NOTIFICATION

In exercise of the powers, conferred under section 26 of Krishna Institute of Medical Sciences Deemed University, in its meeting of the Board of Management held on 23rd June 2007 has been pleased to approve the Bye-law pertaining to Under Graduate Dental Course (BDS) Part I as given in schedule here to Annexed.

The Bye-law as above shall be effective for the students admitted to Under Graduate Dental Course (BDS) Part I from the academic year 2007-08 onwards.

By Order
Registrar

1. This byelaw shall be called Syllabus and Examination pattern for Undergraduate Dental Course (BDS) Part I

B.D.S. Phase - I

HUMAN ANATOMY, EMBRYOLOGY, HISTOLOGY & MEDICAL GENETICS

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 clinically important structures. So that relevant anatomical & scientific foundations are laid down for the clinical years of the BDS course.

Objectives

A. Knowledge & Understanding:
At the end of the 1st year BDS course in Anatomical Sciences the undergraduate student is expected to:

1. Know the normal disposition of the structures in the body while clinically examining a patient and while conducting clinical procedures.
2. Know the anatomical basis of disease and injury.
3. Know the microscopic structure of the various tissues, a pre-requisite for understanding of the disease processes.
4. Know the nervous system to locate the site of lesions according to the sensory and or motor deficits encountered.
5. Have an idea about the basis of abnormal development, critical stages of development, effects of teratogens, genetic mutations and environmental hazards.
6. Know the sectional anatomy of head neck and brain to read the features in radiographs and pictures taken by modern imaging techniques.
7. Know the anatomy of cardio-pulmonary resuscitation.

B. Skills
1. To locate various structures of the body and to mark the topography of the living anatomy.
2. To identify various tissues under microscope.

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3. To identify the features in radiographs and modern imaging techniques.
4. To detect various congenital abnormalities.

C. Integration
By emphasizing on the relevant information and avoiding unwanted details, the anatomy taught integrally with other basic sciences & clinical subjects not only keeps the curiosity alive in the learner 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 & small group teaching
2) Demonstrations
3) Dissection of the human cadaver
4) Study of dissected specimens
5) Osteology
6) Surface anatomy on living individual
7) Study of radiographs & other modern imaging techniques.
8) Study of Histology slides.
9) Study of embryology models
Audio-visual aids

Throughout the course, particular emphasis is placed on the functional correlation, clinical application & on integration with teaching in other bio dental disciplines.
Instructional period - Theory - 890 Hours -
Practical - 4835 Hours.

D. An Outline Of The Course Content:
1. General anatomy: Introduction of anatomical terms and brief outline of various systems of the body.
2. Regional anatomy of head & neck with osteology of bones of head & neck, with emphasis on topics of dental importance.
4. The regional anatomy of the sites of intramuscular & intra vascular injections, & lumbar puncture.
5. General embryology & systemic embryology with respect to development of head & neck.
6. Histology of basic tissues and of the organs of gastrointestinal, respiratory, Endocrine, excretory systems & gonads.
7. Medical genetics.

E. Further Details of The Course.
I. Introduction To
1. Anatomical terms.
2. Skin, superficial fascia & deep fascia
3. Cardiovascular system, portal system collateral circulation and arteries.
4. Lymphatic system, regional lymph nodes
5. Osteology - Including ossification & growth of bones
6. Myology - Including types of muscle tissue & innervation.
7. Syndesmology - Including classification of Joints.
8. Nervous system

II. Head & Neck
1. Scalp, face & temple, lacrimal apparatus
3. Cranial cavity - Meninges, parts of brain, ventricles of brain, dural venous sinuses, cranial nerves attached to the brain, pituitary gland.
5. Orbital cavity - Muscles of the eyeball, supports of the eyeball, nerves and vessels in the orbit.
7. Temporo mandibular joint, muscles of mastication, infratemporal fossa, pterygo - palatine fossa.
8. Submandibular region
9. Walls of the nasal cavity, paranasal air sinuses
10. Palate
11. Oral cavity, Tongue
12. Pharynx (palatine tonsil and the auditory tube) Larynx. OSTEOMETRY - Foetal skull, adult skull, individual bones of the skull, hyoid bone and cervical vertebrae

III. Thorax
Demonstration on a dissected specimen of
1. Thoracic wall
2. Heart chambers
3. Coronary arteries
4. Pericardium
5. Lungs - surfaces; pleural cavity
6. Diaphragm

IV. Abdomen
Demonstration on a dissected specimen of
1. Peritoneal cavity
2. Organs in the abdominal & pelvic cavity.

V. Clinical Procedures:
a. Intramuscular injections: Demonstration on a dissected specimen and on a living person of the following sites of injection.

1. Deltoid muscles and its relation to the axillary nerve and radial nerve.
2. Gluteal regions and the relation of the sciatic nerve.
3. Vastus lateralis muscle.
b. Intravenous injections & venesection: Demonstration of veins in the dissected specimen and on a living person.
1. Median cubital vein
2. Cephalic vein
3. Basilic vein
4. Long saphenous vein

c. Arterial pulsations: Demonstration of arteries on a dissected specimen and feeling of pulsation of the following arteries on a living person.

1. Superficial temporal
2. Facial
3. Carotid
4. Axillary
5. Brachial
6. Radial
7. Ulnar
8. Femoral
9. Popliteal
10. Dorsalis pedis

d. Lumbar puncture: Demonstration on a dissected specimen of the spinal cord, cauda equina & epidural space and the inter vertebral space between L4 & L5.

VI. Embryology
Oogenesis, Spermatogenesis, Fertilisation, Placenta, Primitive streak, Neural crest, Bilaminar and trilaminar embryonic disc, Intra embryonic mesoderm - formation and fate, notochord formation & fate, Pharyngeal arches, pouches & clefts, Development of face, tongue, palate, thyroid gland, pituitary gland, salivary glands, and anomalies in their development, Tooth development in brief.

VII. Histology:
The Cell:
Basic tissues - Epithelium, Connective tissue including cartilage and bone, Muscle Tissue, Nervous tissue: Peripheral nerve, optic nerve, sensory ganglion, motor ganglion, Skin Classification of Glands Salivary glands (serous, mucous and mixed gland), Blood vessels, Lymphoid tissue Tooth, lip, tongue, hard palate, oesophagus, stomach, duodenum, ileum, colon, vermiform appendix Liver, Pancreas, Lung, Trachea, Epiglottis, Thyroid gland, para thyroid gland, supra renal gland and pituitary gland, Kidney, Ureter, Urinary bladder, Ovary and testis.

VIII. Medical Genetics
Mitosis, meiosis, Chromosomes, gene structure, Mendelism, modes of inheritance.

Recommended Books
1. SNELL (Richard S.) Clinical Anatomy for Medical Students, Ed. 5, Little Brown & company, Boston.
5. SADLER, LANGMAN’S, Medical Embryology, Ed. 6.
6. JAMES E ANDERSON, Grant’s Atlas of Anatomy. Williams & Wilkins.
8. EMERY, Medical Genetics.

Scheme of Examination
University Examination -
Theory Examination
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Practical Examination
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Internal Assessment

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Nature of Question Paper

Each paper carries 60 marks

**Section A:**

- Q. No. 1 Multiple choice question (20 MCQs) 20 x 1 20 marks

**Section B:**

- Q. No. 2 Answer any 5 out of 6 5 x 2 10 marks
- Q. No. 3 Answer any 1 out of 2 1 x 10 10 marks

**Section C:**

- Q. No. 4 Answer any 5 out of 6 5 x 2 10 marks
- Q. No. 5 Answer any 1 out of 2 1 x 10 10 marks
Goal
The broad goal of the teaching undergraduate students in Physiology aims at providing the student 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.

Objectives

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

1. Explain the normal functioning of all the organ systems and their interactions for well co-ordinated total body function.
2. Assess the relative contribution of each organ system towards the maintenance of the milieu interior.
3. 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:

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

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

Course Contents Theory

1. General Physiology
   1. Homeostasis: Basic concept, Feedback mechanisms
   2. Structure of cell membrane, transport across cell membrane
   3. Membrane potentials

2. Blood
   Composition & functions of blood. Specific gravity, Packed cell volume, factors affecting & methods of determination.
   Plasma proteins - Types, concentration, functions & variations.

ESR- Methods of estimation, factors affecting, variations & significance.

Haemoglobin- Normal concentration, method of determination & variation in concentration.

Blood Indices- MCV, MCH, MCHC - definition, normal values, variation.

Anaemia - Definition, classification, life span of RBC's destruction of RBC's, formation & fate of bile pigments, Jaundice - types.

Leucocytes: Classification, number, percentage, distribution morphology, properties, functions & variation. Role of lymphocytes in immunity, leucopoiesis life span & fate of leucocytes.

Thrombocytes- Morphology, number, variations, function & thrombopoiesis.

Haemostatis- Role of vasoconstriction, platelet plug formation in haemostasis, coagulation factors, intrinsic & extrinsic pathways of coagulation, clot retraction.


Blood groups: ABO & Rh system, method of determination, importance, indications & dangers of blood transfusion, blood substitutes.

Blood volume: Normal values, variations.

Body fluids: distribution of total body water, intracellular & extracellular compartments, major anions & cations in intra and extra cellular fluid.


3. Muscles And Nerve

4. Digestive System:
Introduction to digestion:
General structure of G.I. tract, Innervation.
Salivary glands:
Structure of salivary glands, composition, regulation of secretion & functions of saliva.

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Stomach:
Composition and functions of gastric juice, mechanism and regulation of gastric secretion.

Exocrine Pancreas -
Structure, composition of pancreatic juice, functions of each component, regulation of pancreatic secretion.

Liver:
Structure, composition of bile, functions of bile, regulation of secretion

Gall bladder:
Structure, functions.

Small intestine -
Composition, functions & regulation of secretion of intestinal juice.

Large intestine -
Functions.

Motor functions of GIT:
Mastication, deglutition, gastric filling & emptying, movements of small and large intestine, defecation.

5. Excretory System
Structure & functions of kidney, functional unit of kidney & functions of different parts.

Juxta glomerular apparatus, renal blood flows.


Mechanism of concentration & dilution of urine.
Role of kidney in the regulation of pH of the blood.

Micturition: anatomy & innervation of Urinary bladder, mechanism of miturition & abnormalities.


7. Endocrinology
General endocrinology
Enumeration of endocrine glands & hormones - General functions of endocrine system, chemistry, mechanism of secretion, transport, metabolism, regulation of secretion of hormones.


Posterior pituitary
Functions, regulation & disorders of secretion.
Thyroid
Histology, synthesis, secretion & transport of hormones, actions of hormones, regulation of secretion & disorders, Thyroid function tests.

Adrenal cortex & Medulla

Other hormones - Angiotensin, A.N.F.

8. Reproduction
Sex differentiation, Physiological anatomy of male and female sex organs.
Female reproductive system:
Menstrual cycle, functions of ovary, actions of oestrogen & Progesterone, control of secretion of ovarian hormones, tests for ovulation, fertilisation, implantation, maternal changes during pregnancy, pregnancy tests & parturition.
Lactation, composition of milk, factors controlling lactation, milk ejection, and reflex.

Male reproductive system:
Spermatogenesis, semen and contraception.

9. Cardio Vascular System
Functional anatomy and innervation of heart Properties of cardiac muscle Origin & propagation of cardiac impulse and heart block.

Electrocardiogram - Normal electrocardiogram. Two changes in ECG in myocardial infarction.

Cardiac cycle -
Phases, Pressure changes in atria, ventricles & aorta.
Volume changes in ventricles. Jugular venous pulse, arterial pulse.
Heart sounds:
Mention of murmurs.
Heart rate:
Normal value, variation & regulation.
Cardiac output:
Definition, normal values, one method of determination, variation, factors affecting heart rate and stroke volume.
Arterial blood pressure:
Definition, normal values & variations, determinants, regulation & measurement of blood pressure.
Coronary circulation.
Cardio vascular homeostasis -
Exercise & posture.

10. Respiratory System
Physiology of Respiration:
External & internal respiration. Functional anatomy of respiratory passage & lungs.
Respiratory movements:
Muscles of respiration, Mechanism of inflation & deflation of lungs. Intra pleural & intra pulmonary pressures & their changes during the phases of respiration.

Mechanics of breathing -
Surfactant, compliance & work of breathing.

Spirometry:
Lung volumes & capacities definition, normal values, significance, factors affecting vital capacity, variations in vital capacity, FEV & its variations.

Pulmonary ventilation -
Alveolar ventilation & dead space - ventilation.
Composition of inspired air, alveolar air and expired air.
Exchange of gases: Diffusing capacity, factors affecting it.
Transport of Oxygen & carbon dioxide in the blood.
Regulation of respiration - neural & chemical.
Hypoxia, cyanosis, dyspnoea, periodic breathing.
Artificial respiration, pulmonary function tests.

11. Central Nervous System
1. Organisation of central nervous system
2. Neuronal organisation at spinal cord level
3. Synapse receptors, reflexes, sensations and tracts
4. Physiology of pain
5. Functions of cerebellum, thalamus, hypothalamus and cerebral cortex.
6. Formation and functions of CSF
7. Autonomic nervous system

12. Special Senses
Fundamental knowledge of vision, hearing, taste and smell.

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
1. Enumeration of Red Blood Cells
2. Enumeration of White Blood Cells
3. Differential leucocyte counts
4. Determination of Haemoglobin
5. Determination of blood group
6. Determination of bleeding time and clotting time
7. Examination of pulse
8. Recording of blood pressure.
Demonstration:
1. Determination of packed cell volume and erythrocyte sedimentation rate
2. Determination of specific gravity of blood
3. Determination of erythrocyte fragility
4. Determination of vital capacity and timed vital capacity
5. Skeletal muscle experiments.
   - Effect of after load and free load on muscle contraction, calculation of work done.
6. Electrocardiography: Demonstration of recording of normal Electrocardiogram
7. Clinical examination of cardiovascular and respiratory system.

Text Books:
2. Ganong; Review of Medical Physiology, 19th edition
3. Vander; Human physiology, 5th edition
4. Choudhari; Concise Medical Physiology, 2nd edition
5. Chaterjee; Human Physiology, 10th edition
6. A.K. Jain; Human Physiology for BDS students, 1st edition

Books For Reference:
1) Berne & Levey; Physiology, 2nd edition
2) West-Best & Taylor’s, Physiological basis of Medical Practise, 11th edition

Experimental Physiology:
1) Rannade; Practical Physiology, 4th edition
2) Ghai; a text book of practical physiology
3) Hutchison’s; Clinical Methods, 20th edition

B) BIOCHEMISTRY

Chemistry of Carbohydrates:
Definition, Occurrence, Biological Importance of carbohydrates Physical and Chemical properties classification with examples.

Chemistry of Lipids:
Definition, Biological Importance, classification of Lipids and Fatty acids with examples; Functions of Cholesterol, Lipoproteins - Classification and their functions
Phospholipids - classification and functions.
Prostaglandin (E1) - Actions & functions

Chemistry of amino acids and proteins
Aminoacids - Definition, Classification, properties, Color reactions.
Peptides - Definition and biological Importance.
Proteins - Definition, classification, Denaturation, Precipitation reactions of proteins.
Plasma proteins - types and functions
4. Enzymes:
   - Definition, classification (IUB), Mechanism of Enzyme action,
   - Factors affecting enzyme activity, Inhibition - (1) competitive (2) Non-competitive
   - Diagnostic Importance of Enzymes. Isoenzymes.
   - Co-enzyme - Definition, Examples,
   - Difference between coenzymes and enzymes.

5. Biological Oxidation
   - Definition, Component of ETC. Inhibitors of ETC.
   - Oxidative Phosphorylation, Uncoupler, ATP synthase

6. Nutrition
   - Constituents of food.
   - Biological Importance of carbohydrate, Lipid and Proteins
   - Role of fibres in diet
   - BMR - Definition, Normal value, Factors affecting, significance.
   - Balanced diet, Caloric Requirements, Nutrition disorder.

7. Carbohydrate Metabolism
   - Dietary importance, RDA, Dietary Forms and their sources, digestion and absorption,
   - Glucose oxidation - Glycolysis, TCA cycle
   - Glycogen Metabolism - Glycogenesis, Glycogenolysis
   - Significance of other pathways - HMP shunt, Gluconeogenesis, Cori’s cycle, Uronic acid pathway.
   - Carbohydrate Metabolism disorders - Diabetes mellitus, Glycogen Storage Diseases,
   - Lactose intolerance
   - Blood Glucose regulation

8. Protein Metabolism:
   - Digestion & Absorption of proteins
   - Catabolic pathways - Deamination, Decarboxylation, Transamination, Transdeamination,
   - Fate and formation of ammonia, Urea cycle, blood urea level, Inborn errors associated with urea cycle,
   - Flow chart of Metabolism of different amino acids - Glycine, Methionine, Tyrosine,
   - Phenylalanine, Tryptophan.

9. Vitamins:
   - Definition, Classification and Characteristics.
   - Fat soluble vitamins - A, D, E & K.
   - Water soluble vitamins - Thiamine, Riboflavin, Niacin, Biotin, Pyridoxine, Folic acid, Vitamin B12 & Ascorbic acid - Chemistry, sources, digestion absorption, transport, storage, dietary requirements, biochemical functions and deficiency manifestations.

10. Lipid Metabolism:
    - Digestion of lipids (in brief)
    - β-Oxidation of fatty acids and role of Carnitine.
    - Ketone body metabolism - Ketogenesis, Ketolysis, Ketosis. Etc.

11. Acid - Base balance
    - Definition of pH, Acid, Base & Buffer
    - Normal Blood pH
Regulation of blood pH by
Blood Buffer
Respiration
Kidney:
   a) Bicarbonate mechanism
   b) Phosphate mechanism
   c) Ammonia Mechanism

Acid - Base imbalance - causes and characteristics

12. Integrated Metabolism
   Significance
   Interrelationship between Carbohydrates, Proteins & Lipids
   Amphibolic nature of TCA cycle.

13. Mineral Metabolism:
   Classification
   Dietary sources. Daily requirements, Biochemical functions and deficiency
   manifestation in detail of Calcium, Phosphorus, Fluoride, & Zn, Cu, Mg, Fe (In brief).

14. Hormones:
   Classification and mechanism of hormone action in brief.

Practical

Name of the Experiment
   Tests for Monosaccharides.
   Tests for disaccharides
   Tests for Polysaccharides
   Color reactions of proteins
   Precipitation reactions of proteins
   Normal urine Analysis
   Abnormal constituents of urine
   Bile analysis
   Gastric juice analysis
   Estimation of blood glucose
   Estimation of serum calcium
   Estimation of serum inorganic phosphorus

Scheme of Examination
University Examination
   Theory Examination
       Theory 60 marks
       Viva 20 marks
       Internal Assessment 20 marks
   Total 100 marks

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Practical Examination
Practicals 80 marks
Internal Assessment 20 marks

Total 100 Marks

* Physiology & Biochemistry same as above with 50% weightage to both subject i.e. Physiology & Biochemistry.

Internal Assessment

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Theory marks to be send to the University out of 20
Practical marks to be send to the University out of 20

Nature of Question Paper

Section A:
Q. No. 1 20 MCQs (10 MCQs for each subject) 20 x 1 20 marks

Section B:
Q. No. 2 Answer any 5 out of 6 5 x 2 10 marks
Q. No. 3 Answer any 1 out of 2 10 x 1 10 marks

Section C:
Q. No. 4 Answer any 5 out of 6 5 x 2 10 marks
Q. No. 5 Answer any 1 out of 2 10 x 1 10 marks
DENTAL MATERIALS

The science of Dental Material has undergone tremendous changes over the years. Continued research has led to new material systems and changing concepts in the dental field. Interlinked with various specialised branches of chemistry, practically all engineering applied sciences and biological characteristics, the science of dental material emerged as a basic sciences in itself with its own values and principles.

1. Introduction (Aims, Objectives & Scope.)

Aims

Aim of the course is to present basic chemical and physical properties of Dental materials as they are related to its manipulation to give a sound educational background so that the practice of the dentistry emerged from art to empirical status of science as more information through further research becomes available. It is also the aim of the course of Dental materials to provide with certain criteria of selection and which will enable to discriminate between facts and propaganda with regards to claims of manufactures.

Objectives

To understand the evolution and development of science of dental material. To explain purpose of course in dental materials to personnels concerned with the profession of the dentistry. Knowledge of physical and chemical properties. Knowledge of biomechanical requirements of particular restorative procedure. An intelligent compromise of the conflicting as well as co-ordinating factors into the desired Ernest. Laying down standards or specifications of various materials to guide to manufacturers as well as to help professionals.

Search for newer and better materials, which may answer our requirements with greater satisfaction. To understand and evaluate the claims made by manufactures of dental materials.

Needs For The Course:

The profession has to rise from an art to a science; the need for the dentist to possess adequate knowledge of materials to exercises his best through knowledge of properties of different types of materials. The growing concern of health hazards due to mercury toxicity, inhalation of certain vapour or dust materials, irritations and allergic reaction to skin due to contact of materials. Materials causing irritation of oral tissues, pH of restorative materials causing inflammation and necrosis of pulp which is a cause for the dentist to posses wider knowledge of physical, chemical and biological properties of materials being used. For the protection for the patient and his own protection certain criteria of selection are provided that will enable the dentist to discriminate between facts and propaganda, which will make a material biologically accept.

Scope:

The dental materials are employed in mechanical procedures including restorative dentistry such as Prosthodontics, endodontics, periodontal, orthodontics and restorative materials. There is scarcely a dental procedure that does not make use of dental materials in one form or another and therefore the application of dental material is not limited to any one branch of dentistry. Branches such as minor
surgery and periodontics require less use of materials but the physical and chemical characters of materials are important in these fields. The toxic and tissue reaction of dental materials and their durability in the oral cavity where the temperature is between 32 & 37 degree centigrade, and the ingestion of hot or cold food ranges from 0-70 degree centigrade. The acid an alkalinity of fluids shown pH varies from 4 to 8.5. The load on 1 sq. mm of tooth or restorative materials can reach to a level as high as many kilograms. Thus the biological properties of dental materials cannot be separated from their physical and chemical properties.

Change of state, inter atomic primary bonds, inter atomic secondary bonds, inter atomic bond distance and bonding energy, thermal energy, crystalline structure, non crystalline structures, diffusion, adhesion and bonding and adhesion to tooth structures.

3. Important Physical Properties Applicable To Dental Materials
Physical properties are based on laws of mechanics, acoustics, optics, thermodynamics, electricity, magnetism, radiation, atomic structure or nuclear phenomena. Hue, value, chroma and translucency physical properties based on laws of optics, dealing with phenomena of light, vision and sight. Thermal conductivity & coefficient of thermal expansion are physical properties based on laws of thermodynamics. Stress, strain, proportional limit, elastic limit yield strength, modulus of elasticity, flexibility, resilience, impact, impact strength, permanent deformation, strength, flexure strength fatigue, static fatigue, toughness, brittleness, ductility & malleability, hardness, abrasion resistance, relaxation, rheology, Thixotropic, creep, static creep, dynamic creep, flow, colour, three dimensional colour - hue, values, chroma, Munsell system, metamersim, fluorescence, physical properties of tooth, stress during mastication.

4. Biological Considerations In Use Of Dental Materials.
Materials used are with the knowledge of appreciation of certain biological considerations for use in oral cavity. Requirement of materials with biological compatibility. Classification of materials from perspective of biological compatibility. eg. contact with soft tissues, affecting vitality of pulp, used for root canal fillings, affecting hard tissues of teeth, laboratory materials that could be accidentally be inhaled or ingested during handling. Hazards associated with materials: pH-effecting pulp, polymers causing chemical irritation, mercury toxicity, etc. Microleakage, Thermal changes, Galvanism, toxic effect of materials. Biological evaluation for systemic toxicity, skin irritation, mutagenecity and carcinogenicity. Disinfection of dental materials for infection control.

5. Gypsum & Gypsum Products.
Gypsum - its origin, chemical formula, Products manufactured from gypsum. Dental plaster, Dental stone, Die stone, high strength, high expansion stone.

Application and manufacturing procedure of each, macroscopic and microscopic structure of each. Supplied as and Commercial names. Chemistry of setting, setting reaction, theories of setting, gauging water, Microscopic structure of set material.

Setting time: working time and setting time, Measurement of setting time and factors controlling setting time.
Setting expansion, Hygroscopic setting expansion - factors affecting each.

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Strength: wet strength, dry strength, factors affecting strength, tensile strength
Slurry - need and use.
Care of cast.

ADA classification of gypsum products.
Description of impression plaster and dental investment
Manipulation including recent methods or advanced methods.
Disinfection: infection control, liquids, sprays, radiation
Method of use of disinfectants
Storage of material - shelf life

6. Impression Materials Used In Dentistry
Impression plaster, Impression compound, Zinc oxide eugenol impression paste & bite registration paste incl., non eugenol paste, Hydrocolloids, reversible and irreversible, Elastomeric impression materials. Polysulphide, Condensation silicones, Addition silicones, Polyether, Visible light cure polyether urethane dimethacrylate Historical background & development of each impression material, Definition of impression, Purpose of making impression, Ideal properties required and application of material Classification as per ADA specification, general & individual impression material.
Application and their uses in different disciplines Marketed as and their commercial names, Mode of supply & mode of application bulk/wash impression.
Composition, chemistry of setting, Control of setting time, Type of impression trays required, Adhesion to tray, manipulation, instruments & equipments required.
Techniques of impression, storage of impression, (Compatibility with cast and die material). Any recent advancement in material and mixing devices.
Study of properties: Working time, setting time, flow, accuracy, strength, flexibility, tear strength, dimensional stability, compatibility with cast & die materials incl., electroplating Biological properties: tissue reaction, Shelf life & storage of material.
Infection control - disinfection
Advantages & disadvantages of each material.

7. Synthetic Resins Used In Dentistry.
Historical background and development of material, Denture base materials and their classification and requirement
Classification of resins
Dental resins - requirements of dental resins, applications, polymerisation, polymerisation mechanism stages in addition polymerisation, inhibition of polymerisation, co polymerization, molecular weight, crosslinking, plastixizers, Physical properties of polymers, polymer structures types of resins.

Acrylic Resins:
Mode of polymerisation: Heat activated, chemically activated; Light activated Mode of supply, application, composition, polymerisation reaction of each.

Technical considerations:
Methods of manipulation for each type of resin.
Physical properties of denture base resin
Miscellaneous resins & techniques: Repair resins, Raining and rebasing.

Short term and long-term soft-liners, temporary crown and bridge resins, Resin impression trays, Tray materials, Resin teeth, materials in maxillofacial prosthesis,
Denture cleansers, Infection control in detail, Biological properties and allergic reactions.

Restorative Resins
Historical background, Resin based restorative materials, Unfilled & filled, Composite restorative materials, Mode of supply, Composition, Polymerisation mechanisms: Chemically activated, Light activated, Dual cure: Degree of conversion, Polymerisation shrinkage

Classification of Composites: Application, composition and properties of each Composite of posterior teeth, Prosthodontics resins for veneering.

Biocompatibility - microleakage, pulpal reaction, pulpal protection Manipulation of composites:
Techniques of insertion of Chemically activated, light activated, dual cure Polymerisation, Finishing and polishing of restoration, Repair of composites, Direct bonding.

Bonding: Need for bonding, Acid - etch technique; Enamel bonding, Dentin bonding agents.

Mode of bonding, Bond strength, Sandwich technique its indication and procedure

Extended application for composites:
Resins for restoring eroded teeth, Pit and fissure sealing, Resin inlays system - Indirect & direct, Core builds up, Orthodontic applications.

8 Metal And Alloys
Structure and behaviour of metals, Solidification of metals, mechanism of crystallisation amorphous & crystalline. Classification of alloys, Solid solutions, Constitutes or equilibrium phase diagrams: Electric alloys, Physical properties, Peritectic alloys, Solid state reaction other binary systems:
Metallography & Heat treatment
Tarnish and corrosion
Definition, causes of corrosion, protection against corrosion., Corrosion of dental restorations, clinical significance of galvanic current.
Dental Amalgam

History:
Definition of dental amalgam, application, Alloy classification, manufacture of alloy powder composition - available as.
Amalgamation: setting reaction & resulting structure, properties, Microleakage Dimensional stability, Strength, Creep, Clinical performance
Manipulation: Selection of alloy, proportioning, mechanism of trituration, condensation, carving & finishing.
Effect of dimensional changes, Marginal deterioration, Repair of amalgam, mercury toxicity, mercury hygiene.
Direct filling gold:
Properties of pure gold, mode of adhesion of gold for restoration forms of direct filling gold for using as restorative material

**Dental Casting Alloys:**

Historical background, desirable properties of casting alloys. Alternatives to cast metal technology: direct filling gold, amalgam, and mercury free condensable intermetallic compound - an alternative to metal casting process. CAD-CAM process for metal & ceramic inlays - without need of impression of teeth or casting procedure, pure titanium, most bio compatible metal which are difficult to cast can be made into crowns with the aid of CAD- CAM technology. Another method of making copings - by copy milling (without casting procedures). Classification of casting alloys: By function & description. Recent classification, High noble (HN), Noble (N) and predominantly base metal (PB)

Alloys for crown & bridge, metal ceramic & removable partial denture. Composition, function, constituents and application, each alloy both noble and base metal.


**9 Dental Waxes Including Inlay Casting Wax**

Introduction and importance of waxes. Sources of natural waxes and their chemical nature.

**Classification of Waxes:**


**10 Dental Casting Investments.**


KRISHNA INSTITUTE OF MEDICAL SCIENCES DEEMED UNIVERSITY, KARAD.
Properties: Strength, porosity, and fineness & storage.
Technical considerations: For Casting procedure
Preparation of die, Wax pattern, spruing, investing, control of shrinkage compensation, wax burnout, and heating the invested ring, casting.
Casting machines, source of heat for melting the alloy.
Defects in casting.

11 Soldering, Brazing And Welding

Need of joining dental appliances
Terms & Definition
Solders: Definition, ideal requirement, types of solders - Soft & hard and their fusion temperature, application
Mode of supply of solders, Composition and selection, Properties.
Tarnish & corrosion resistance mechanical properties, microstructure of soldered joint.
Fluxes & Anti fluxes: Definition, Function, Types, commonly used fluxes & their selection
Technique of Soldering & Brazing: free hand soldering and investment, steps and procedure.
Welding: Definition, application, requirements, procedure, weld decay - causes and how to avoid it.
Laser welding.

Wrought Base Metal Alloys
Applications and different alloys used mainly for orthodontics purpose
1. Stainless steel
2. Cobalt chromium nickel
3. Nickel titanium
4. Beta titanium

Properties required for orthodontic wires, working range, springiness, stiffness, resilience, Formability, ductility, ease of joining, corrosion resistance, stability in oral environment, bio compatibility
Stainless steels: Description, type, composition & properties of each type. Sensitisation & stabilisation, Mechanical properties - strength, tensile, yield strength, KHN. Braided & twisted wires their need, Solders for stainless steel, Fluxes, Welding

1. Wrought cobalt chromium nickel alloys, composition, allocation, properties, heat treatment, physical properties
2. Nickel - Titanium alloys, shape, memory & super elastic
3. Titanium alloys, application, composition, properties, welding, Corrosion resistance

12 Dental Cements

Definition & Ideal requirements:
Cements: Silicate, Glass ionomer, metal modified glass ionomer, resin modified glass ionomer, zinc oxide eugenol, modified zinc oxide eugenol, zinc phosphate, zinc silico phosphate, zinc poly carboxylate
Cavity liners and cement bases
Varnishes Calcium hydroxide
Gutta percha

Application, classification (general and individual), setting mechanism, mode of supply, Properties, factors affecting setting, special emphasis on critical procedures of
Dental ceramics: definition, classification, application, mode of supply, manufacturing procedure, methods of strengthening.

Properties of fused ceramic: Strength and factors affecting, modulus of elasticity, surface hardness, wear resistance, thermal properties, specific gravity, chemical stability, esthetic properties, biocompatibility, technical considerations.

Metal Ceramics (PFM):
Alloys - Types and composition of alloys
Ceramic - Type and Composition.
Metal Ceramic Bond - Nature of bond.
Bonding using electro deposition, foil copings, bonded platinum foil, swaged gold alloy foil coping.
Technical considerations for porcelain and porcelain fused metal restorations.
Recent advances - all porcelain restorations, Manganese core, injection moulded, castable ceramics, glass infiltrated alumina core ceramic (In cervam), ceramic veneers, inlays and onlays, and CAD - CAM ceramic.
Chemical attack of ceramic by fluoride.
Porcelain furnaces.

14 Abrasion & Polishing Agents
Definition of abrasion and polishing
Need of abrasion and polishing
Types of abrasives: Finishing, polishing & cleaning
Types of abrasives: Diamond, Emery, aluminium oxides garnet, pumice, Kieselgurh, tripoli, rouge, tin oxide, chalk, chronic oxide, sand, carbides, diamond, zirconium silicate Zinc oxide

Abrasive Action
Desirable characteristics of an abrasive, Rate of abrasion, Size of particle, pressure and speed.
Grading of abrasive & polishing agents.
Binder,
Polishing materials & procedures used.
Technical consideration - Material and procedure used for abrasion and polishing Electrolytic polishing and burnishing.

15 Die And Counter Die Materials Including Electroforming And Electropolishing.
Types - Gypsum products, Electroforming, Epoxy resin, Amalgam.

16 Dental Implants
Evolution of dental implants, types and materials.

17 Mechanics Of Cutting: Burs and points.
At the end of the course the student should have the knowledge about the composition, properties, manipulative techniques and their various commercial names. The student
should also acquire skills to select and use the materials appropriately for laboratory and clinical use.

**Recommended Books:**
2. Restorative Dental Materials - 10 edn. Robert G.Craig

**Scheme of Examination**

**University Examination**

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<thead>
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<th>Theory Examination</th>
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**Internal Assessment**

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<td>Prelims</td>
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| Total    | 200 | 150 |

Theory marks to be send to the University out of 20
Practical marks to be send to the University out of 20

**Nature of Question Paper**

Each paper carries 60 marks

**Section A:**

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**Section B:**

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**Section C:**

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<td>Q. No. 5</td>
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<td>1 x 10</td>
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