

THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY
No. 69, ANNA SALAI, GUINDY, CHENNAI – 600 032.

B.D.S.

DEGREE COURSES



SYLLABUS AND CURRICULUM

THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY, CHENNAI

PREFACE

The Syllabus and Curriculum for the B.D.S.Courses have been restructured with the Experts from the concerned specialities to educate students of BDS course to

1. Take up the responsibilities of dental surgeon of first contact and be capable of functioning independently in both urban and rural environment.
2. Provide educational experience that allows hands-on-experience both in hospital as well as in community setting.
3. Make maximum efforts to encourage integrated teaching and de-emphasize compartmentalisation of disciplines so as to achieve horizontal and vertical integration in different phases.
4. Offer educational experience that emphasizes health rather than only disease.
5. Teach common problems of health and disease and to the national programmes.
6. Use learner oriented methods, which would encourage clarity of expression, independence of judgement, scientific habits, problem solving abilities, self initiated and self-directed learning.
7. Use of active methods of learning such as group discussions, seminars, role play, field visits, demonstrations, peer interactions etc., which would enable students to develop personality, communication skills and other qualities towards patient care.

The Students passing out of this Prestigious University should be acquire adequate knowledge, necessary skills and such attitudes which are required for carrying out all the activities appropriate to general dental practice involving the prevention, diagnosis and treatment of anomalies and diseases of the teeth, mouth, jaws and associated tissues. The students should also understand the concept of community oral health education and be able to participate in the rural health care delivery programmes existing in the country.

(Subject to changes in Amendments in DCI Regulations and SAB Resolutions)

**Prof. Dr.S.GEETHALAKSHMI, M.D., Ph.D.
VICE-CHANCELLOR**

Comments / Feed back are welcome if any and mail it to registrar@tnmgrmu.ac.in

B.D.S. - DEGREE COURSE

FIRST YEAR SUBJECTS

Sl. No.	Subjects	Page. No.
	I Year	
1.	General Anatomy including Embryology and Histology	1 - 16
2.	General Human Physiology and Biochemistry	17 - 44 45 - 56
3.	Dental Anatomy, Embryology and Oral Histology	57 - 67

1. GENERAL ANATOMY INCLUDING EMBRYOLOGY AND HISTOLOGY

1. GOAL

The students should gain the knowledge and insight into the functional anatomy of the normal human head and neck, functional histology and an appreciation of the genetic basis of inheritance and disease, and the embryological development of the clinically important structure, so that the relevant anatomical and scientific foundations are laid down for the clinical years of the BDS course.

2. OBJECTIVES

a. KNOWLEDGE AND UNDERSTANDING:

At the end of the first BDS in anatomical science the undergraduate student is expected to

- i. Know the normal disposition of the structures in the body while clinically examining a Patient and while conducting the clinical procedures
- ii. Know the anatomical basis of disease and injury
- iii. Know the microscopic structure of the various tissues, a prerequisite for understanding the disease process.
- iv. Know the nervous system to locate the site of lesion according to the sensory and or the motor deficits encountered
- v. Have an idea about the basis of the abnormal development, critical stages of development, effects of teratogens, genetic mutations and environmental hazards
- vi. Know the sectional anatomy of the head and neck and brain to read the features in the Radiographs and the picture taken by modern technique
- vii. Know the anatomy of cardiopulmonary resuscitation

b. SKILLS:

- i. To locate various structure of the body and to mark the topography of the living anatomy
- ii. To identify various tissues under microscope
- iii. To identify the features in radiography and modern imaging techniques.
- iv. To detect various congenital abnormalities.

c. ATTITUDE:

- i. Willingness to apply the current knowledge of dentistry in the best interest of the patient and community
- ii. Seek to improve awareness and provide possible solutions for oral health problems and needs throughout the community

d. INTEGRATION:

By emphasizing on the relevant information the anatomy taught integrally with other basic sciences and clinical subjects not only keeps the learner curious but also lays down the scientific foundation for making a better doctor, a benefit to the society. This insight is gained in a variety of ways:

- 1) Lectures and small group teachings
- 2) Demonstrations
- 3) Dissection of human cadavers
- 4) Study of dissected specimens
- 5) Osteology
- 6) Study of histology slides
- 7) Audio visual aids
- 8) Charts and models for embryology and genetics

e. KNOWLEDGE ABOUT INFECTION AND CROSS INFECTION IN DENTISTRY

Knowledge about asepsis – disinfection and sterilization of instruments, clinical area / personal care as per universal protection, and disposal of medical wastes in the appropriate modes. Students should be aware of the rules and regulations pertaining to maintenance of clinical set up and waste disposal.

f. COMPUTER PROFICIENCY

Basic knowledge of Computers, MS Office, Window 2000, Statistical Programmes Basic operative skills in analysis of data and knowledge of multimedia. Students should utilize a combination of traditional classroom courses, and online courses. The following validation is required and must be completed.

- i) Technological Requirements for all Graduate Students

- ii) A laptop or desktop computer that supports the following requirements
 - a) Operating system requirements
 - b) Internet browser requirements
 - c) Reliable and consistent access to the internet
 - d) Anti virus software which is current and consistently updated
 - e) Microsoft Office
 - f) Adobe Reader (or equivalent to view PDF files)

3. COMPETENCIES

- i. General skills:
 - Apply knowledge & skills in day to day practice
 - Apply principles of ethics
 - Analyze the outcome of treatment
 - Evaluate the scientific literature and information to decide the treatment
 - Participate and involve in professional bodies
 - Self-assessment & willingness to update the knowledge & skills from time to time
 - Involvement in simple research projects
 - Minimum computer proficiency to enhance knowledge and skills
 - Refer patients for consultation and specialized treatment
 - Basic study of forensic odontology and geriatric dental problems
- ii. Practice Management :
 - Evaluate practice location, population dynamics & reimbursement mechanism
 - Co-ordinate & supervise the activities of allied dental health personnel
 - Maintain all records
 - Implement & monitor infection control and environmental safety programs
 - Practice within the scope of one's competence
- iii. Communication and Community Resources:
 - Assess patients goals, values and concerns to establish rapport and guide patient care
 - Able to communicate freely, orally and In writing with all concerned
 - Participate in improving the oral health Of the individuals through community activities.

iv. Patient Care – Diagnosis:

- Obtaining patient's .history in a methodical way
- Performing thorough clinical examination
- Selection and interpretation of clinical, radiological and other diagnostic information
- Obtaining appropriate consultation
- Arriving at provisional, differential and final diagnosis

v. Patient Care - Treatment Planning:

- Integrate multiple disciplines into an individual comprehensive sequence treatment plan using diagnostic and prognostic information
- Ability to order appropriate investigations
- Recognition and initial management of medical emergencies that may occur during dental treatment
- Perform basic cardiac life support
- Management of pain including post operative
- Administration of all forms of local anaesthesia
- Administration of intra muscular and venous injections
- Prescription of drugs, pre operative, prophylactic and therapeutic requirements
- Uncomplicated extraction of teeth
- Transalveolar extractions and removal of simple impacted teeth
- Minor oral surgical procedures
- Management of oro-facial infections
- Simple orthodontic appliance therapy ,
- Taking, processing and interpretation of various types of intra oral radiographs
- Various kinds of motivative procedures using different materials available
- Simple endodontic procedures
- Removable and fixed prosthodontics
- Various kinds of periodontal therapy

vi. Competencies specific to the subject.

4. TEACHING HOURS

Lecture Hours -100 hrs

Practical Hours -175 hrs

Total -275 hrs

5. TEACHING METHODOLOGY

- Combination of Lectures
- Small group seminars, tutorials
- Dissection and learning from dissected specimens
- Microscopic demonstration
- Audio visual aids
- Demonstration of articulated and individual bone specimens.
- Use of workbook for practical classes
- Drawing histology diagrams in record notebook
- Surface anatomy on living individual
- Study of radiographs & other modern imaging techniques.
- Study of Histology slides.
- Study of embryology models.

6. THEORY SYLLABUS

TOPIC	MUST KNOW	DESIRABLE TO KNOW	NICE TO KNOW
Anatomical terminology	An understanding of the various subdivisions of anatomy <ul style="list-style-type: none">♣ Anatomical position♣ Anatomical planes♣ Terms of direction, relation, comparison, laterality & movement		
Introduction to bones	Composition of bone and bone marrow <ul style="list-style-type: none">♣ Regional classification of skeleton♣ Structural classification of bonea. Distribution of spongy and compact bone in the body		Laws of ossification, including direction of nutrient foramen and the growing end of the

	<ul style="list-style-type: none"> ♣ Classification of bone according to shape ♣ Classification of bone based on ossification ♣ Parts of a long bone ♣ Blood and nerve supply of a long bone ♣ Special features of a sesamoid bone 		<p>bone</p> <ul style="list-style-type: none"> ♣ Exceptions to the laws of ossification
Introduction to joints	<p>Definition Classification according to</p> <ol style="list-style-type: none"> a. Structure- with subtypes and examples of fibrous, cartilaginous and synovial joints b. Mobility c. Axes of movement <ul style="list-style-type: none"> ♣ Complex and compound joints ♣ Nerve supply of joints- Hilton's law <p>Blood supply of joints</p>		
Introduction to the muscular system	<p>Structural classification of muscle</p> <ul style="list-style-type: none"> ♣ Parts of a skeletal muscle Differentiate tendon and aponeurosis ♣ General principles about how attachments of muscles affect the joints they cross ♣ Classification of muscle according to action (agonists, antagonists, synergists, fixators) 		<p>Classification of muscle according to direction of muscle fibres and shape</p>
Introduction to the cardiovascular system	<p>Classification into blood vascular system</p> <ul style="list-style-type: none"> ♣ Differentiate pulmonary and systemic circulation ♣ Layers of any blood vessel ♣ Types of blood vessels <ol style="list-style-type: none"> a. General differences between arteries and veins b. Functional difference between elastic, muscular arteries and arterioles c. Function of meta-arterioles, precapillary sphincters, arterio-venous anastomoses d. Microvasculature-types of capillaries and their functional significance 		<p>Concepts of thrombosis, infarction, aneurysm</p> <ul style="list-style-type: none"> ♣ Concept of lymphoedema and spread of tumors via lymphatics and venous system

	<ul style="list-style-type: none"> ♣ Venous return <ul style="list-style-type: none"> a. Musculo-venous pumps b. Role of valves ♣ Definition and structure of a portal system 		
Lymphatic system	<p>Components and function of the lymphatic system</p> <ul style="list-style-type: none"> a. Structure of lymph capillaries b. Concept that lymphatics accompany blood vessels c. Concept that lymph ultimately drains into the venous system d. Function of lymph nodes in the lymphatic system 		
Nervous system	<p>Subdivisions of nervous system into Central and peripheral nervous system, somatic and autonomic nervous system</p> <p>Structure and classification of neuron</p>		
Respiratory system	Trachea, pleura and Lungs		
Gastrointestinal system Accessory organs of digestion	Name, position, external and internal features, important peritoneal and other relations, blood supply, nerve supply, lymphatic drainage and applied aspects of: Spleen, Abdominal part of esophagus Stomach, Liver & its vascular segments Gall bladder, Pancreas, Small intestines Caecum, Appendix, Colon, Extrahepatic biliary apparatus		
Urinary system	Kidneys, Ureter Suprenals , Urinary bladder		
Genital system	Testis, Ovary, Uterus, Fallopian tube		
Introduction	Terms used in embryology Stages of development		
Mitosis and Meiosis and	Primordial germ cells Concept of Chromosomal abnormalities		
Gametogenesis	Oogenesis Spermatogenesis		
Uterine and ovarian cycles	Uterine and ovarian cycles Ovulation		
Fertilization	Definition, Phases of fertilization, Results of fertilization		

and Blastocyst			
Bilaminar germ disc	Implantation Abnormal implantation		
Trilaminar germ disc	Gastrulation		
Embryonic period	Definition, Neurulation – neural pores and the time of closure, Derivatives of each of the 3 germ layers, Somites		
Fetal membranes and Placenta	Structure, Placental circulation, Function, Placental barrier		
Amnion and umbilical cord	Structure and function	Amniotic fluid-hydramnios and oligohydramnios	
Birth defects	Face Palate Tongue Branchial apparatus Pituitary gland Thyroid gland Eye		Types of abnormalities-malformation, disruption, deformation, syndrome, Teratogens
			Facial clefts, First Arch Anomalies, Developmental anomalies of tongue, Branchial cysts and fistulae, Ectopic thymic, parathyroid or thyroid tissue, Thyroglossal cyst
Chromosomes	Structure of chromosomes Classification of chromosomes based on position of centromere		
Karyotyping	Technique of preparing a Karyotype Types of banding		

	<ul style="list-style-type: none"> ♣Clinical applications of karyotyping ♣Reading of karyotypes for normal male, female, Trisomies, Turner syndrome, Klinefelter syndrome 		
Osteology	<p>Anatomical position of skull Identification and locations of individual skull bones in an articulated skull</p> <ul style="list-style-type: none"> ♣Features seen in Normas frontalis, verticalis, occipitalis, lateralis and basalis ♣Cranial cavity- subdivisions, foraminae and structures passing through them ♣Details of Mandible and Maxilla, ♣Features of typical and atypical cervical vertebrae 		<p>Concept of bones which ossify in membranes and cartilage</p> <ul style="list-style-type: none"> ♣Frankfort Plane ♣Parietal, Occipital, Frontal and Temporal bones ♣Sphenoid,
Scalp	Layers of scalp, Extent/ attachment of each layer, Surgical importance of each layer, Blood supply, nerve supply and lymphatic drainage		
Superficial dissection of the face	<p>Muscles of facial expression Muscle groups acting upon the angle of the mouth - Attachments of the orbicularis oculi, orbicularis oris and buccinator muscles only</p> <ul style="list-style-type: none"> ♣Sensory innervation of the face 		Names of the superficial muscles in the face, with their actions and nerve supply
Deep dissection of the face	<p>Facial artery: Origin, course and branches</p> <ul style="list-style-type: none"> ♣Facial vein: Formation, course and tributaries ♣Facial nerve: Branches in the face ♣Lymphatic drainage of the face ♣Surgical importance of the deep facial vein 		
Parotid Region	<p>Parts, borders, surfaces, contents, relations and nerve supply of parotid gland</p> <ul style="list-style-type: none"> ♣Course of parotid duct 		<p>Parotid abscess</p> <ul style="list-style-type: none"> ♣Plane of dissection and main complication of superficial parotidectomy
The side of the	Boundaries and subdivisions of posterior triangle		

neck Posterior Triangle	<ul style="list-style-type: none"> ♣ Boundaries and contents of the subclavian and occipital triangles ♣ Special emphasis on with nerve supply and actions ♣ Sternocleidomastoid with attachments and relations, Wry neck Lymphatic drainage of head and neck 		
Dissection of back	<p>Contents of the vertebral canal Suboccipital triangle</p> <p>Boundaries and contents</p> <ul style="list-style-type: none"> ♣ Position, direction of fibres, relations, nerve supply, actions of: <p>Semispinalis capitis, Splenius capitis</p>		
Cranial Cavity	<p>Cranial fossae: structures related and major foramina and structures passing through Dural venous sinuses</p> <ul style="list-style-type: none"> ♣ Pituitary gland 	Pituitary tumours	Clinical importance of dural venous sinuses
Orbit	<p>Attachments, nerve supply and actions of muscles of eyeball</p> <ul style="list-style-type: none"> ♣ Nerves and vessels in the orbit ♣ Ciliary ganglion 		
Anterior Triangle	<p>Boundaries and subdivisions of the anterior triangle</p> <ul style="list-style-type: none"> ♣ Boundaries and contents of the muscular, carotid, digastric and submental triangles 		
Cranial nerves	extra cranial course 5th, 7th and 9th nerves and upper Cervical nerves.		
Temporal and Infratemporal regions	<p>Extent, boundaries and contents of temporal and infratemporal fossae</p> <ul style="list-style-type: none"> ♣ Attachments, direction of fibres, nerve supply and actions of muscles of mastication Temporomandibular joint 		Dislocation of temporomandibular joint
Submandibular region	<p>Parts, borders, surfaces, relations, nerve supply of submandibular gland</p> <ul style="list-style-type: none"> ♣ Course and relations of submandibular duct ♣ Submandibular ganglion ♣ Position, relations and nerve supply of sublingual gland 		Bidigital palpability of submandibular swelling
Deep	Thyroid gland- location, parts, borders, surfaces, relations,	Thyroid	Vagus Nerve in the

structures in the neck	<p>blood supply</p> <ul style="list-style-type: none"> ♣Parathyroid glands- location, blood supply ♣Trachea, Tracheostomy- structures encountered ♣Subclavian artery- Origin, parts, course, branches 	<p>swellings - anatomically relevant clinical features</p> <ul style="list-style-type: none"> ♣Awareness of liability of injury to external and recurrent laryngeal nerves during thyroidectomy 	<p>neck- Course and branches</p> <ul style="list-style-type: none"> ♣Accessory Nerve- Course and supply ♣Cervical Sympathetic chain- Components, branches, area of supply ♣Deep cervical fascia- parts, extent, attachments, modifications Deep cervical lymph nodes
Mouth, Pharynx, Palate	<ul style="list-style-type: none"> ♣Names, position, actions and nerve supply of muscles of palate and pharynx ♣Palatine tonsil- Position, relations, blood supply ♣Waldeyer's lymphatic ring- Components and their function ♣Boundaries and clinical significance of pyriform fossa 	Killian's dehiscence	<p>Tonsillitis and tonsillectomy</p> <ul style="list-style-type: none"> ♣Adenoids ♣Paratonsillar abscess
Cavity of Nose	<ul style="list-style-type: none"> ♣Nasal septum Epistaxis- significance of Little's area ♣Lateral wall of nasal cavity ♣Paranasal sinuses concept of referred pain 		<p>Sinusitis</p> <p>Maxillary sinus tumours</p>
Larynx	<p>Names, nerve supply and actions of intrinsic and extrinsic muscles of larynx</p> <p>Cartilages and ligaments</p> <ul style="list-style-type: none"> ♣Sensory innervation and blood supply of larynx 		Recurrent laryngeal nerve injury
Tongue	<p>Names, nerve supply and actions of extrinsic and intrinsic muscles of tongue</p> <ul style="list-style-type: none"> ♣Nerve supply and lymphatic drainage of tongue 		Hypoglossal nerve palsy
Organs of hearing and	Parts, boundaries, contents, relations, blood supply and nerve supply of external ear, middle ear and Auditory tube		

equilibrium			
Eyeball	Parts and layers of eye ball		
Prevertebral region and Joints of Head and neck	Atlanto-occipital joint		
External features	External features of the brain and spinal cord and its meningeal coverings and blood supply		
Spinal cord	<ul style="list-style-type: none"> a) External and internal features b) Organization of grey matter into nuclei c) Coverings of spinal cord d) Ascending and descending tracts and their functions e) Upper and lower motor neurons f) Spinal segment and dermatome g) Blood supply h) Modifications of piamater 		
Brainstem	External and internal features		
Cerebellum	Gross features and subdivisions of cerebellum. Deep nuclei, afferent and efferent connections. Cerebellar peduncles		Morphological subdivisions of cerebellum into archi, paleo and neocerebellum, Cerebello-pontine angle tumour, symptoms of cerebellar disease
Cerebrum	Gross features (gyri and sulci) of the cerebral hemisphere – superolateral, Medial and inferior surface, and the subdivisions into lobes, and blood supply. Functional areas and Brodmann's numerals (motor, sensory, visual, auditory, speech, frontal eye field, prefrontal cortex)		

	Horizontal section of cerebrum Midsagittal section of cerebrum		
White fibres of cerebrum	Association, commissural and projection fibres		
Ventricles of the brain	Features of lateral, third and fourth ventricle. Choroid plexus, Circulation of Cerebro-Spinal Fluid (CSF)		
Blood supply of brain and spinal cord	Blood supply of brain and spinal cord		

Bioethics

Bioethics is the application of ethics to the field of medicine and healthcare. Bioethics includes medical ethics, which focuses on issues in health care; research ethics, which focuses issues in the conduct of research; environmental ethics, which focuses on issues pertaining to the relationship between human activities and the environment, and public health ethics.

7. PRACTICAL HOURS

- Osteology - 30 hrs
 - Organ Demonstration - 5 hrs
 - Histology-Slide Demonstration - 30 hrs
 - Demonstration of dissected specimens
Head and Neck and Brain -110 hrs
- 175 hrs

8. THEORY EXAMINATION (3 Hours)

- Elaborate on : 2 x 10=20 Marks
- Write Notes on :10x 5=50 Marks

Total= 70 Marks

Note : Write Notes On: one question should be from Histology and one from embryology.

9. PRACTICAL EXAMINATION

SPOTTERS : 90 MARKS (45X2=90 marks)

Gross anatomy (head & neck, neuroanatomy) 20 X 2 = 40 Marks

Histology spotters 15 X 2 = 30 Marks

Osteology (5),embryology (4), genetics(1 chart) 10 X 2 = 20 Marks

Total 45 spotters: $45 \times 2 = 90$ Marks

Criteria to be followed during Anatomy practical examination:

One minute to be given for identification and writing the answers for each spotter Identification of microscopic tissue and any two most relevant points for identification should be mentioned for histology spotters For other spotters two points per spotter to be answered.

VIVA VOCE -20 MARKS

Osteology-10 marks, Embryology -10 marks

	Examination	Internal Assessment	Viva	Total
Theory	70	10	20	100
Practicals	90	10	-	100
Total				200

10. FORMATIVE/INTERNAL ASSESSMENT

The continuing assessment examination (both Theory/Practical) held at least 3times in a particular year and best of two examinations shall be considered. The Internal Assessment marks to be submitted to the university, once in every three months. The marks scored by the students shall be displayed on the Notice board and a copy forwarded by HOD shall be sent to the University once in every 3 months.

Theory - 10 Marks

Practical - 10 Marks

Total – 20 Marks

Topics for each assessment:

General anatomy, embryology (concerned), histology (concerned), Head and neck portions and osteology. Model exam at the end

11. RECORD NOTE / LOG BOOK

Record shall be maintained and assessed periodically by faculty and HOD. Institution shall provide adequate number of cases/teaching materials as specified in Dental Council of India regulation for the students during clinical/practical training and examinations.

12. TEXT BOOKS:

Gross Anatomy

1. Cunningham's Manual of Practical Anatomy Volumes 1, 2 and 3 15th edition by GJ Romanes
2. Clinical Oriented Anatomy 7th edition by Moore KL, Agur AMR and Dalley AF
3. Textbook human anatomy(Head and Neck), Inderbir singh
4. A Textbook of Human Anatomy, 2000 by T.S. Ranganathan

Neuroanatomy

1. Clinical Neuroanatomy 7th edition 2009 by Richard S. Snell
2. Essentials of Human Anatomy Neuroanatomy 4th edition 2012 by AK Datta
3. Textbook of Clinical Neuroanatomy 2nd edition Vishram Singh
4. Illustrated Textbook of Neuroanatomy 12th edition by GP Pal

Histology

1. Inderbir Singh's Textbook of Human Histology with Colour Atlas and Practical Guide 7th edition, 2014 by Vasudeva Neelam
2. Wheater's Functional Histology: A Text and Colour Atlas, 6th Edition by Barbara Young, Geraldine O'Dowd, Phillip Woodford
3. Textbook of Histology 2008 by GP Pal

Embryology

1. Langman's Medical Embryology 13th edition by T.W. Sadler,

2. Larsen's Human Embryology 5th Edition 2014 by Schoenwolf, Bleyl, Brauer and Francis-West
3. The Developing Human: Clinically Oriented Embryology 9th edition, 2012 by Keith L. Moore
4. Human Embryology 10th edition by IB Singh

13. REFERENCE BOOKS

1. Gray's Anatomy 41st Edition 2016 Standring S
2. Emery Medical Genetics
3. SNELL (Richard S.) Clinical Anatomy for Medical Students, Ed. 5, Little Brown & company, Boston.
4. RJ LAST'S Anatomy- McMinn, 9th edition.
5. ROMANES(G.J.) Cunningham Manual of Practical Anatomy: Head & Neck & Brain Ed.15. VOL. III, Oxford Medical Publication.
6. WHEATER, BURKITT & DANIELS, Functional Histology, Ed. 2, Churchill Livingstone.
7. SADLER, LANGMAN'S, Medicals Embryology, Ed.6.
8. JAMES E ANDERSON, Grant's Atlas of Anatomy, Williams & Wilkins.
9. WILLIAMS, Gray's Anatomy, Ed.38. , Churchill Livingstone.

2. GENERAL HUMAN PHYSIOLOGY

1. GOAL

The broad goal of teaching Human Physiology to undergraduate Dental students is to provide comprehensive knowledge of the normal functions of the organ systems of the body, to facilitate an understanding of the physiological basis of health and disease.

2. OBJECTIVES

a. KNOWLEDGE AND UNDERSTANDING:

At the end of the course, the student will be able to:

- i. Explain the normal functioning of all the organ systems and their interactions for wellco-ordinated total body function.
- ii. Assess the relative contribution of each organ system towards the maintenance of the milieu interior.
- iii. List the physiological principles underlying the pathogenesis and treatment of disease

b. SKILLS:

At the end of the course, the student shall be able to :

- i. Conduct experiments designed for the study of physiological phenomena.
- ii. Interpret experimental and investigative data
- iii. Distinguish between ' normal and abnormal data derived as a result of tests which he/she has performed and observed in the laboratory.

c. ATTITUDE:

To develop the attitude to serve the rural community.

d. INTEGRATION:

At the end of the integrated teaching the student shall acquire an integrated knowledge of organ structure and function and its regulatory mechanisms.

e. KNOWLEDGE ABOUT INFECTION AND CROSS INFECTION IN DENTISTRY

Knowledge about asepsis – disinfection and sterilization of instruments, clinical area/ personal care as per universal protection, and disposal of medical wastes in the appropriate modes. Students should be aware of the rules and regulations pertaining to maintenance of clinical set up and waste disposal.

f. COMPUTER PROFICIENCY:

Basic knowledge of Computers, MS Office, Window 2000, Statistical Programmes Basic operative skills in analysis of data and knowledge of multimedia. Students should utilize a combination of traditional classroom courses, and online courses. The following validation is required and must be completed during the first year of study.

- i). Technological Requirements for all Graduate Students
- ii). A laptop or desktop computer that supports the following requirements
 - a). Operating system requirements
 - b). Internet browser requirements
 - c). Reliable and consistent access to the internet
 - d). Antivirus software which is current and consistently updated
 - e). Microsoft Office
 - f). Adobe Reader (or equivalent to view PDF files)

3. COMPETENCIES

- i. General skills:
 - Apply knowledge & skills in day to day practice
 - Apply principles of ethics
 - Analyze the outcome of treatment
 - Evaluate the scientific literature and information to decide the treatment
 - Participate and involve in professional bodies
 - Self-assessment & willingness to update the knowledge & skills from time to time
 - Involvement in simple research projects
 - Minimum computer proficiency to enhance knowledge and skills
 - Refer patients for consultation and specialized treatment
 - Basic study of forensic odontology and geriatric dental problems

ii. Practice Management :

- Evaluate practice location, population dynamics & reimbursement mechanism
- Co-ordinate & supervise the activities of allied dental health personnel
- Maintain all records
- Implement & monitor infection control and environmental safety programs
- Practice within the scope of one's competence

iii. Communication and Community Resources:

- Assess patients goals, values and concerns to establish rapport and guide patient care
- Able to communicate freely, orally and In writing with all concerned
- Participate in improving the oral health Of the individuals through community activities.

iv. Patient Care – Diagnosis:

- Obtaining patient's .history in a methodical way
- Performing thorough clinical examination
- Selection and interpretation of clinical, radiological and other diagnostic information
- Obtaining appropriate consultation
- Arriving at provisional, differential and final diagnosis

v. Patient Care - Treatment Planning:

- Integrate multiple disciplines into an individual comprehensive sequence treatment plan using diagnostic and prognostic information
- Ability to order appropriate investigations
- Recognition and initial management of medical emergencies that may occur during dental treatment
- Perform basic cardiac life support
- Management of pain including post operative
- Administration of all forms of local anaesthesia
- Administration of intra muscular and venous injections
- Prescription of drugs, pre operative, prophylactic and therapeutic requirements
- Uncomplicated extraction of teeth
- Transalveolar extractions and removal of simple impacted teeth
- Minor oral surgical procedures

- Management of oro-facial infections
- Simple orthodontic appliance therapy ,
- Taking, processing and interpretation of various types of intra oral radiographs
- Various kinds of restorative procedures using different materials available
- Simple endodontic procedures
- Removable and fixed prosthodontics
- Various kinds of periodontal therapy

vi. Competencies specific to the subject

4. TEACHING HOURS

Lecture Hours – 120 hour

- General Physiology	- 8 hours
- Blood	- 16 hours
- Muscle and Nerve	- 7 hours
- Gastrointestinal tract	- 16 hours
- Excretion, Body temperature and functions of skin	- 9 hours
- Endocrinology	- 14 hours
- Reproduction	- 7 hours
- Cardiovascular system	- 10 hours
- Respiratory system	- 10 hours
- Central Nervous system	- 15 hours
- Special senses	- 8 hours

Practical Hours – 60 hours

5. TEACHING METHODOLOGY

The objectives of teaching General human Physiology can be achieved by various teaching techniques such as:

- a) Lectures
- b) Lecture Demonstrations
- c) Practical exercises

- d) Audio visual aids
- e) Seminar & Small group discussions with regular feed back from the students
- f) Integrated Teaching
- g) Symposium and continuing medical education programmes

6. THEORY SYLLABUS

TOPIC	MUST KNOW	DESIRABLE TO KNOW	NICE TO KNOW
Homeostasis and Feedback System	Describe the concept of maintenance of internal environment <ul style="list-style-type: none"> • Recognize that negative feedback is the most common type of physiological control 	State and describe examples of negative feedback <ul style="list-style-type: none"> • State and describe instances of positive feedback in human physiology 	
Cell Membrane	Describe with diagram the fluid mosaic model		
Membrane Transport	Classify transport mechanisms as Passive and active with examples and differentiate between them. <ul style="list-style-type: none"> • List and describe the following passive transport processes with examples: <ul style="list-style-type: none"> • Simple diffusion of respiratory gases through lipid film • Diffusion of ions through ion channels • Sodium, potassium, calcium and chloride channels • Non-gated channels, voltage gated, ligand-gated channels and mechano-gated channels • Facilitated diffusion – Glucose transporters (GluTs) • Osmosis • Describe the following active transport processes: <ul style="list-style-type: none"> • Primary active transport: <ul style="list-style-type: none"> • sodium-potassium pump, • Secondary active transport: sodium-glucose co- 	Describe the differences between channel and carrier-mediated transport processes State Fick's law of diffusion <ul style="list-style-type: none"> • Describe the following active transport processes: <ul style="list-style-type: none"> • Primary active transport: <ul style="list-style-type: none"> • Proton pumps - V type H ATPase, H/K ATPase • Secondary active 	

	<p>transport (SGLT) and sodium-amino acid co-transport</p> <ul style="list-style-type: none"> • Describe the following transport processes by formation of membrane vesicles Endocytosis• Exocytosis 	<p>transport: sodium hydrogen exchangers, sodium calcium exchangers, Na/2Cl/K symport</p>	
Membrane Potential	<p>Describe the mechanisms involved in genesis of resting membrane potential (RMP) in a prototype cell</p> <ul style="list-style-type: none"> • Recognise the RMP in a nerve or cardiac cell • Nernst or equilibrium potential 'Equilibrium potential' • Action potentials in neuron, skeletal muscle cell, Sino atrial node and cardiac ventricular cell 	<ul style="list-style-type: none"> • Patch Clamp Technique • Cathode Ray Oscilloscope 	
Blood Introduction	<ul style="list-style-type: none"> • Describe the normal composition of blood • Describe the composition of plasma • State the difference between plasma and serum. 		
Plasma Proteins (Integration with Biochemistry)	<ul style="list-style-type: none"> • State the site of production, normal range and describe the functions of Albumin • Discuss causes for decrease in serum Albumin levels with specific examples of disease conditions • Explain what is plasma on cotic pressure • Discuss the production, various types and role of Globulins (alpha, beta and gamma globulins) 		
Erythrocyte Sedimentation Rate (ESR):	<ul style="list-style-type: none"> • Define and state normal values for ESR in men and women • Describe the factors influencing ESR (fibrinogen particularly) • Discuss the significance of ESR in disease states 		
RBC	<ul style="list-style-type: none"> • Describe the physical characteristics of red blood cells • List causes and give explanation for physiological variations of the normal RBC count • Explain the functions of RBCs • List the changes in sites of erythropoiesis with age 		

	<ul style="list-style-type: none"> • Illustrate the major changes that take place during the stages of erythropoiesis. • Describe the factors regulating/affecting erythropoiesis, • Discuss the normal life span and destruction of RBCs 		
Hemoglobin	<ul style="list-style-type: none"> • State the components of Hb, the various types of Hb and normal range of Hb in men and women • Briefly discuss the synthesis of haemoglobin • what is reduced hemoglobin. • Define and describe cyanosis • Discuss the types of jaundice • Abnormal Hemoglobin 		
Anaemia	<ul style="list-style-type: none"> • Define anaemia • Classify anaemia based on etiology and morphology • Discuss the principles of treating anemias • Describe major symptoms, signs and effects of anemia 		
Platelet	<ul style="list-style-type: none"> • Describe the formation, structure, life span & removal of platelets • State the normal platelet count • Describe the functions of platelets. • Discuss the causes and effects of thrombocytopenia 		
Hemostasis	<ul style="list-style-type: none"> • Describe the processes involved in hemostasis such as: • vasoconstriction • Platelet plug formation • Clotting or coagulation pathways • Clot retraction • Describe anticlotting and fibrinolytic mechanisms in the body • List anticoagulants and their mechanism of action • Explain various causes for abnormal hemostasis 		

	<ul style="list-style-type: none"> • List the clotting factors and Explain the pathways of coagulation • Explain various causes for abnormal hemostasis • Perform and interpret simple tests of hemostasis like bleeding time by Duke's method and clotting time by capillary method of Wright on oneself by collecting blood using finger prick method using aseptic method • Explain Lee and White's method for determining clotting time 		
Blood groups & Blood banking	<ul style="list-style-type: none"> • Describe the importance of blood groups • Explain the genetic determination of blood groups • Describe the ABO system of blood grouping • State the frequency of different blood groups • Describe the Rh system of blood grouping • Explain the mechanism and consequence of ABO and Rh incompatibility • Explain the condition Erythroblastosis Fetalis, state preventive measure and treatment option for the same. 		
Body fluids	<ul style="list-style-type: none"> • List the different body fluid compartments, - state the volume, osmolarity and electrolyte composition of each of the following compartments • Total body water, extracellular, intracellular, plasma, intravascular • Describe the term transcellular fluid • Measurement of volumes of compartments • Describe the Starling's forces that govern fluid exchange across the membranes separating the various compartments • Define Donnan effect and equilibrium • Use the Concept of electro neutrality in the fluid compartments to calculate 'Anion gap' 		

	<ul style="list-style-type: none"> • Define anion gap as the term referring to unmeasured anions in plasma. 		
WBC	<ul style="list-style-type: none"> • State the normal Total and Differential count • Classify types of WBC as granulocytes, agranulocytes • Describe the morphology and functions of neutrophils, eosinophils, basophils, mast cells; Lymphocytes, monocytes. • Perform and interpret total leucocyte on their own blood / provided blood using aseptic precautions • List Conditions in which total leucocyte counts is increased or decreased. • List conditions in which counts of each type of WBC are increased or decreased • Describe the various cells that constitute the monocyte - macrophage system and state their function 		
Leucopoiesis	<ul style="list-style-type: none"> • Outline the process of maturation of white blood cells 		
Lymph	<ul style="list-style-type: none"> • Describe the formation and composition of lymph • Illustrate the lymphatic circulation. • Discuss functions of lymph. 		
Reticulo endothelial system	Functions of reticulo endothelial system		
Skeletal Muscle Morphology	<ul style="list-style-type: none"> • Describe and draw the structure of sarcomere marking actin filament, myosin filament, I band, A band, H band, Z line and sarcomere • Describe the functions of contractile and regulatory proteins involved in muscle contraction • Draw and describe the structure of the sarco-tubular system 		

Neuromuscular junction	<ul style="list-style-type: none"> • Draw and Describe the structure of the neuromuscular junction • Describe the events involved in neuromuscular transmission • Describe the pathophysiology of diseases affecting the neuromuscular junction like myasthenia gravis • Describe the mechanism of action cholinesterase inhibitors • Motor Unit 		
Muscle Contraction	<ul style="list-style-type: none"> • Describe the molecular Basis of muscle contraction, events involved in excitation contraction coupling. • Explain the types of Muscle contraction • Describe the sliding filament theory of muscle contraction Role of ATP and calcium pumps in the mechanism of relaxation of the muscle • Describe the Factors affecting the force of contraction 		
Smooth Muscle	<ul style="list-style-type: none"> • Structure, distribution, types, molecular mechanism of contraction 		
Factors modulating smooth muscle contraction And Properties	<ul style="list-style-type: none"> • List the various factors that modulate smooth muscle contraction like stretch, sympathetic nervous system, circulating substances etc. • Describe the special properties of smooth muscle like latch-bridge mechanism and plasticity 		
Digestive System Introduction to GIT,			
Salivary Glands	<p>Name the Salivary Glands composition</p> <ul style="list-style-type: none"> • Functions of saliva. 	Deficient salivation – Xerostomia	

	• Describe the regulation of salivary, secretion		
Stomach	Describe the composition and functions of gastric secretion • Describe the mechanism of gastric acid Secretion Discuss regulation of gastric secretion	proton pump inhibitor Pernicious anemia	
Exocrine Pancreas	Exocrine Pancreas- Describe the composition and functions of pancreatic secretion Explain the regulation of pancreatic secretion	Reason for the alkaline pH of pancreatic secretion and its importance	
Liver& Gall Bladder	Describe the composition and functions of Bile • Regulation of secretion	• Gall Stones • Jaundice	
Liver& Gall Bladder	Describe the composition and functions of Bile • Regulation of secretion		
Small Intestine	Discuss the secretions of small intestine and their functions& regulation of secretion	Malabsorption syndrome	
Large intestine	Explain the functions of large intestine and formation of faeces	dietary fibre • Constipation	
GI Motility	Mastication, deglutition, vomiting gastric filling and emptying, movements of small intestine ,large intestine, defaecation	State what is basic electrical rhythm of the gastrointestinal tract and it's role	
Excretory System Functional Anatomy of Kidney Structure of Nephron	Structure& functions of kidney and its functional Renal circulation • Describe the structure of the juxtaglomerular apparatus.		
Glomerular filtration	Glomerular filtration rate- definition, determination, factors influencing GFR	Concept of Renal Clearance	
Tubular reabsorption & secretion	Reabsorption of sodium, glucose ,water & other substances Secretion of urea, hydrogen and other substances	The concept of the transport maximum for glucose, renal	

		threshold	
Concentration of Urine	<p>Countercurrent Mechanism</p> <ul style="list-style-type: none"> • Countercurrent Multiplier • Countercurrent Exchanger • Role of Urea 		
Regulation of Acid base balance	<p>Blood buffers</p> <p>Role of Respiratory system and kidneys in maintaining acid base balance</p>	Anion gap	
Micturition	Describe the innervation of Bladder and reflex pathway of micturition	cystometrogram	
Endocrinology Introduction to Endocrinology	<ul style="list-style-type: none"> • Define Hormone • Classify and list the hormones based on chemical nature • Mechanism of negative and positive feedback regulation of hormone release 	<ul style="list-style-type: none"> • Describe the mechanism of action of hormones including the receptors and second messengers 	
Hypothalamus	<ul style="list-style-type: none"> • Describe the relationship between hypothalamus and pituitary including the Hypothalamohypophyseal tract and the hypothalamohypophyseal portal circulation • List the various releasing and inhibiting hormones released by the hypothalamus 		
Pituitary Gland	<ul style="list-style-type: none"> • List the various types of secretory cells of Anterior and Posterior Pituitary • List the Hormones secreted by the anterior and posterior pituitary. Growth hormone: • List the important actions of growth hormone, its effects on growth and metabolism • Describe the regulation of growth hormone secretion • List important stimuli that increases or decreases the secretion of GH • Prolactin: • Describe the actions and regulation of prolactin 	<ul style="list-style-type: none"> • Describe the physiological basis and important features of abnormalities of growth hormone secretion like - Gigantism, acromegaly and pituitary dwarfism • Describe the mechanism of action of Growth hormone (JAK-STAT Pathway) 	

	<p>secretion</p> <ul style="list-style-type: none"> • List the features of excess Prolactin secretion • Antidiuretic hormone (ADH) • Explain the synthesis, release and mechanism, functions and regulation of actions of ADH • Discuss the disorders of ADH secretion <ul style="list-style-type: none"> - Diabetes Insipidus • Oxytocin • Explain the synthesis, release mechanism, functions and regulation of Oxytocin List the functions of Oxytocin • Role in milk ejection reflex and parturition 	<ul style="list-style-type: none"> • Explain how Insulin like growth factor (IGF) or Somatomedin mediates the actions of growth hormone • Types of Diabetes Insipidus • Panhypopituitarism • Shehan's Syndrome • Postpartum Pituitary Necrosis 	
Thyroid Gland (Horizontal and Vertical Integration)	<ul style="list-style-type: none"> • Explain the functional Anatomy of Thyroid Gland • List the steps involved in the synthesis of thyroid hormones • Explain the mechanism of release of Thyroid Hormone • Explain the transport actions of thyroid hormone • Describe the regulation of thyroid hormone secretion • List the causes and features of Hypo secretion of thyroid hormones - Myxedema and Cretinism, Goitre and features of Hypothyroidism • List the causes and features Hypersecretion of thyroid hormones – Gigantism and Acromegaly • Calcitonin • Secretion and action of Calcitonin 	<ul style="list-style-type: none"> • Explain the physiological basis for Simple Goitre • List the differences between dwarfism and cretinism 	
Adrenal Gland	<ul style="list-style-type: none"> • List the hormones secreted by the different layers of Adrenal Cortex • Describe the Functional Anatomy of Adrenal Cortex • Describe the mechanism of action, functions and regulation of action of Mineralocorticoids, 	<ul style="list-style-type: none"> • Disorders produced by the deficiency of enzymes involved in adrenocortical 	

	<p>Glucocorticoids and sex steroids</p> <ul style="list-style-type: none"> • Discuss the causes and features of Cushing's Syndrome and Addison's Disease • Adrenal medulla: • Synthesis and physiological effects of epinephrine and nor-epinephrine on various systems of the body • Factors that regulate the secretion of adrenal medullary hormones 	<p>hormone synthesis</p> <ul style="list-style-type: none"> • Diseases related to Mineral ococorticoids • Conn's Syndrome • Aldosterone Escape • Atrial Natriuretic Peptide (ANP) 	
Endocrine Pancreas	<ul style="list-style-type: none"> • Name the different cells present in the Islets of Langerhans • Physiological stimulus for Insulin secretion • List the target cells of Insulin and the cells that do not require insulin action for glucose uptake • Mention the mechanism of action of Insulin on its receptor • List the important actions of insulin • List the various factors that regulate insulin secretion • Describe the features of hyper secretion of Insulin and Hypoglycemia • Glucagon • List the important actions of glucagon 	<ul style="list-style-type: none"> • Describe the steps in biosynthesis of Insulin and the origin of the C- peptide (Connecting peptide) • Diabetes Mellitus: • Discuss the Pathophysiology of Diabetes mellitus • List the hormones that raise blood sugar level 	
Reproductive System Sex Determination	<ul style="list-style-type: none"> • Differentiate between Genetic sex, Gonadal sex and phenotypic sex. • Describe the role of SRY gene and testis determining factor in development of gonads • Describe the role of testosterone and Mullerian inhibiting substance in the development of male and female internal genitalia 	<ul style="list-style-type: none"> • Discuss the role of dihydrotestosterone in the development of external genitalia 	
Male	<ul style="list-style-type: none"> • Describe the functional anatomy of the male 	<ul style="list-style-type: none"> • Outline the steps 	

Reproductive Physiology	<p>reproductive tract (Testis seminiferous tubules, Sertoli cells, Leydig cells, Blood Testis barrier, Epididymis, Vas deferens, Seminal vesicle, Prostate gland).</p> <ul style="list-style-type: none"> • Describe the blood- testis barrier and its function • Discuss factors that regulate Spermatogenesis • Describe the structure of spermatozoa • Describe the source, mechanism of action and functions of testosterone and dihydrotestosterone • State the source and functions of inhibin Discuss the hypothalamic and pituitary control on testicular function and Feed back control of testicular hormones on hypothalamus and pituitary • Describe the role of prostate, seminal vesicles in reproductive function • Describe the mechanisms that cause erection and ejaculation • State what is capacitation and discuss the changes that occur during capacitation 	<p>involved in spermatogenesis</p> <ul style="list-style-type: none"> • State the composition of semen and recognize use of semen analysis as a test to evaluate infertility • Discuss about abnormalities of the male reproductive system: • Hypogonadism • Cryptorchidism 	
Puberty Menopause Pituitary Gonadotropins (FSH,LH) and Prolactin	<ul style="list-style-type: none"> • Describe the mechanism of action functions and regulation of secretion of pituitary gonadotropins and prolactin • Explain the changes that occur during puberty and describe the mechanism of onset of puberty • Define menopause and describe the physiological changes during menopause 	<ul style="list-style-type: none"> • Discuss causes of precocious and delayed puberty 	
Female reproductive system	<ul style="list-style-type: none"> • Describe the Functional anatomy of the female reproductive system • Outline the stages of Oogenesis • State differences between oogenesis and spermatogenesis • Describe the development of ovarian follicles (Stages of follicle development, ovulation, 	<ul style="list-style-type: none"> • Differences between oogenesis and spermatogenesis • Discuss the physiological basis of use of synthetic estrogens 	

	<p>luteinisation, luteal regression)</p> <ul style="list-style-type: none"> • Describe the control of follicular development, ovulation and luteinisation (role of FSH, estrogen and LH) • Describe the process of follicle attrition • List the hormones produced by the ovary • Illustrate the synergistic role of thecal and granulosa cells in steroidogenesis • Discuss the mechanism of action and functions of estrogen and progesterone • Describe the feedback regulation of ovarian function • Describe the physiological changes occurring in ovaries, uterus, cervix , vagina and breast during a menstrual cycle • Discuss and illustrate the hormonal changes during the menstrual cycle (changes in FSH, LH, estrogen and progesterone) 	<p>and progestins as oral contraceptives</p> <ul style="list-style-type: none"> • Describe the mechanism of ovulation • State the tests for ovulation and their physiological basis • Common causes of anovulatory cycles (physiological, PCOD) • Protein hormones produced by the ovary and state their source and functions • Identify common causes of anovulatory cycles (physiological, PCOD) 	
Physiology of Pregnancy	<ul style="list-style-type: none"> • Outline the process of fertilization, implantation and placental formation • Discuss the importance of corpus luteum of pregnancy • Discuss the functions of placenta. • Discuss the secretion and function of hCG from the placenta. • Describe the role of hormonal and mechanical factors influencing labor • Describe the changes that occur in the various organ systems in the mother during pregnancy 	<ul style="list-style-type: none"> • Physiological basis of immunological tests for pregnancy based on hCG • Parturition • Source and functions of relaxin • Describe the fetoplacental unit 	

Lactation	<ul style="list-style-type: none"> • Describe the Role of estrogen and progesterone in breast development • Describe the mechanism that causes initiation of lactation after delivery • Describe the role of Prolactin and prolactin inhibitory factor (Dopamine) in lactation • Describe the Milk ejection reflex 	<ul style="list-style-type: none"> • Role prolactin inhibitory factor (Dopamine) in lactation • Discuss the effect of lactation on menstrual cycle 	
Contraception	<ul style="list-style-type: none"> • Classify male & female contraceptive methods- (temporary and permanent) • Describe the physiological basis of the various methods of contraception 	<ul style="list-style-type: none"> • Details of contraceptives devices, side effects 	
Cardiovascular System Introduction to CVS	Functional anatomy and innervation of heart		
Conducting system of Heart SA Node	<ul style="list-style-type: none"> • Origin and propagation of cardiac impulse ventricular cell action potential (fast AP). • Describe how the action potential leads to an increase in cytosolic calcium concentration • Describe excitation-contraction coupling • State the basic concepts of the sliding filament theory of contraction 	<ul style="list-style-type: none"> • Intrinsic rate of the SA node and influence of autonomic nervous system, hormones and temperature. • Sinus arrhythmia, sinus bradycardia, sinus tachycardia • Record respiration with a stethograph or respiration belt transducer, as well as ECG or pulse simultaneously, to demonstrate respiratory sinus arrhythmia. calcium 	

		exchanger (NCX)	
Cells of conducting pathway	<ul style="list-style-type: none"> • State the type of: • AV node AP - similar to SA nodal cell (slow AP) • His Bundle cell: fast AP • Purkinje fibres: fast AP 		
Properties of Cardiac Muscle	<ul style="list-style-type: none"> • Automaticity • Excitability • Conductivity • Contractility 		
Cardiac Cycle	<ul style="list-style-type: none"> • Describe with a diagram, the chronological relationship of the following events shown on the same time axis: • ECG • Valvular events • Heart sounds • Pressure curves: Left ventricular pressure, Atrial pressure and aortic pressure • Ventricular Volume curve: volume changes in ventricles, JVP Arterial pulse potential. 	<ul style="list-style-type: none"> • Concept of Murmurs • Timing of Murmurs • State the timing of murmurs in various valvular and congenital heart defects • Cardiac Catheterization 	
ECG	<ul style="list-style-type: none"> • Describe the 12 Leads in which ECG is recorded. • State the rationale of recording from multiple leads. • Identify the lead which is commonly used to monitor patients continuously. • Describe the P, QRS, T and U waves of an ECG in lead II configuration and describe the electrical events responsible for these waves • Describe PR and QT intervals and state what they represent • Describe the significance of ST segment being on the isoelectric line in a normal ECG • Record an ECG in a human subject in all 12 leads • Calculate rate from a normal ECG tracing 	<ul style="list-style-type: none"> • Hyperkalemia • Ventricular tachycardia • State the causes for PR prolongation • Describe the types of Heart block as represented by ECG changes • Arrhythmias • Vector cardiogram • Calculation of axis 	

	<ul style="list-style-type: none"> • Identify if every QRS complex is preceded by a P wave and if every P wave is followed by a QRS complex • State in what conditions the above will not happen 	<ul style="list-style-type: none"> • His bundle electrogram 	
Cardiac Output	<ul style="list-style-type: none"> • Definition of Stroke Volume, Cardiac Index, EDV, ESV, and EF • Discuss the determinants of cardiac output • Describe the regulation of cardiac output • Discuss high output and low output states 	<ul style="list-style-type: none"> • Methods of Measuring Cardiac Output 	
Heart Rate	<ul style="list-style-type: none"> • Innervation of Heart – Parasympathetic and Sympathetic • Normal Values • Regulation of Heart Rate • Factors affecting Heart Rate 	<ul style="list-style-type: none"> Tachycardia Bradycardia Arrhythmias 	
Blood Pressure	<ul style="list-style-type: none"> • Define the following terms: • Mean arterial blood pressure, Systolic pressure, Diastolic pressure, pulse pressure • Describe the determinants of blood pressure • Discuss the short-term (neural and hormonal) and long term (renal) mechanisms regulating blood pressure (with special reference to shock and exercise). • Demonstrate the method of measurement of blood pressure using a sphygmomanometer. • Describe the principle of measuring blood pressure by sphygmomanometry • Discuss other methods of measuring blood pressure by sphygmomanometer hypertension Cardiovascular changes during exercise and postural changes 	<ul style="list-style-type: none"> • Hypertension • Hypotension hypertension 	
Cardiovascular homeostasis	<ul style="list-style-type: none"> • Features and regulation of the following circulations: • Coronary Changes in blood flow during different phases of cardiac cycle 		

Coronary circulation	<ul style="list-style-type: none"> • Features and regulation of the following circulations: • Coronary Changes in blood flow during different phases of cardiac cycle Methods for measuring coronary blood flow sympathetic regulation versus local metabolic factors in the regulation of the regional circulations mentioned above. 	Angina pectoris Myocardial infarction	
Hypertension	<ul style="list-style-type: none"> • State the normal ranges for systolic and diastolic blood pressures in the various age groups • Define hypertension 	<ul style="list-style-type: none"> • Discuss the risk factors for essential hypertension and causes of secondary hypertension 	
Respiratory System Functional Anatomy	<ul style="list-style-type: none"> • Functional Anatomy of the respiratory tract • Functions of nose and para-nasal sinuses • Conducting zone and respiratory zone • Pulmonary vasculature • Structure of alveolus & alveolo capillary membrane 	Examination of RS	
Muscles of Respiration	<ul style="list-style-type: none"> • Muscles of Inspiration and Expiration • Accessory Muscles of respiration 		
Surface Tension Surfactant	<ul style="list-style-type: none"> • Surface Tension in air liquid interface • Law of Laplace • Role of surfactant 	<ul style="list-style-type: none"> • Respiratory Distress Syndrome 	
Mechanics of respiration Pulmonary Ventilation	<ul style="list-style-type: none"> • State the normal respiratory rate and define inspiration & expiration • List the muscles of inspiration, expiration & accessory muscles of respiration • Describe the movements of chest wall and the changes in chest wall dimensions produced by respiratory muscles • Recognise the difference between quiet breathing and forceful breathing • Discuss the factors affecting airflow between the atmosphere and alveoli 		

	<ul style="list-style-type: none"> • State the recoil nature of Lungs and chest wall • State the values of intra alveolar pressure, Intra pleural pressure • Discuss the changes in alveolar and intra pleural pressures during respiration • Identify the sites of air way resistance • Indicate changes in airway resistance with inspiration and expiration • Explain the action of autonomic nervous system on bronchial tone • List histamine as a bronchoconstrictor • Recognise that airway resistance is increased in obstructive lung diseases • Define lung compliance and relate it to clinical conditions in which it is altered • State clinical conditions in which work of breathing is increased 		
Lung Volumes and Capacities	<ul style="list-style-type: none"> • Define the lung volumes and capacities; state the normal values and discuss their physiological variations • Explain the recording of the Spirogram with a diagram and recognize the volumes and capacities which cannot be measured by spirometry • Record the lung volumes and capacities of a normal subject using a spirometer • Discuss the physiological significance of the Residual volume & functional residual capacity • Describe the forced expiratory spirogram and describe FEV1, FVC and the FEV1/FVC ratio and its variations in obstructive and restrictive lung diseases. • Define peak expiratory flow & state its normal value • Record peak expiratory flow in abnormal subject 	<ul style="list-style-type: none"> • List the common causes Pathology & clinical features of obstructive and restrictive lung diseases. • Asthma • COPD • Emphysema • Chronic bronchitis • State the physiological basis of tests to differentiate them. • Recognize the flow-volume curves • Methods of 	

	<ul style="list-style-type: none"> Record FEV1, FVC and calculate the FEV1/FVC ratio in a normal subject Interpret altered values of absolute lung volumes, peak expiratory flow and FEV1/FVC ratio in restrictive and obstructive lung diseases Define minute ventilation, anatomical dead space, physiological dead space & alveolar ventilation Discuss the effect of changes in respiratory rate and tidal volume on alveolar ventilation 	<ul style="list-style-type: none"> determining FRC and RV Helium dilution method Whole body plethysmography Measurement of dead space 	
Alveolar Ventilation	<ul style="list-style-type: none"> Total ventilation = Tidal Volume x Respiratory Rate Dead Space and Classification Alveolar Ventilation Factors affecting alveolar ventilation 	Measurement of Dead Space	
Gas Exchange	<ul style="list-style-type: none"> Discuss the factors that affect rate of gas exchange at lung & tissue level, with application to clinical conditions State Fick's law of diffusion Discuss normal composition of atmospheric, tracheal and alveolar air and recognize the conditions which can affect it Discuss the normal partial pressures of gases in blood entering and leaving lung Explain oxygen uptake and carbon dioxide elimination by lungs & tissues and state the normal rates of the same Define respiratory exchange ratio and state its normal values State normal time taken for gas equilibration & its application in exercise State the physiological causes for normal alveolar-arterial oxygen difference Explain the dependence of carbon dioxide elimination on ventilation Define physiological shunt 	<ul style="list-style-type: none"> Define Type I respiratory failure and state the common causes Explain Type I respiratory failure due to unequal V/Q distribution even when total ventilation and perfusion may be normal State the Alveolar gas equation and discuss its application Recognize that arterial PCO2 is equal to alveolar PCO2 and that arterial PCO2 can be used in the alveolar gas equation 	

		<ul style="list-style-type: none"> • State the causes for abnormal Alveolar – arterial oxygen difference • Distinguish between intrapulmonary and extrapulmonary right to left shunts. 	
Transport of Oxygen	<ul style="list-style-type: none"> • Explain the forms of oxygen transport in blood • Discuss hemoglobin affinity for oxygen • Explain & illustrate oxygen hemoglobin dissociation curve and discuss the factors affecting it and the physiological advantages of the curve • Explain Bohr effect • Discuss oxygen carrying capacity of blood • Differentiate between oxygen content of blood & % oxygen saturation of hemoglobin • Define hypoxemia and hypoxia; explain the physiological basis of types of hypoxia with examples • Define cyanosis and differentiate between conditions in which it occurs and may not occur 	State the physiological basis of oxygen therapy as treatment for the different types of hypoxias	
Transport of Carbon dioxide	<ul style="list-style-type: none"> • Explain the forms of carbon dioxide transport in blood • Explain the role of chloride shift and Haldane effect 		
Regulation of Respiration	<ul style="list-style-type: none"> • Express the concept of the sensors, central controller in brain & effectors in the respiratory control system • Describe the location and functions of the respiratory centres in brain; describe the current explanation for the basic rhythm of respiration • Describe the effects of neural inputs on respiration in terms of the voluntary cortical control, motor 	<ul style="list-style-type: none"> • State the normal values of arterial blood gases (ABG) and interpret altered values • Define hypercapnoea and hypocapnoea 	

	<p>cortical input, limbic input, peripheral afferent inputs (Heringbreuer reflexes, J receptor input, proprioceptor input, and other peripheral inputs)</p> <ul style="list-style-type: none"> • Express the aim of chemical control of respiration; explain the role of peripheral and central chemoreceptors; explain the feedback control of ventilation to regulate gas exchange & maintain normal levels of arterial blood gases and pH • Discuss and compare the influence of arterial carbon dioxide and oxygen on ventilation in health and in disease • Describe Cheyne-stokes breathing, state its causes, explain the physiological and pathophysiological mechanisms that produce it; state the abnormality in Biot's breathing • Demonstrate the effect of apnoea & hyperventilation on respiration; demonstrate the effect of breathing through a tube and the effect of speech & cough on respiration 	<ul style="list-style-type: none"> • State the causes of asphyxia 	
Pulmonary Function Tests	<ul style="list-style-type: none"> • Spirometry • Arterial Blood Gas Analysis • Peak Flow Meter • Pulseoxymetry 		
Central Nervous System Organization of the nervous system	<p>CNS PNS Somatic NS Autonomic NS Enteric NS</p>		
Neuronal organization at spinal cord level	<p>Neural Tissue Nerve Fibres Electrical properties of the nerve cell membrane</p>	<p>Numerical classification of sensory fibres</p> <ul style="list-style-type: none"> • Mechanism of axoplasmic transport 	

		•Wallerian degeneration Neurotransmitters	
Synapse, receptors, reflexes, sensations and tracts	Define the structure properties of synapse: classification of reflexes ascending and descending tracts, Types of sensations	Pathway for proprioception	
Physiology of pain	Pathway for transmission of pain, fast pain & slow pain, referred pain	Endogenous Analgesic system and gate control theory	
Cerebellum Thalamus Hypothalamus, Cerebral cortex	Structure, functions, connections and applied aspects of cerebellum, thalamus, hypothalamus, cerebral cortex	cerebellar lesions cerebellar function tests, thalamic syndrome, corpus callosum	
CSF	• Describe the composition, Secretion, Circulation, Drainage and Functions	• Papilledema • Hydrocephalus	
Autonomic nervous system	Organization of sympathetic and parasympathetic nervous system.		
Special Senses Vision, Hearing, Taste and Smell	Fundamental knowledge of Vision, Hearing, Taste and Smell		

Bioethics

Bioethics is the application of ethics to the field of medicine and healthcare. Bioethics includes medical ethics, which focuses on issues in health care; research ethics, which focuses issues in the conduct of research; environmental ethics, which focuses on issues pertaining to the relationship between human activities and the environment, and public health ethics.

7. PRACTICALS

The following list of practical is minimum and essential. All the practical have been categorised as procedures and demonstrations. The procedures are to be performed by the students during practical classes to acquire skills. All the

procedures are to be included in the University practical examination. Those categorised as demonstrations are to be shown to the students during practical classes. However these demonstrations would not be included in the University examinations but question based on this would be given in the form of charts, graphs and calculations for interpretation by the. students.

PROCEDURES

- a. Enumeration of Red Blood Cells
- b. Enumeration of White Blood Cells
- c. Differential leucocyte counts
- d. Determination of Haemoglobin
- e. Determination of blood group
- f. Determination of, bleeding time and clotting time
- g. Examination of pulse
- h. Recording of blood pressure.

DEMONSTRATION:

- a. Determination of packed cell volume and erythrocyte sedimentation rate
- b. Determination of specific gravity of blood
- c. Determination of erythrocyte fragility
- d. Determination of vital capacity and timed vital capacity
- e. Skeletal muscle experiments. Study of laboratory appliances in experimental physiology. Frog's gastrocnemius sciatic preparation. Simple muscle curve, effects of two successive stimuli, effects of increasing strength of stimuli, effects of temperature, genesis of fatigue and tetanus. Effect of after load and free load on muscle contraction, calculation of work done.
- f. Electrocardiography: Demonstration of recording of normal Electro cardiogram
- g. Clinical examination of cardiovascular and respiratory system.

8. THEORY EXAMINATION

Essay 1 × 10 = 10 marks
Short Essay 3 × 5 = 15 marks
Short Answers 5 × 2 = 10 marks

Total = 35 marks

9. PRACTICAL /CLINICAL EXAMINATION

PRACTICAL EXAMINATION

MAJOR- 20 MARKS

- Enumeration of Red Blood Cells.
- Enumeration of White Blood Cells.
- Differential leucocyte counts.
- Recording of blood pressure.

MINOR- 15 MARKS

- Determination of Haemoglobin.
- Determination of blood group.
- Determination of, bleeding time and clotting time.

OSPE - 4 MARKS

- Recording Blood Pressure by Palpatory Method
- Examining Radial Pulse

CHART - 6 MARKS

TOTAL – 45 MARKS

VIVA - 10 MARKS

	Examination	Internal Assessment	Viva	Total
Theory	35	5	10	50
Practicals	45	5	-	50
Total				100

10. FORMATIVE / INTERNAL ASSESSMENT

The continuing assessment examination (both Theory/Practical) held at least 3times in a particular year and best of two examinations shall be considered. The Internal Assessment marks to be submitted to the university, once in every three

months. The marks scored by the students shall be displayed on the Notice board and a copy forwarded by HOD shall be sent to the University once in every 3 months.

Theory – 5 marks
Practical – 5 marks
Total - 10marks

Topics for each Assessment

- a. General Physiology, Blood, Nerve and Muscle Physiology.
- b. Gastro intestinal Tract.
- c. Cardiovascular System.
- d. Respiratory System.
- e. Excretory System, Endocrinology and Reproductive System.
- f. Central Nervous System And Special Senses.

11. RECORD NOTE / LOG BOOK

Record shall be maintained and assessed periodically by faculty and HOD. Institution shall provide adequate number of cases/teaching materials as specified in Dental Council of India regulation for the students during clinical/practical training and examinations.

12. TEXT BOOKS

- i) A .K. Jain ;Human Physiology for BDS students
- ii) Chauduari ;Concise Medical Physiology

13. REFERENCE BOOKS

- i) Guyton ; Textbook of Physiology
- ii) Berne & Levey; Physiology, 2nd edition
- iii) West-Best & Taylor's, Physiological basis of Medical Practise, 11th edition.

BIOCHEMISTRY

1. GOAL

The broad goal of the teaching of undergraduate students in biochemistry is to make them understand the scientific basis of the life processes at the molecular level and to orient them towards the application of the knowledge acquired in solving dental oriented clinical problems.

2. OBJECTIVES

KNOWLEDGE AND UNDERSTANDING

At the end of the course, the student should be able to:

- i. describe the molecular and functional organization of a cell and list its subcellular components;
- ii. delineate structure, function and inter-relationships of biomolecules and consequences of deviation from normal;
- iii. summarize the fundamental aspects of enzymology and clinical application wherein regulation of enzymatic activity is altered;
- iv. describe digestion and assimilation of nutrients and consequences of malnutrition;
- v. integrate the various aspects of metabolism and their regulatory pathways;
- vi. explain the biochemical basis of inherited disorders with their associated sequelae;
- vii. describe mechanisms involved in maintenance of body fluid and pH homeostasis;
- viii. outline the molecular mechanisms of gene expression and regulation, the principles of genetic engineering and their application in dentistry
- ix. summarize the molecular concepts of body defence and their application in dentistry
- x. outline the biochemical basis of environmental health hazards, biochemical basis of cancer and carcinogenesis
- xi. explain the principles of various conventional and specialized laboratory investigations and instrumentation analysis and interpretation of a given data relevant to dentistry
- xii. suggest experiments to support theoretical concepts and clinical diagnosis.

SKILLS:

At the end of the course, the student should be able to : (1) make use of conventional techniques/instruments to perform biochemical analysis relevant to clinical screening and diagnosis; (2) analyze and interpret investigative data; (3) demonstrate the skills of solving scientific and clinical problems and decision making in dentistry.

ATTITUDE:

At the end of the course, the student should be able to understand the biochemical basis of the health and diseases.

INTEGRATION:

The knowledge acquired in biochemistry should help the students to integrate molecular events with structure and function of the human body

KNOWLEDGE ABOUT INFECTION AND CROSS INFECTION IN DENTISTRY

Knowledge about asepsis – disinfection and sterilization of instruments, clinical area/ personal care as per universal protection, and disposal of medical wastes in the appropriate modes. Students should be aware of the rules and regulations pertaining to maintenance of clinical set up and waste disposal.

COMPUTER PROFICIENCY

Basic knowledge of Computers, MS Office, Window 2000, Statistical Programmes. Basic operative skills in analysis of data and knowledge of multimedia. Students should utilize a combination of traditional classroom courses, and online courses. The following validation is required and must be completed.

- i. Technological Requirements for all Graduate Students
- ii. A laptop or desktop computer that supports the following requirements
 - a. Operating system requirements
 - b. Internet browser requirements
 - c. Reliable and consistent access to the internet
 - d. Antivirus software which is current and consistently updated
 - e. Microsoft Office
 - f. Adobe Reader (or equivalent to view PDF files)

3. COMPETENCIES

- i. General skills:
 - Apply knowledge & skills in day to day practice

- Apply principles of ethics
 - Analyze the outcome of treatment
 - Evaluate the scientific literature and information to decide the treatment
 - Participate and involve in professional bodies
 - Self-assessment & willingness to update the knowledge & skills from time to time
 - Involvement in simple research projects
 - Minimum computer proficiency to enhance knowledge and skills
 - Refer patients for consultation and specialized treatment
 - Basic study of forensic odontology and geriatric dental problems
- ii. Practice Management :
- Evaluate practice location, population dynamics & reimbursement mechanism
 - Co-ordinate & supervise the activities of allied dental health personnel
 - Maintain all records
 - Implement & monitor infection control and environmental safety programs
 - Practice within the scope of one's competence
- iii. Communication and Community Resources:
- Assess patients goals, values and concerns to establish rapport and guide patient care
 - Able to communicate freely, orally and In writing with all concerned
 - Participate in improving the oral health Of the individuals through community activities.
- iv. Patient Care – Diagnosis:
- Obtaining patient's .history in a methodical way
 - Performing thorough clinical examination
 - Selection and interpretation of clinical, radiological and other diagnostic information
 - Obtaining appropriate consultation
 - Arriving at provisional, differential and final diagnosis
- v. Patient Care - Treatment Planning:
- Integrate multiple disciplines into an individual comprehensive sequence treatment plan using diagnostic and prognostic information
 - Ability to order appropriate investigations

- Recognition and initial management of medical emergencies that may occur during dental treatment
- Perform basic cardiac life support
- Management of pain including post operative
- Administration of all forms of local anaesthesia
- Administration of intra muscular and venous injections
- Prescription of drugs, pre operative, prophylactic and therapeutic requirements
- Uncomplicated extraction of teeth
- Transalveolar extractions and removal of simple impacted teeth
- Minor oral surgical procedures
- Management of oro-facial infections
- Simple orthodontic appliance therapy ,
- Taking, processing and interpretation of various types of intra oral radiographs
- Various kinds of restorative procedures using different materials available
- Simple endodontic procedures
- Removable and fixed prosthodontics
- Various kinds of periodontal therapy

To sensitize the students on the ethical issues in the form of Lectures.

- Introduction to ethics.
- Ethics of the individual.
- Profession ethics.
Research ethics

vi. Competencies Specific to the subject

4. TEACHING HOURS

Theory classes: Total: 70 hours.

S. no	Topic	Number of hours
1	Cell	1
2	Chemistry of carbohydrates	3

3	Chemistry of lipids	2
4	Chemistry of proteins	3
5	Chemistry of nucleic acids	2
6	Vitamins	8
7	Minerals	5
8	Nutrition	2
9	Enzymes	3
10	Bioenergetics	2
11	Carbohydrate metabolism	7
12	Lipid metabolism	5
13	Protein metabolism	6
14	Integration of metabolism	1
15	Hemoglobin, Immunoglobulins & plasma proteins	5
16	Nucleotide metabolism & medical genetics	5
17	Homeostatic mechanisms in the body (pH, acid base, water and electrolyte balance)	3
18	Hormones	1
19	Muscle ,Bone and connective tissue	2
20	Metabolism of xenobiotics & oxygen toxicity	1
21	Function tests	2
22	Importance of ethical issues in laboratory medicine	1

5. TEACHING METHODOLOGY

Lectures, tutorials, seminars, small group discussions, integrated teaching modules, use of charts (paper-based clinical scenarios) for case discussions, practical exercises and demonstrations.

6. THEORY SYLLABUS

TOPIC	MUST KNOW	DESIRABLE TO KNOW	NICE TO KNOW
Chemistry of Bio-Organic Molecules	Cell: structure & function of cellular components Structure of membranes and transport.		

	<p>Exocytosis and endocytosis</p> <p>Chemistry of Carbohydrates: Definition, biological importance and classification. Monosaccharides - Isomerism, anomerism. Sugar derivatives, Disaccharides. Polysaccharides. Components of starch and glycogen.</p> <p>Chemistry of Lipids : Definition, biological importance and classification. Fats and fatty acids. Introduction to compound lipids. Hydrophobic and hydrophilic groups. Cholesterol. Bile salts. Micelle.</p> <p>Chemistry of Proteins: Biological importance. Classification and properties of amino acids & proteins. Peptides. Introduction to protein structure. Denaturation. Fibrous protein: Collagen and elastin. Glycosaminoglycans. Classification, separation & functions of Plasma proteins</p> <p>Chemistry of Nucleic acids: Biological importance of nucleic acids. Outline structure of DNA and RNA.</p>	Glycosaminoglycans	
Macro Nutrients and Digestion	Digestion and absorption of carbohydrates, proteins & lipids		
Micro Nutrients	Vitamins :Definition, classification, daily requirement, sources,biochemical functions and deficiency symptoms of Vitamin A, Vitamin D, Vitamin E, Vitamin K, Vitamin B and Vitamin C.	Introduction to antivitamins and hypervitaminosis.	

	<p>Minerals: Classification, sources, absorption, functions and daily requirement of Calcium, phosphorus, Iron, Iodine and Fluoride.</p> <p>Nutrition: Energy needs: Basal metabolic rate. Dietary fibres. Nitrogen balance. Essential amino acids. Protein calorie malnutrition .</p>	<p>Iodine: source, absorption & functions. Other trace elements.</p> <p>Balanced diet.</p>	
Energy Metabolism	<p>Electron Transport Chain And Oxidative Phosphorylation Components of respiratory chain Oxidative Phosphorylation & mechanism of ATP generation, Inhibitors & uncouplers of ETC, & Clinical aspects</p> <p>Carbohydrate Metabolism: Glycolysis, pyruvate oxidation, citric acid cycle and Gluconeogenesis. Lactate metabolism . Introduction to glycogenesis, glycogenolysis. Importance of pentose phosphate pathway. Formation of glucuronic acid. Regulation of blood glucose. Diabetes mellitus and related disorders. Evaluation of glycemic status.</p> <p>Lipid Metabolism: Beta oxidation of fatty acids, Ketone body formation and utilisation, Outlines of cholesterol synthesis and breakdown.</p> <p>Protein Metabolism: Ammonia metabolism. Urea formation.</p>	<p>Glycogen storage disorders, glucose 6-phosphate dehydrogenase deficiency</p> <p>fatty acid synthesis, lipogenesis and lipolysis.</p>	
Special aspects of Metabolism	<p>Importance of pentose phosphate pathway. Formation of glucuronic acid. Phosphocreatine formation. Transmethylation.</p>	<p>Biogenic Amines. Introduction to other functions of amino</p>	

		acids including one carbon transfer. Detoxication: Typical reactions. Examples of toxic compounds. Oxygen Toxicity.	
Biochemical Genetics and Protein Synthesis	Structure and functions of DNA & RNA.	Antimetabolites and antibiotics interfering in replication, transcription and translation. Introduction to cancer, viruses and oncogen.	
Enzyme and Metabolic Regulation	Enzymes: Definition, classification, specificity and active site. Cofactors. Effect of pH, temperature and substrate concentration. Introduction to enzyme inhibitors, proenzymes and isoenzymes. Introduction to allosteric regulation, covalent modification and regulation by induction/repression. Serum enzymes in diagnosis Hormones: Brief introduction to thyroid hormones.	Introduction to second messengers, cyclic AMP, calcium ion, inositol triphosphate. Hyperthyroidism and hypothyroidism: Biochemical	Mechanism of action of steroid hormones, epinephrine, glucagon and insulin in brief.

	Acid base regulation & electrolyte balance: Normal pH of blood and its regulation.	evaluation. Approaches to treatment.	
Structural Components and Blood Proteins	Connective tissue: Collagen and elastin, Bone structure, Introduction to cytoskeleton. Haemoglobin & Immunoglobulins: Structure & functions of Heme & Immunoglobulins.Heme degradation. Other plasma proteins	Introduction to heme synthesis.	Myofibril and muscle contraction. Plasma lipoproteins.
Medical Biochemistry	a) Regulation of blood glucose,Diabetes mellitus & related disorders,Evaluation of glycemc index. b) Hyperthyroidism and hypothyroidism: Biochemical evaluation. Approaches to treatment. c) Hyperlipoproteinemias and atherosclerosis. d) Jaundice: Classification and evaluation. Liver function tests: Plasma protein pattern, serum enzymes levels. e) Kidney function tests & gastric function tests. f) Disorders of Acid base balance & Electrolyte balance. Ethics: - To sensitise the students on the ethical issues in the form of Lectures. -Introduction to ethics.		

8. THEORY EXAMINATION

Essay	1 x 10 marks =	10 marks
Short Notes	3 x 5 marks =	15 marks
Short answers	5 x 2 marks =	10 marks
	Total =	35 marks

9. PRACTICAL /CLINICAL EXAMINATION

- Quantitative estimation - 20 Marks
Quantitative estimation of analyst- Glucose
Protein
- Qualitative analysis of abnormal constituents in urine- 15 marks
- Chart 6 marks
2 Charts 3 marks each.
- OSPE - 4 marks
2 Performance stations 2 marks each.

Total – 45 Marks

Viva -10Marks

	Examination	Internal Assessment	Viva	Total
Theory	35	5	10	50
Practicals	45	5	-	50
	Total			100

10. FORMATIVE / INTERNAL ASSESSMENT

The continuing assessment examination (both Theory/Practical) held at least 3 times in a particular year and best of two examinations shall be considered. The Internal Assessment marks to be submitted to the university, once in every three months. The marks scored by the students shall be displayed on the Notice board and a copy forwarded by HOD shall be sent to the University once in every 3 months.

Theory – 5 marks
Practical – 5 marks
Total - 10 marks

Topics for each Assessment

1. Cell & chemistry of carbohydrates, lipids and proteins
2. Enzymes, vitamins and minerals
3. Metabolism of carbohydrates, lipids and proteins
4. Hemoglobin, immunoglobulin, Nutrition and acid base disorders
5. Hormones, connective tissue, metabolism of xenobiotics and oxygen toxicity
6. Molecular biology

11. RECORD NOTE / LOG BOOK

Record shall be maintained and assessed periodically by faculty and HOD. Institution shall provide adequate number of cases/teaching materials as specified in Dental Council of India regulation for the students during clinical/practical training and examinations.

12. Recommended Books:

1. D.M Vasudevan ,Text book of Biochemistry for Dental students
2. Ambika Shanmugam's Text book of Biochemistry

13. Reference Books:

1. Harper's Illustrated Biochemistry
2. Lippincotts Illustrated reviews
3. Text book of Biochemistry with clinical correlations 1997, T.N. Pattabiraman
4. Basic and applied Dental Biochemistry, 1979, R.A.D. Williams & J.C.Elliot.

3. DENTAL ANATOMY, EMBRYOLOGY AND ORAL HISTOLOGY

1. GOAL

To produce a dental graduate and clinician who is competent in examining, understanding and treating common oral disorders/diseases, alleviate pain, swelling, stomatodynia, stomatopyrosis, dysphagia and dysarthrosis using the best available evidence as per current knowledge and understanding of common oral diseases process; to employ reliable diagnostic modalities including but not limited to radiology, sialogram and to refer to a competent specialist in case of oral diseases with uncommon presentations, signs and symptoms.

2. OBJECTIVES

KNOWLEDGE AND UNDERSTANDING:

- To acquire an understanding of how cells, tissues, and organs develop and function in order to gain a clear perspective of these structures as a basis for understanding oral biology/ecology
- To develop a comprehension of the principles of embryogenesis and human development with emphasis on the face and structures of the oral cavity
- To understand, comprehend, describe, compare, and illustrate the histologic characteristics of oral tissues in health and diseased states
- To develop a professional vocabulary of terminology related to the head and neck, the oral complex, and the teeth so as to apply in clinical scenario
- To identify, locate, and relate the gross anatomical structures of the head and neck to include various teeth, the bones of the skull, musculature, major nerves, glands and the circulatory and lymphatic systems.
- To identify the histologic and anatomic features of the extra-oral and intraoral structures.
- To compare and contrast the human dentition in relationship to location, function, and morphology
- To identify, comprehend, describe the sequence and eruption patterns of primary and permanent teeth and their implications on future oral and overall health
- To understand the oral physiology, unique biochemical basis behind of oral musculature, glands and movements
- To be able to clinically apply and incorporate knowledge of tooth morphology, dental occlusion, head and neck anatomy, histology, and embryology into patient assessment, preventive management, treatment planning, and patient education in future

SKILLS:

- Able to carve and reproduce the morphology of human permanent teeth in wax blocks
- Able to identify different oral hard tissues in clinical situations
- Able to differentiate normal from abnormal and diseased states
- Able to identify various types of human teeth based on their morphology
- Able to appreciate the influence of age, gender and race on oral and para-oral structures
- Able to locate the different areas/surfaces of the teeth
- Able to understand the implications of the disease process and ageing on normal oral structures
- Able to appreciate the eruption and shedding pattern of human teeth
- Able to appreciate and integrate the concept of occlusion, range of human jaw movements in preclinical and clinical situations
- Able to use effectively the terminologies and anatomical terms for clinical and patient communications

KNOWLEDGE ABOUT INFECTION AND CROSS INFECTION IN DENTISTRY

Knowledge about asepsis – disinfection and sterilization of instruments, clinical area / personal care as per universal protection, and disposal of medical wastes in the appropriate modes. Students should be aware of the rules and regulations pertaining to maintenance of clinical set up and waste disposal.

COMPUTER PROFICIENCY

Basic knowledge of Computers, MS Office, Window 2000, Statistical Programmes. Basic operative skills in analysis of data and knowledge of multimedia. Students should utilize a combination of traditional classroom courses, and online courses. The following validation is required and must be completed during the first year of study.

- i. Technological Requirements for all Graduate Students
- ii. A laptop or desktop computer that supports the following requirements
 - a. Operating system requirements
 - b. Internet browser requirements
 - c. Reliable and consistent access to the internet
 - d. Antivirus software which is current and consistently updated
 - e. Microsoft Office
 - f. Adobe Reader (or equivalent to view PDF files)

3. COMPETENCIES

i. General skills:

- Apply knowledge & skills in day to day practice
- Apply principles of ethics
- Analyze the outcome of treatment
- Evaluate the scientific literature and information to decide the treatment
- Participate and involve in professional bodies
- Self-assessment & willingness to update the knowledge & skills from time to time
- Involvement in simple research projects
- Minimum computer proficiency to enhance knowledge and skills
- Refer patients for consultation and specialized treatment
- Basic study of forensic odontology and geriatric dental problems

ii. Practice Management :

- Evaluate practice location, population dynamics & reimbursement mechanism
- Co-ordinate & supervise the activities of allied dental health personnel
- Maintain all records
- Implement & monitor infection control and environmental safety programs
- Practice within the scope of one's competence

iii. Communication and Community Resources:

- Assess patients goals, values and concerns to establish rapport and guide patient care
- Able to communicate freely, orally and In writing with all concerned
- Participate in improving the oral health Of the individuals through community activities.

iv. Patient Care – Diagnosis:

- Obtaining patient's .history in a methodical way
- Performing thorough clinical examination
- Selection and interpretation of clinical, radiological and other diagnostic information
- Obtaining appropriate consultation
- Arriving at provisional, differential and final diagnosis

v. Patient Care - Treatment Planning:

- Integrate multiple disciplines into an individual comprehensive sequence treatment plan using diagnostic and prognostic information
- Ability to order appropriate investigations
- Recognition and initial management of medical emergencies that may occur during dental treatment
- Perform basic cardiac life support
- Management of pain including post operative
- Administration of all forms of local anaesthesia
- Administration of intra muscular and venous injections
- Prescription of drugs, pre operative, prophylactic and therapeutic requirements
- Uncomplicated extraction of teeth
- Transalveolar extractions and removal of simple impacted teeth
- Minor oral surgical procedures
- Management of oro-facial infections
- Simple orthodontic appliance therapy ,
- Taking, processing and interpretation of various types of intra oral radiographs
- Various kinds of restorative procedures using different materials available
- Simple endodontic procedures
- Removable and fixed prosthodontics
- Various kinds of periodontal therapy

vi. Competencies specific to the subject

To gain knowledge about the microscopic configuration of normal histological structure of both soft and hard tissues.

4. TEACHING HOURS

Lecture hours – 105 hours

Practical/clinical hours – 250 hours

5. TEACHING METHODOLOGY

- I. LECTURE
- II. DEMONSTRATION
- III. GROUP DISCUSSION
- IV. SEMINAR PRESENTATION BY THE STUDENTS

6. THEORY SYLLABUS

TOPIC	MUST KNOW	DESIRABLE TO KNOW	NICE TO KNOW
Introduction to tooth morphology	<ul style="list-style-type: none"> ➤ Human dentition : types and functions ➤ Notation systems : Palmer's, FDI system, Universal and Victor-Haderup system ➤ Tooth surfaces, their junctions – line angles and point angles ➤ Definition in terms used in dental morphology <p>Contact areas and embrasures – clinical significance</p>	<ul style="list-style-type: none"> ➤ Dental formula 	Evolution of human dentition
Morphology of permanent teeth	<ul style="list-style-type: none"> ➤ Description of individual teeth, along with their endodontic anatomy and including a note on their chronology of development, differences between similar classes of teeth and identification of individual teeth. ➤ Variations and anomalies commonly seen in individual teeth. 		
Morphology of deciduous teeth	<ul style="list-style-type: none"> ➤ Difference between deciduous and permanent teeth ➤ Description of individual deciduous teeth, including their chronology and development ➤ Differences between deciduous and permanent dentition 	Endodontic anatomy	

	➤ Identification of individual deciduous teeth		
Occlusion	➤ Definition, factors influencing occlusion – basal bon, arch, individual teeth, external and internal forces and sequence of eruption	➤ Inclination of individual teeth – compensatory curves ➤ Centric relation and centric occlusion – protrusive, retrusive and lateral occlusion	➤ Introduction to and classification of malocclusion ➤ Clinical significance of normal occlusion
ORAL EMBRYOLOGY	Brief review of development of face, jaws, lips, palate and tongue with applied aspect		
Development of teeth	➤ Epithelial mesenchymal interaction, ➤ Detailed study of different stages of development of crown, root and supporting tissue of teeth and detailed study of formation of calcified tissues. ➤ Applied aspects of disorders in development of teeth.	Deviation or aberration in tooth formation	Exposure to microscopic slides
Eruption of deciduous and permanent teeth	➤ Mechanisms in tooth eruption ➤ Theories and histology of eruption, formation of Dentogingival junction, role of gubernacular chord in eruption of permanent teeth. Clinical or applied aspect of disorders of eruption.	Physiological tooth movement – Preeruptive, Eruptive and Posteruptive tooth movements	
Shedding of teeth	➤ Factors and mechanism of shedding of deciduous teeth ➤ Complications of shedding	Root resorption and resorptive cell	

ORAL HISTOLOGY Enamel	Detailed microscopic study	Age changes	<ul style="list-style-type: none"> ➤ Fluoride applications ➤ Etching ➤ Clinical and forensic significance
Dentin	<ul style="list-style-type: none"> ➤ Detailed microscopic study ➤ Dentin hypersensitivity ➤ Reaction of pulp tissue to varying insults on exposed dentin 		<ul style="list-style-type: none"> ➤ Clinical and forensic significance
Cementum	Detailed microscopic study	<ul style="list-style-type: none"> ➤ Hypercementosis ➤ Repair 	Clinical and forensic significance
Pulp	<ul style="list-style-type: none"> ➤ Detailed microscopic study ➤ Functions ➤ Age changes and Pulp calcification 	Pulp anatomy – pulp cavity, pulp chamber, pulp horn, pulp canal, apical and lateral foramen	Clinical significance
Periodontal ligament and Alveolar bone	<ul style="list-style-type: none"> ➤ Detailed microscopic study ➤ Functions ➤ Age changes 	Histological changes in periodontal ligament and bone in normal and orthodontic tooth movement	<ul style="list-style-type: none"> ➤ Applied aspects of alveolar bone resorption
Oral mucosa	<ul style="list-style-type: none"> ➤ Detailed microscopic study ➤ Variation in structure in relation to functional requirements ➤ Mechanisms of keratinisation ➤ Clinical parts of gingiva ➤ Dentogingival and Mucocutaneous junctions ➤ Lingual papillae 	Age changes and clinical considerations	

Salivary glands	<ul style="list-style-type: none"> ➤ Detailed microscopic study of acini and ductal system. ➤ Age changes and clinical considerations. 		
TM Joint	<ul style="list-style-type: none"> ➤ Review of basic anatomical aspects, microscopic study and clinical considerations. 		
ORAL PHYSIOLOGY <ul style="list-style-type: none"> • Saliva 	<ul style="list-style-type: none"> ➤ Composition of saliva – variations, formation of saliva ➤ Functions ➤ Role of saliva in dental caries and applied aspects of hyper and hypo salivation. 	Mechanism of secretion, salivary reflexes, brief review of secretomotor pathway	
<ul style="list-style-type: none"> • Mastication 	Peculiarities of masticatory muscles	Masticatory cycle, masticatory reflex and neural control of mastication	Masticatory force and its measurement, need of mastication
<ul style="list-style-type: none"> • Deglutition 	<ul style="list-style-type: none"> ➤ Stages of deglutition, swallow in infants 	neural control of deglutition and dysphagia	
<ul style="list-style-type: none"> • Calcium, phosphorous and fluoride metabolism 	Source, requirements, absorption, distribution, function and excretion, clinical considerations	hypocalcemia and hypercalcemia, hyper-phosphatemia and hypophosphatemia and fluorosis	
<ul style="list-style-type: none"> • Theories of mineralisation 	Definition, mechanism, theories and their drawbacks	Applied aspects of physiology of mineralisation	Pathological considerations – calculus formation
<ul style="list-style-type: none"> • Physiology of taste 	Innervation of taste buds and taste pathway,	Physiological basis of taste sensation, age changes	Applied aspects – taste disorders

<ul style="list-style-type: none"> • Physiology of speech 		<ul style="list-style-type: none"> ➤ Review of basic anatomy of larynx and vocal chords 	<ul style="list-style-type: none"> ➤ Voice production, resonators, production of vowels and different consonants – role of palate, teeth and tongue. Effects of dental prosthesis and appliances of speech and basic speech disorders
--	--	--	--

Bioethics

Bioethics is the application of ethics to the field of medicine and healthcare. Bioethics includes medical ethics, which focuses on issues in health care; research ethics, which focuses issues in the conduct of research; environmental ethics, which focuses on issues pertaining to the relationship between human activities and the environment, and public health ethics. Cadaver ethics.

7. PRACTICALS:

Drawing and wax carving of permanent tooth except maxillary second, mandibular first, maxillary second and third molars. Microscopic study of tooth germ, enamel, dentin, pulp, cementum, periodontal ligament, alveolar bone, salivary glands and oral mucosa including papillae and taste buds.

8. THEORY EXAMINATION (3 Hours)

- I. Elaborate on : 2 x 10 = 20 marks
- II. Write Notes on: 10 x 5 = 50 marks

70 marks

9. PRACTICAL / CLINICAL EXAMINATIONS

Scheme for practical examination–spotters/carving/microscopic identification of slides - 90 marks.

Carving - 30 Marks
Spotters and microscopic identification of slides - 60 Marks.

Total - 90 Marks

Viva – 20 marks

Viva – emphasis on tooth numbering systems, chronology of eruption, nerve and blood supply, mechanism of dental pain and dentine sensitivity, calcium and phosphate metabolism, bone, shedding and eruption of teeth with molecular basis.

	Examination	Internal Assessment	Viva	Total
Theory	70	10	20	100
Practicals	90	10	-	100
Total				200

10. FORMATIVE / INTERNAL ASSESSMENT

The continuing assessment examination (both Theory/Practical) held at least 3times in a particular year and best of two examinations shall be considered. The Internal Assessment marks to be submitted to the university, once in every three months. The marks scored by the students shall be displayed on the Notice board and a copy forwarded by HOD shall be sent to the University once in every 3 months.

Theory - 10 Marks
Practicals - 10 Marks
Total - 20 Marks

11. RECORD NOTE / LOG BOOK :

Record shall be maintained and assessed periodically by faculty and HOD. Institution shall provide adequate number of cases/teaching materials as specified in Dental Council of India regulation for the students during clinical/practical training and examinations.

12. TEXT BOOKS :

- (i) Recommended books (Orban's Oral histology & embryology) and (Wheeler's Dental anatomy, physiology and occlusion). Suggested books (Ten Cate's Oral Histology).
- (ii) Orban's oral histology and embryology – S.N. Bhaskar 10thEd
- (iii) Ten Cate's Oral histology _A Nanci 8th ed
- (iv) Oral development and histology – James and Avery
- (v) Wheeler's dental anatomy, physiology and occlusion – Major.M. Ash
- (vi) Dental anatomy -its relevance to dentistry – Woelfel and Scheid
- (vii) Applied physiology of mouth – Lavelle
- (viii) Physiology and biochemistry of mouth - Jenkins

13. REFERENCE BOOKS :

- (i) Fundamentals of Oral Histology and Physiology.
- (ii) Sicher and DuBrul's Oral Anatomy.
- (iii) Orban's Oral Histology & Embryology – S.N.Bhaskar
- (iv) Oral Development & Histology - James & Avery
- (v) Wheeler's Dental Anatomy, physiology & Occlusion – Major.M.Ash
- (vi) Dental Anatomy – its relevance to dentistry – Woelfel & Scheid
- (vii) Applied Physiology of the mouth – Lavelle
- (viii) Physiology & Biochemistry of the mouth - Jenkins