

DR.M.G.R EDUCATIONAL & RESEARCH INSTITUTE UNIVERSITY
DEPARTMENT OF PROSTHODONTICS

Subject Code:	Subject Name : Dental Materials					T / L/ ETL	L	T / S.Lr	P/ R			
	Prerequisite:					T						
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab.												
OBJECTIVE:												
1.Perform clinical and Laboratory procedures with understanding of biomaterials, tissue conditions related to prosthesis and have competent dexterity and skill for performing clinical and laboratory procedures in fixed, removable, maxillofacial, TMJ and esthetics Prosthodontics.												
2. Laboratory technique management based on skills and knowledge of Dental Materials and dental equipment and instrument management.												
3. Restore lost functions of stomatognathic system namely mastication, speech, appearance and psychological comforts. By understanding biological, biomedical, bioengineering principles and systemic condition of the patient to provide a quality health care of the craniofacial region.												
4.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.												
5.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.												
6.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.												
COURSE OUTCOMES (COs) : (3- 5)												
CO1	To understand the evolution and development of science of dental material											
CO2	To explain purpose of course in dental materials to personnels concerned with the profession of the dentistry.											
CO3	To gain Knowledge of physical and chemical properties. Knowledge of biomechanical requirements of particular restorative procedure.											
CO4	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.											
CO5	To Search for newer and better materials this may answer our requirements with greater satisfaction.											
CO6	To understand and evaluate the claims made by manufactures of dental materials											
Mapping of Course Outcomes with Program Outcomes (POs)												
Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	H	L	L	H	H	L	L	L	L	M
CO2	H	H	H	L	L	H	H	L	L	L	L	M
CO3	H	H	H	L	L	H	H	L	L	L	L	M
CO4	H	H	H	L	L	H	H	L	L	L	L	M
CO5	H	H	H	L	L	H	H	L	L	L	L	M
CO6	H	H	H	L	L	H	H	L	L	L	L	M
COs /PSOs	PSO1	PSO2	PSO3	PSO4								
CO1	L	M	H	M								
CO2	L	M	H	M								
CO3	L	M	H	M								
CO4	L	M	H	M								
CO5	L	M	H	M								
CO6	L	M	H	M								
H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low												

Category	Basic Sciences	Medical and Allied Health Science	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
				✓					
Approval									

Revised B.D.S regulation 2007 approved by dental council of India.

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UNIT1-Structure Of Matter And Principles Of Adhesion-Change of state, inter atomic primary bonds, inter atomic-secondary bonds, inter atomic bond distance-bonding energy, thermal energy, crystalline structure, non crystalline structures, diffusion, adhesion and bonding and adhesion to tooth structures.

UNIT2-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

UNIT3-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-affecting pulp, polymers causing chemical irritation, mercury toxicity, etc. Microleakage, Thermal changes, Galvanism, toxic effect of materials. Biological evaluation for systemic toxicity, skin irritation, mutagenicity and carcinogenicity. Disinfection of dental materials for infection control.

UNIT4-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 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

UNIT5-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 advancements 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.

UNIT6-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.

UNIT7-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, Relining 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.

UNIT8-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 Composites 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 build up,Orthodontic applications.

UNIT9-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.

UNIT10-Direct Filling Gold: Properties of pure gold, mode of adhesion of gold for restoration forms of direct filling gold for using as restorative material Classification : Gold Foil, Electrolytic precipitate, powdered gold-Manipulation: Removal of surface impurities and compaction of direct filling gold.-Physical properties of compacted gold, Clinical performance.

UNIT11-Dental Casting Alloys: Historical background, desirable properties of casting alloys. Alternatives to cast metal technology: direct filling gold, amalgam, 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. Properties of alloys: Melting range, mechanical properties, hardness, elongation, modulus of elasticity, tarnish and corrosion. Casting shrinkage and compensation of casting shrinkage. Biocompatibility - Handling hazards & precautions of base metal alloys, casting investments used. Heat treatment : Softening & hardening heat treatment. Recycling of metals. Titanium alloys & their application, properties & advantages.Technical considerations In casting . Heat source, furnaces.

UNIT12-Dental Waxes Including Inlay Casting Wax-Introduction and importance of waxes. Sources of natural waxes and their chemical nature.Classification of Waxes: Properties: melting range, thermal expansion, mechanical properties, flow & residual stresses, ductility. Dental Wax: Inlay wax: Mode of supply : Classification & composition, Ideal requirements: Properties of inlay wax: Flow, thermal properties Wax distortion & its causes. Manipulation of inlay wax: Instruments & equipment required, including electrically heated instruments metal tips and thermostatically controlled wax baths.Other waxes: Applications, mode of supply & properties.Casting Wax, Base plate wax,

Processing wax, Boxing wax, Utility wax, Sticky wax, Impression wax for corrective impressions, Bite registration wax.

UNIT13-Dental Casting Investments-Definition, requirements, classification-Gypsum bonded - classification. Phosphate bonded, Silica bonded-Mode of Supply: Composition, application, setting mechanism, setting time & factors controlling.-Expansions :Setting expansion, Hygroscopic Setting expansion, & thermal expansion : factors affecting. 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.

UNIT 14-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.

UNIT15-Wrought Base Metal Alloys-Applications and different alloys used mainly for orthodontics purpose-Stainless steel- Cobalt chromium nickel-Nickel-titanium-Beta titaniumProperties 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 & stabilization-Mechanical properties – strength, tensile, yield strength, KHN. Braided & twisted wires their need ,Solders for stainless steel, Fluxes, Welding Wrought cobalt chromium nickel alloys, composition, allocation, properties, heat treatment, physical properties Nickel – Titanium alloys, shape, memory & super elastic Titanium alloys, application, composition, properties, welding, Corrosion resistance

UNIT16-. Dental Cement-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 manipulation and protection of cement, mode of adhesion, biomechanism of caries inhibition-Agents for pulpal protection., Modifications and recent advances, Principles of cementation. Special emphasis on cavity liners and cement bases and luting agents.

UNIT 17dental Ceramics-Historical background & General applications.-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 ceram), ceramic veneers, inlays and onlays, and CAD-CAM ceramic. Chemical attack of ceramic by fluoride. Porcelain furnaces.

UNIT18-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, chromic oxide, sand, carbides, diamond, zirconium silicate Zinc oxide

UNIT19-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 polishin Electrolytic polishing and burnishing.

UNIT20-Die And Counter Die Materials Including Electroforming And Electropolishing.

Types – Gypsum Products, Electroforming, Epoxy Resin, Amalgam.

Unit21-Dental Implants : Evolution Of Dental Implants, Types And Materials.

Unit22-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.

TOTAL NUMBER OF HOURS: LECTURE-80,PRACTICAL-240

RECOMMENDED BOOKS:

1. Phillips Science of Dental Materials – 10th edn.- Kenneth J. Anusavice
2. Restorative Dental Materials – 10 edn. Robert G.Craig
3. Notes on Dental Materials – E.C. Combe

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