomerular filtration & tubular reabsorption		
	Describe the Clinical Significance of Glomerular Filtration, Active Tubular Secretion and Passive Tubular Reabsorption of Drugs		
	Define first pass elimination		
F-Ph-005	Define and enlist factors affecting Plasma Half-Life		Plasma Half-Life
	Explain clinical significance of plasma half-life		
	Explain steady state plasma concentration		
F-Ph-006	Define & Explain Elimination and Orders of Elimination – First & Zero Order Kinetics with examples		Order Kinetics
	Tabulate differences between First order kinetics and Zero Order Kinetics		
F-Ph-007	Define, explain & calculate maintenance dose and loading dose using appropriate formula		Maintenance dose
F-Ph-008	Understand the concept of drug clearance		Drug clearance
	Describe factors affecting drug clearance		
	Explain the Clinical Significance of different values of Drug Clearance		

F-Ph-009	Elaborate Transmembrane signaling pathways		Signaling pathways
	Name the Effectors controlled by G-proteins		
F-Ph-010	Define Pharmacodynamics, Affinity, Efficacy, Potency		Pharmacodynamics
	Explain Agonist, partial agonist, inverse agonist, bias, allosteric agonists and modulators with examples		
	Define Spare receptor and give clinical importance		
	Describe various Drug–antagonism types with examples		
	Compare & discuss the information derived from Graded and Quantal dose-response curves		
	Define Median Effective (ED50), Median Toxic (TD50) & Median Lethal Dose (LD50) and its clinical relevance		
	Define Therapeutic index and give its clinical importance		
	Define Therapeutic window and give its clinical importance		
	Define Desensitization, Tachyphylaxis, Tolerance, Resistance, super sensitivity, hypersensitivity, super infection, iatrogenic effect, idiosyncrasy, and give examples		
	Describe the Phenomenon of down regulation and up regulation of receptors		
	Enlist factors affecting Dose and action of Drugs		
F-Ph-011	Describe Pharmacogenetics and give examples		Pharmacogenetics
F-Ph-012	Illustrate various phases of Drug development		Drug development
F-Ph-013	Describe Drug Interactions		Drug Interactions

COMMUNITY DENTISTRY AND PUBLIC HEALTH			
CODE	SPECIFIC LEARNING OUTCOMES	TOTAL HOURS = 05	
		INTEGRATING DISCIPLINE	TOPIC
F-CD-001	Define dental public health, health and its dimensions, disease, and illness.		Public Health
	Difference Between clinical and public health Dentist.		
	Identify criteria for a disease to be of public health importance.		
	Describe the Concepts of prevention and its levels.		
BEHAVIOURAL SCIENCES			
CODE	SPECIFIC LEARNING OUTCOMES	TOTAL HOURS = 03	
		INTEGRATING DISCIPLINE	TOPIC
F-Bhs-001	Understand the components and significance of the bio-psycho-social model and systems approach in healthcare		Bio-psycho-social model
	Appreciate the need for a holistic approach to patient care		
F-Bhs-002	Define concepts of normality and abnormality in behavior and health		behavior and health
	Understand how psychology, sociology, and anthropology contribute to health		
	Cultivate an open-minded perspective towards diverse patient behaviors and conditions		
F-Bhs-003	Value the interdisciplinary approach to healthcare		interdisciplinary approach
F-Bhs-004	Recognize the role of behavior in health outcomes;		behavioral interventions

	Appreciate the impact of behavioral interventions on patient care		
	Understand the neurological basis of behavior		
F-Bhs-005	Relate brain functions to behavioral outcome		Neurological basis of behavior

PRACTICAL / LAB WORK OF FOUNDATION MODULE			
PHARMACOLOGY			
CODE	**SPECIFIC LEARNING OUTCOMES**	**TOTAL HOURS =02**	
		INTEGRATING DISCIPLINE	**TOPIC**
F-Ph-014	Calculations of drug dosing (e.g., IV infusion) & dose of children.		Calculation
F-Ph-015	Calculations (Mean, Mode, Median, Standard Deviation, and Standard Error), and Metrology.		Drug dosing
ORAL BIOLOGY AND TOOTH MORPHOLOGY			
CODE	**SPECIFIC LEARNING OUTCOMES**	**TOTAL HOURS =10**	
		INTEGRATING DISCIPLINE	**TOPIC**
F-OB-007	List all structures of a tooth. Identify, draw, and label structures of the tooth on models.	Oral Histology Tooth Morphology	Enamel, Dentine, Pulp, Cementum, Periodontal Ligament, Salivary gland, TMJ, Oral Mucosa.
F-OB-008	Identify and differentiate, on tooth specimen/models/images: anatomical crown, clinical crown, anatomical root, clinical root, enamel, dentin, cementum, cervical line, pulp cavity, cusps, tubercles, cingulum, ridges (marginal, triangular, transverse, oblique and cusp ridges), inclined plane, mamelons, fossa, developmental (primary) groove, supplemental (secondary) groove, line angles, point angles, and tooth surfaces (mesial, distal, lingual/palatal, buccal/labial, incisal/occlusal),		Introduction & Nomenclature of tooth

	Carve tooth models in wax/soap (one anterior & one posterior) and demonstrate the morphological features.		
	Identify & number different teeth according to universal, palmar notation & FDI numbering systems		
F-OB-009	Draw & label the diagram of cytoskeletal elements.	Oral Histology	Cytoskeleton
F-OB-010	Draw & label the diagram of tight junctions, desmosomes, hemidesmosomes, and gap junctions.		Cell Junctions
F-OB-011	Draw and label steps of collagen synthesis and assembly		Fibroblast
MICROSCOPIC ANATOMY (HISTOLOGY)			
CODE	**SPECIFIC LEARNING OUTCOMES**	**TOTAL HOURS =13**	
		INTEGRATING DISCIPLINE	**TOPIC**
F-A-015	Identify under a light microscope and draw & label different types of epithelia.		Epithelium
F-A-016	identify under a light microscope and draw & label different types of connective tissues.		Connective tissue
F-A-017	Identify under a light microscope and draw & label different types of cartilages.		Cartilage
F-A-018	Identify under a light microscope and draw & label compact and spongy bones.		Bone
F-A-019	Identify under a light microscope and draw & label different types of muscles.		Muscle
F-A-020	Identify under a light microscope and draw & label lymphoid organs.		Lymphoid organs
F-A-021	Identify under a light microscope and draw & label thick and thin skin.		Skin
PHYSIOLOGY			

CODE	SPECIFIC LEARNING OUTCOMES	TOTAL HOURS =5	
		INTEGRATING DISCIPLINE	TOPIC
F-P-007	Parts of Microscope and their functions and how to operate it		Microscope
F-P-008	How to Obtain verbal consent from subject before and observation of drawing blood for CBC testing.		CBC Report Analysis
	Interpret the RBC count, hemoglobin, concentration and hematocrit in the CBC report generated by automated Analyzer		
F-P-009	Read and interpret ESR result on Westergren's tube and mentions conditions in which ESR is increased or decreased physiologically and pathologically.		ESR
PATHOLOGY			
CODE	**SPECIFIC LEARNING OUTCOMES**	**TOTAL HOURS =04**	
		INTEGRATING DISCIPLINE	**TOPIC**
F-Pa-013	Identify the types of necrosis on slides/ pictures		Cell Injury
F-Pa-014	Identify the cellular adaptation (atrophy, metaplasia, hyperplasia)		Cell Adaptations
F-Pa-015	Demonstrate the proper usage of hot air oven and autoclave.	Microbiology	Sterilization
F-Pa-016	Perform centrifugation and micro pipetting	Hematology	Introduction to Lab Techniques

MODULE NO. 02:

Craniofacial -I

MODULE RATIONALE

The Craniofacial 1 provides foundational knowledge on the general embryology and also embryological and structural development of the craniofacial region and the genetic disorders associated with the craniofacial complex. It serves as a critical phase in building the foundational knowledge necessary for advanced clinical modules.

MODULE OUTCOMES

- Explain the general embryological processes and underlying craniofacial development, including the formation and differentiation of the skull, face, palate, and temporomandibular joint (TMJ).
- Identify genetic mechanisms involved in craniofacial anomalies and systemic diseases.
- Demonstrate practical skills in identifying development of craniofacial structures.
- Integrate multidisciplinary knowledge to develop a comprehensive understanding of craniofacial development, enabling effective foundation for clinical contexts such as orthodontics, oral surgery, and periodontology.

SUBJECTS INTEGRATED IN THE MODULE

1. Anatomy
2. Oral Biology
3. General Pathology
4. Microbiology


SYLLABUS

THEORY			
ANATOMY			
CODE	**SPECIFIC LEARNING OUTCOMES**	**TOTAL HOURS =42**	
		INTEGRATING DISCIPLINE	**TOPIC**
CF1-A-001	Briefly describe the process of mitosis and meiosis		Cell Division
CF1-A-002	Describe the process of oogenesis, including the stages and regulatory mechanisms involved.		Gametogenesis
	Describe spermatogenesis and spermiogenesis, highlighting their roles in male fertility.		
	Describe the embryological basis of teratoma.		
CF1-A-003	Discuss the ovarian cycle, hormonal regulation and its phases.		First week of development: Ovulation to implantation
	Enlist and explain the main outcomes of fertilization and their relevance to early embryonic development.		
CF1-A-004	Describe the embryological basis of hydatidiform mole and its pathological significance.		Second week of Development: Bilaminar Germ Disc
	Describe the formation of embryonic disc, amniotic cavity and yolk sac		
CF1-A-005	Discuss the process of gastrulation		Third Week of Development: Trilaminar Germ Disc
	Discuss the growth and differentiation of the embryonic disc, including the clinical implications of its anomalies.		

	Describe the embryological basis for situs inversus, sirenomelia, holoprosencephaly		
	Describe the development of trophoblast during third week of development		
CF1-A-006	Explain the stages of neurulation and the formation of the neural tube.		Third to Eight Weeks: Embryonic Period
	Describe the process of vasculogenesis and its role in embryonic vascular development.		
	Discuss craniosynostosis (premature closure of sutures) and its impact on skull and brain growth.		
CF1-A-007	Discuss the clinical presentation of numerical and structural chromosomal abnormalities		Birth Defects
ORAL BIOLOGY			
CODE	**SPECIFIC LEARNING OUTCOMES**	**TOTAL HOURS = 33**	
		INTEGRATING DISCIPLINE	**TOPIC**
CF1-OB-001	Describe the origin, migration, and differentiation of neural crest cells, and explain their contributions to the formation of bone, cartilage, connective tissues in craniofacial development and the associated development defects.	General Embryology (Anatomy)	Neural Crest Cells and Head Formation
CF1-OB-002	Describe the formation, organization, and derivatives (muscles, nerves, skeletal structures) of the five pharyngeal (branchial) arches and its clinical implications	General Embryology (Anatomy)	Branchial (Pharyngeal) Arches and the Primitive Mouth
	Identify the embryological contributions of the pharyngeal pouches, grooves, and membranes and its clinical implications (Branchial Cleft Cysts and Fistulas).		

CF1-OB-003	Describe the key facial prominences (frontonasal, maxillary, and mandibular) and their fusion process in forming the forehead, nose, upper lip, and jaw. Discuss the critical periods of facial development, teratogenic factors disrupting it, and the clinical implications of improper facial fusion, including anomalies like cleft lip and midline facial clefts		Formation of the Face
CF1-OB-004	Describe the development of the primary and secondary palate, including the growth, elevation, and fusion of palatal shelves, and discuss the molecular signals involved in palatal development and its clinical implications due to non- fusion like Cleft Palate including the teratogenic factors that cause it.	Oral Embryology, Oral pathology	Formation of the Palate
CF1-OB-005	Describe the embryonic development of the tongue, contributions of key structures (lateral lingual swellings, tuberculum impar, copula), muscle derivation, and sensory/motor innervation and Developmental Defects associated with it like ankyloglossia	Oral Embryology, Oral Pathology	Formation of the Tongue
CF1-OB-006	Explain the two types of ossification: intramembranous (flat bones) and endochondral (base of the skull). Describe the role of Meckel's cartilage in mandibular development and the process of intramembranous ossification in forming the mandible and maxilla. Define jaw size anomalies and their embryological basis and clinical impact (Micrognathia and Macrognathia).	Oral Histology, Oral Embryology, Oral Pathology	Development of the Mandible and Maxilla

CF1-OB-007	Describe the development of the temporomandibular joint (TMJ), including the role of secondary cartilage, and potential developmental disorders (congenital dislocation, condylar hypoplasia	Oral Embryology, Oral Pathology	Development of the Temporomandibular Joint (TMJ)
CF1-OB-008	Describe the formation of the primary epithelial band and its role in initiating tooth development.	Oral Embryology	Early Tooth Development
	Explain the process of tooth initiation and the molecular signals involved in odontogenesis.		
	Discuss the determination of different tooth types based on patterning signals in the oral ectoderm.		
CF1-OB-009	Describe the histological and morphological changes that occur during the bud stage of tooth development	Oral Embryology	Stages of Tooth Development
	Explain the bud-to-cap transition and the role of epithelial-mesenchymal interactions in tooth differentiation.		
	Describe the histological and morphological changes that occur during the cap stage of tooth development.		
	Describe the histological and morphological changes that occur during the bell stage of tooth development.		
	Describe the role of signaling centers such as the enamel knot in controlling tooth shape and structure.		
CF1-OB-010	Explain the process of hard tissue formation, including enamel, dentin, and cementum development in reference to late bell stage of the tooth development	Oral Embryology	Neural and Vascular Contributions

CF1-OB-011	Describe the role of nerve innervation and vascularization during early tooth development and how they contribute to tissue differentiation.		Formation of the Permanent Dentition
CF1-OB-012	Discuss the mechanisms of root development and the role of Hertwig's epithelial root sheath (HERS) in determining root length and shape.		Hard Tissue and Root Formation
	Describe the formation of the supporting tissues of the tooth, including the periodontal ligament, cementum, and alveolar bone in reference to late bell stage		
CF1-OB-013	Differentiate between the development of primary and permanent dentition and explain the timing of their formation.		Primary and Permanent Dentition
CF1-OB-014	Enlist, Define and Identify developmental Anomalies in Tooth Number	Oral Pathology	Developmental Anomalies related to Tooth Development and Dental Structures
	Enlist, Define and Identify developmental Anomalies related to Tooth Size		

GENERAL PATHOLOGY			
CODE	**SPECIFIC LEARNING OUTCOMES**	**TOTAL HOURS = 10**	
		INTEGRATING DISCIPLINE	**TOPIC**
CF1-Pa-001	Define genetic disorders and explain their causes.	Biochemistry	Genetic Disorders: Introduction and causes
CF1-Pa-002	Describe different types of mutations (point mutations, insertions, deletions) with examples relevant to dentistry		Types of Mutations

CF1-Pa-003	Explain Mendel's principles and their application to autosomal and X-linked disorder and examples relevant to dentistry		Mendel principles and genetic disorders
CF1-Pa-004	Describe chromosomal abnormalities (e.g., trisomy, monosomy, translocations) and examples relevant to dentistry	Embryology	Chromosomal abnormalities
CF1-Pa-005	Define, Identify and Correlate specific syndromes with their embryological defects i. Down Syndrome ii. Turner Syndrome iii. Treacher Collins Syndrome iv. Pierre Robin Sequence v. Goldenhar Syndrome vi. Crouzon Syndrome vii. Apert Syndrome viii. Van der Woude Syndrome ix. Hemifacial Microsomia x. Cleidocranial Dysplasia xi. Nager Syndrome xii. DiGeorge Syndrome	Embryology, OMFS, Orthodontics, Oral Pathology	Congenital Craniofacial Anomalies and Developmental Defects
CF1-Pa-006	Describe how PCR and sequencing help in genetic testing.	Biochemistry	Genetic testing
	Compare different genetic tests and their uses.		
	Differentiate between karyotyping, sequencing, and biochemical tests.		
	Identify the role of genetic tests in prenatal and carrier screening.		

MICROBIOLOGY			
CODE	SPECIFIC LEARNING OUTCOMES	TOTAL HOURS = 03	
		INTEGRATING DISCIPLINE	TOPIC
CF1-Pa-007	Define microbial teratogens and their role in congenital craniofacial and dental anomalies.	Pharmacology	Infectious diseases
CF1-Pa-008	Define TORCH infections and identify the impact of maternal infections (TORCH complex) on embryonic development and their dental implications.	Embryology	Infectious diseases
CF1-Pa-009	Describe the embryological development of the immune system and its relation to congenital immunodeficiencies affecting oral health.	Embryology	Immunology
PRACTICAL / LAB WORK			
ORAL BIOLOGY & TOOTH MORPHOLOGY			
CODE	SPECIFIC LEARNING OUTCOMES	TOTAL HOURS =07	
		INTEGRATING DISCIPLINE	TOPIC
CF1-OB-015	Identify the congenital defects (cleft lip and palate,) on pictures/models:	Oral Embryology	Development of Human embryo with special emphasis on tooth-related structures.
	Identify the common tongue anomalies on pictures/models: Aglossia, micro/macroglossia, fissured tongue, cleft tongue, bifid tongue, tongue tie		
CF1-OB-016	Draw and label different stages of tooth development		Tooth Development
	Draw and label the root formation of single-rooted and multi-rooted teeth		

MODULE NO. 03:

Cariology-I

MODULE RATIONALE

This module establishes a comprehensive foundation in cariology, focusing on the biological, microbial, and environmental factors in dental caries development. By building this knowledge base, students are prepared for advanced applications in clinical practice and public health initiatives. Since caries follows the same biological principles worldwide, the methods for teaching its underlying biology, etiology, epidemiology, prevention, diagnosis, and treatment should also be consistent.

MODULE OUTCOMES

- Describe the basic structure and function of teeth.
- The natural history of dental caries
- Identify the microbial, dietary, and environmental factors in caries formation.
- Evaluate the impact of dietary habits, saliva composition, and environmental factors on caries development.
- Explain the principles of caries prevention and oral hygiene
- Discuss caries prevention strategies

SUBJECTS INTEGRATED IN THE MODULE

1. Oral Biology
2. Biochemistry
3. Community Dentistry and Public Health
4. Oral Pathology
5. Operative Dentistry


SYLLABUS

THEORY			
ORAL BIOLOGY			
CODE	SPECIFIC LEARNING OUTCOMES	TOTAL HOURS = 22	
		INTEGRATING DISCIPLINE	TOPIC
Car1-OB-001	Describe the physical & chemical properties of enamel	Operative dentistry	Enamel
	Describe the structural organization of enamel and Identify the enamel on radiograph		
	Describe the Differentiation of ameloblasts with reference to reciprocal induction		
	Describe the life cycle of Ameloblast		
	Enlist the stages of Amelogenesis and describe the pre secretory stage		
	Describe the secretory stage of amelogenesis and role of Tom's process		
	Describe the maturative stage of amelogenesis and process of modulation		
	Classify enamel proteins according to their function during amelogenesis		
	Describe the regulation of pH during enamel formation		
	Describe the structural features of enamel, including: (Hunter-Schreger bands, Incremental lines, Enamel lamellae, Enamel tufts, Enamel spindles, Gnarled enamel)		

	Discuss the effects of fluoride on enamel structure and resistance to caries.		
	Discuss the principles of enamel etching and its importance in restorative dentistry.		
	Describe the age changes & repair/regeneration of enamel		
	Explain how developmental disturbances can affect enamel formation.		
Car1-OB-002	Describe the composition and structure of dentin		Dentin
	Describe the process of dentinogenesis, including the role of the molecular factors.		
	Differentiate between the three main types of dentin: primary, secondary, and tertiary, and describe their locations and formation.		
	Identify the structure of dentin radiographically		
	Describe the mechanisms that control dentin mineralization, and differentiate between the pattern of mineralization in mantle dentin and circumpulpal dentin.		
	Explain the processes of secondary and tertiary dentinogenesis, including the stimuli that trigger their formation.		
	Describe the structure and function of dentinal tubules.		
	Differentiate between peritubular and intertubular dentin, and explain their respective compositions and roles.		

	Explain the formation and significance of sclerotic dentin and interglobular dentin.		
	Describe the structural features of dentin, including incremental growth lines and granular layer of Tom's.		
	Describe the cellular contents of the dental pulp		
	Discuss the innervations, vascular supply & lymphatic supply of the dentin-pulp complex		
	Explain the mechanisms of dentin sensitivity, focusing on the hydrodynamic theory.		
	Describe the formation and clinical significance of pulp stones (denticles).		
	Explain how developmental disturbances can affect Dentine formation (Denitnogenesis Imperfecta and dysplasias)		
	Explain the age-related changes that occur in the dentin-pulp complex.		
Car1-OB-003	List down the components of saliva. State the functions of saliva.		Saliva
Car1-OB-004	Differentiate between the following terms: Lobe, Axial Position, Contact Area, Interproximal space, Embrasure, Height of Contour, Cervical Line, Gingival Line, Epithelial Attachment.		Tooth Morphology
	Describe the number and names of the lobes of the anterior and posterior teeth		
	Describe and differentiate contact areas and height of contours including their location, size, function, age related changes, and clinical significance		

	Describe the components, boundaries and functions of interproximal space and embrasures		
	Describe the depressions on tooth surface (pit, fissures, and developmental groves)		
BIOCHEMISTRY			
CODE	**SPECIFIC LEARNING OUTCOMES**	**TOTAL HOURS = 08**	
		INTEGRATING DISCIPLINE	**TOPIC**
Car1-B-001	Explain the biochemical properties of sucrose, glucose, and fructose.	Operative Dentistry	Biochemical Role of carbohydrates in Dental Caries
	Compare the cariogenic potential of sucrose, glucose, and starch,		
Car1-B-002	Define dental plaque and explain its composition.	Oral Pathology	Biofilm Formation and Plaque Biochemistry
	Discuss the role of sucrose in synthesizing extracellular polysaccharides (e.g., glucans via glucosyltransferases) and their contribution to plaque biofilm adhesion and stability		
	Discuss the impact of diet, pH, and host factors on plaque development.		
Car1-B-003	Illustrate the glycolytic pathway in cariogenic bacteria and its role in acid production.		Carbohydrate Metabolism and Acidogenesis in relation to Dental Caries
	Explain the process of lactic acid fermentation, including the conversion of pyruvate into organic acids.		
	Explain the concept of acidogenicity and aciduricity in cariogenic bacteria.		
Car1-B-004	Define Critical pH. Relate the critical pH for enamel demineralization (5.5 for enamel and 6.2 for dentine) to acid production and the role of saliva in buffering pH and supplying calcium/phosphate for remineralization.	Oral Pathology	pH and Buffering Systems in Oral Health
Car1-B-005	Identify and analyze the components of saliva (salivary proteins, enzymes, bicarbonate, statherin, lysozyme,	Oral Pathology	

	lactoferrin, amylase, histatins) and their functions in maintaining oral pH and enamel repair		Saliva's Biochemical Role
	Describe the buffering action of saliva (bicarbonate, phosphate, and protein buffers).		
	Discuss factors that affect salivary flow and pH regulation.		
	Explain the role of carbonic anhydrase in maintaining oral pH.		
Car1-B-006	Discuss how fluoride disrupts bacterial glycolysis and acid production.		Fluoride's Biochemical Mechanism
Car1-B-007	Compare the metabolism of sugar alcohols (xylitol, sorbitol) versus fermentable sugars in the oral cavity.		Biochemistry of Artificial Sweeteners and Sugar Substitutes
	Explain the mechanism by which xylitol inhibits *Streptococcus mutans* growth and acid production.		
COMMUNITY DENTISTRY AND PUBLIC HEALTH			
CODE	**SPECIFIC LEARNING OUTCOMES**	**TOTAL HOURS = 08**	
		INTEGRATING DISCIPLINE	**TOPIC**
Car1-CD-001	Discuss the importance and role of diet in caries.		Dental Caries
	Discuss the concept and importance of Stephen curve in dental caries		
	Role of dental biofilm in acid production		
	Discuss the concept of Demineralization and the remineralization process		
	Describe the importance of oral hygiene and its effects on caries.		
	Explain the concept of Keye's Circles in the etiology of dental caries		
Car1-CD-002	Classify Basic types of toothbrushing		Prevention of Dental Caries
	The clinical effect of tooth cleaning		
	The effect of dental flossing		

	Identify the basic concept and importance of fluoride in caries prevention		
	Discuss preventive measures, such as fluoride treatments, improved oral hygiene practices, and dietary modifications.		
ORAL PATHOLOGY			
CODE	**SPECIFIC LEARNING OUTCOMES**	**TOTAL HOURS = 08**	
		INTEGRATING DISCIPLINE	**TOPIC**
Car1-OP-001	Knows the etiology and pathogenesis of acquired and generalized enamel hypoplasia.	Operative Dentistry/ Radiology	Enamel & Dentine Developmental Anomalies
	Know the types of amelogensis imperfecta according to their clinical and radiological appearance.		
	Identify and classify the developmental disturbances in structure of dentin.		
	Describe and compare the clinical presentation, radiographic and histopathological features of dentinogenesis imperfecta and dentin dysplasia.		
Car1-OP-002	Define phenomenon of dental caries.	Operative Dentistry & Oral Radiology	Microbiology and Pathogenesis of Caries
	Identify the etiological factors and explain their effects (pathogenesis) in the development of caries.		
	Describe the microbiological aspect of caries; the role and characteristics of cariogenic bacteria.		
	Define plaque and stages of plaque development		
	Describe the changes that develop in enamel and dentin of erupted teeth in association with microorganisms.		
OPERATIVE DENTISTRY			
CODE	**SPECIFIC LEARNING OUTCOMES**	**TOTAL HOURS = 06**	
		INTEGRATING DISCIPLINE	**TOPIC**

Car1-OD-001	Describe the anatomical features of pits and fissures and their role in caries susceptibility.	Operative Dentistry & Oral Radiology	Pit and Fissure Caries
	Explain the preventive strategies, including using sealants and fluoride applications.		
Car1-OD-002	Discuss the factors that increase caries risk on smooth surfaces, such as poor oral hygiene and dietary habits.	Operative Dentistry & Oral Radiology	Smooth Surface Caries
	Describe the appearance of smooth surface caries and its progression pattern.		
	Recognize the role of fluoride in preventing smooth surface caries.		
Car1-OD-003	Identify the unique etiological factors associated with root carries, including gingival recession and xerostomia.		Root Caries
	Describe the clinical features and progression of root caries.		
Car1-OD-004	Describe the characteristics of active caries, including appearance, texture, and progression.		Active Caries
	Understand the clinical significance of active caries in its potential to progress and cause further tooth damage.		
	Develop strategies to manage active caries, focusing on preventive, minimally invasive, and restorative approaches.		
Car1-OD-005	Define arrested caries and describe their clinical features, such as smooth, shiny surfaces and hardness upon probing.	Operative Dentistry & Oral Radiology	Arrested Caries
	Understand the biological process of caries arrest and remineralization.		
	Identify the factors that promote caries arrest.		

PRACTICAL / LAB WORK			
OPERATIVE DENTISTRY			
CODE	**SPECIFIC LEARNING OUTCOMES**	**TOTAL HOURS = 04**	
		INTEGRATING DISCIPLINE	**TOPIC**
Car1-OD-006	Identify fluoride gel and procedure to apply it	Community Dentistry	Prevention of Dental Caries
Car1-OD-007	How to use Disclosing agents for Identification of Dental Plaque on tooth surfaces		Identification Plaque
	Identification on tooth models pits an fissure caries, smooth surface caries and root caries on E-Slides or clinical images.		
	Identify the features of Arrested Caries and Active Caries on E-Slides or clinical images		
ORAL BIOLOGY			
CODE	**SPECIFIC LEARNING OUTCOMES**	**TOTAL HOURS = 10**	
		INTEGRATING DISCIPLINE	**TOPIC**
Car1-OB-005	Draw and label "Enamel rods: fish scale pattern & keyhole pattern		Enamel
	Ameloblasts (life cycle)		
	DEJ with organic defects		
	Draw and label Enamel rods, striae of retzius, bands of Hunter & Schreger, gnarled enamel, DEJ, tufts, lamella, spindles & neonatal lines.		
	Identify amelogenesis imperfacta (hypoplastic, hypocalcified &hypomaturative types) & fluorosis.		
	Identify enamel on x-rays.		

	Prepare the ground section of the tooth, mount it on a microscopic slide & identify the structural details of enamel & dentin	Dental Radiology/ Oral Pathology	
Car1-OB-006	Draw & label primary, secondary & tertiary dentin, dentinal tubules in crown & root portions, dentin-pulp complex showing dentinal tubules, pre dentin & zones of dental pulp showing its different cells, odontoblast with different developmental shapes, peritubular and intra tubular dentin, inter globular dentin, dead tracts, pulp stones.	Dental Radiology	Dentin
	Identify dentin genesis imperfect, identify dentin & pulp cavity on x-rays.		
Car1-OB-007	Identify and differentiate on tooth specimen/models/images: periodontium, lobe, axial position, contact point, contact area, interproximal space, embrasure, line angle, height of contour, cervical line, gingival line, and epithelial attachment.	Tooth Morphology	Anatomic & Physiologic Considerations of Form & Function of Tooth
Car1-OB-008	Identify and differentiate on tooth specimen/models/images: pits, fissures, embrasures, and sulcus.	Tooth Morphology	Introduction & Nomenclature of tooth
ORAL PATHOLOGY			
CODE	**SPECIFIC LEARNING OUTCOMES**	**TOTAL HOURS = 06**	
		INTEGRATING DISCIPLINE	**TOPIC**
Car1-OP-003	Examine the histopathological changes in enamel and dentine associated with caries in E-Slides/ Pictures		Histopathological changes in Enamel and Dentine
Car1-OP-004	Identify bacteria in dental plaque samples using Gram Staining under microscope		Microscopic Analysis of Plaque
Car1-OP-005	Identify pathological processes in a carious ground section of tooth slide.		Microscopy of Caries lesions