Course Topic 1: Introduction to Dental Materials Science and Terminologies

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
1.	**Introduction, Selection & Evaluation of Dental Materials**	• Define Dental Materials Science. • Identify the different materials used in dentistry. • Classify Dental Materials. • Report the criteria for dental material selection and evaluation in relation to the clinical problem to be addressed.	• Lectures	• Class Test • Final Examination

Course Topic 2: Biocompatibility, Biomechanics and Biomaterial Testing

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
1.	**Biocompatibility & Biological Evaluation of Materials**	• Define the terms biocompatibility, post op sensitivity, hypersensitivity (Type IV). • Appreciate the concept of toxicity-corrosion. • Define the influence of dental materials on biological systems. • Describe their performance depending on the in vitro and in vivo tests as well as clinical trials.	• Lectures	• Quiz • Class Participation • Final Examination

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
2.	**Biomaterials**	• Underline the concept relating to interaction of dental biomaterials (DBMs)with the biological system • Describe the use of DBMs in the body with focus on development of the concept that a dental material essentially falls within the broader realm of biomaterials, • Recall different biomaterials in use, • Quote the concept of scaffolds in materials, tooth and tissue engineering.	• Lectures	• Class Presentation • Final Examination
3.	**Biomechanics**	• Recognise how materials behave in a structure in everyday life in the body; (Dental Amalgam, Metals, Ceramic, Resin based materials)	• Lectures	• Class Presentation • Final Examination
4.	**Biomaterial testing**	• Express an understanding of : 1. In vivo models, 2. In vitro models, • Identify the names of biomaterial quality assurance and monitoring agencies – ADA, ANSI, FDA, ISO • Express different levels of testing/usage of dental biomaterials; 1° level; Toxicity – in vitro 2° level; Animal Allergy test, baboons, monkeys, rabbits, mice 3° level; Recognise clinical tests/ randomised clinical trials (RCTs) as the gold standard in biomaterial testing.	• Lectures	• Class Presentation • Final Examination

Course Topic 3: Properties Used to Characterise Dental Materials

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
1.	**Physical properties of Materials**	• State the ideal properties of dental materials. • Describe an understanding of the physical characteristics of dental materials. • Discuss wettability and its significance in dentistry. • State the difference between; absorption and adsorption, sorption, adhesion and cohesion, mechanical and chemical adhesion • Analyse the factors affecting color appearance and selection. • Differentiate between radiopacity and radiolucency • Analyse the factors affecting the colour appearance and selection • Define the following terms; hue, chroma, value, metamerism, transparency, translucency, opalescence.	• Lectures	• Quiz • Class Test • Class Participation • Individual Assignment • Group Assignment • Final Examination
2.	**Mechanical properties of Materials**	• State the ideal properties of dental materials. • Illustrate and discuss stress and strain relationships of different dental materials with examples. • Discuss stress and its types. • Express a conceptual foundation of the reasons for fracture of restorative materials; the different types of forces and their effects. • Define modulus of elasticity. • Describe tooth wear and its types with examples. • Define the terms elastic/plastic strain, resilience, toughness, ductility, malleability, brittleness, hardness, elasticity/viscoelasticity and creep. • Interpret how a material will react under oral conditions in light of knowledge of mechanical properties and how this influences the clinician's choice of a material.	• Lectures	• Quiz • Class Test • Class Participation • Individual Assignment • Group Assignment • Final Examination

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
3.	**Thermal Properties of Materials**	• Discuss various thermal properties of Dental materials. • State the differences between thermal conductivity and thermal diffusivity.	• Lectures	• Quiz • Class Test • Class Participation • Individual Assignment • Group Assignment • Final Examination
4.	**Rheological Properties of Materials**	• Compare creep & flow. • Categories flow characteristics of dental materials according to the behavior they exhibit. • Contrast the different features of fluid behavior. • Define viscoelasticity and percolation.	• Lectures	• Quiz • Class Test • Class Participation • Individual Assignment • Group Assignment • Final Examination •
5.	**Biological Properties of Materials**	• Recall potential risks of toxic & allergic reactions associated with the use of different materials for both patients & dental care personnel. • Cite materials as being in their most reactive and harmful state during mixing and manipulation. • Understand the concept of risk/benefit analysis for dental materials.	• Lectures	• Quiz • Class Test • Class Participation • Individual Assignment • Group Assignment • Final Examination
6.	**Chemical Properties of Materials**	• To develop an understanding of the chemical stability of materials used in dentistry and familiarization with the terms solubility, erosion (tooth wear), corrosion and tarnish with respect to dental materials. • State the difference between chemical and electrochemical corrosion.	• Lectures	• Quiz • Class Test • Class Participation • Individual Assignment • Group Assignment • Final Examination

Course Topic 4: Impression Materials; Classification and Requirements

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
1.	**Introduction to Impression Materials**	• State the ideal properties of impression materials. • Develop an understanding of impression making • Classify the different impression materials used in dentistry. • Impression materials as duplicating materials. • Describe their general requirements, manipulative variables and clinical considerations. • Underline the choice of impression material in terms of a particular clinical application. • Reproduce the concept of tissue management and cross infection control. • Identify the different types of impression materials used in dentistry.	• Lectures • Tutorial	• Quiz • Class Test • Class Participation • Individual Assignment • Group Assignment • Final Examination
2.	**Non elastic impression materials**	• Tabulate non elastic impression materials (Impression plaster, Impression compound, Impression waxes, Impression pastes) with application in dentistry. • Recall their composition and selection based on the clinical problem to be addressed.	• Lectures • Tutorial • Laboratory Practical	• Class Test • Class Participation • Individual Assignment • Group Assignment • Final Examination
3.	**Elastic impression materials**	• Enlist and classify the various types of elastic impression materials. • Describe their composition, properties, indications, contraindications and selection based upon clinical considerations. • Specify the mixing ratio of alginate with water. • Dramatize the mixing of alginate impression powder with water. • Impression making on phantom heads using alginate.	• Lectures • Tutorial • Laboratory practical	• Class Test • Class Participation • Individual Assignment • Group Assignment • Final Examination

Course Topic 5: Gypsum Products for Dental Casts

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
1.	**General Introduction and Classification of Gypsum products**	• State the chemical formula of dental gypsum • Recall the gypsum classes according to ISO standard • Describe the requirements of dental cast materials • Write the composition and setting reaction of dental plaster and dental stone. • Discuss the setting characteristics of dental plaster and the set material in detail. • Define die and cast; mention different types of die materials. • Enlist advantages and disadvantages of gypsum.	• Lectures • Tutorial	• Quiz • Class Test • Class Participation • Final Examination
2.	**Manipulative variables and setting characteristics**	• Display ability to correctly manipulate these materials. • Demonstrate the ability to mix soft plaster. • Successfully demonstrate the procedure for making a plaster slab/block by adhering to allocated dimensional guidelines. • Justify and appreciate any visualized change in slab dimensions (during and after completion of setting reaction) with theoretical background. • Apply the given task with standard protocol. • Adhere to mixing guidelines of gypsum with water. • Demonstrate the technique of model pouring. • Fabricate dental cast/model. • Perform adequate trimming and finishing of study models.	• Lectures • Tutorial • Laboratory practical	• Quiz • Class Test • Class Participation • Final Examination
3.	**Manufacturing processes**	Dry and wet calcination for producing dental plaster and dental stone	• Lecture	• Class Test • Final Examination

Course Topic 6: Waxes Used in Dentistry

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
1.	**Ideal requirements and classification of dental waxes**	• Tabulate dental waxes with their application in dentistry. • Describe the components of dental waxes. • Express the ideal requirements for wax pattern materials. • Classification of dental waxes; according to use and according to origin.	• Lectures • Tutorial	• Class Test • Class Participation • Individual Assignment • Final Examination
2.	**Properties and Applications of dental waxes**	• Describe properties of dental waxes. • Discuss all waxes in general and modelling and inlay waxes in detail. • Identify and recognise the different classes of Kennedy's classification on study models. • Analyze partial denture design on study models. • Organize the steps of partial denture construction. • Justify the given wax used for partial denture pattern • Dramatize the steps of wax up on given model.	• Lectures • Tutorial • Laboratory practical	• Class Test • Class Participation • Individual Assignment • Final Examination

Course Topic 7: Polymers and Separating Media Used in Dentistry

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
1.	**Synthetic Polymers**	• Introduction • Stages of polymerisation • Structure and properties • Describe in detail; Classification and types, composition, properties, characteristics, clinical application and manipulation of synthetic and prosthetic laboratory resins.	• Lectures • Tutorial	• Quiz • Class Participation • Final Examination
2.	**Denture base polymers**	• Requirement of denture base materials; • Properties of acrylic resin as a denture base material; • Composition; Manipulation and processing; • Alternative denture base material • Describe and display familiarisation with the terms; polymethylmethacrylate, synthetic resins, acrylics, polymer, monomer, polymerization, self-cured, light-cured, heat-cured etc. • Appreciate the concept and need of adequate temporisation (chairside and laboratory) in light of appropriate PMMA material based selection and setting chemistry. • Mix and identify the physical stages of PMMA polymerisation/ acrylic denture base polymerisation (cold cure). • Successfully dramatize the fabrication of acrylic partial denture.	• Lectures • Tutorial • Laboratory practical	• Quiz • Class Test • Class Participation • Final Examination
3.	**Denture Lining materials**	• Hard reline materials; • Tissue conditioners; • temporary soft lining materials; • Permanent relining materials	• Lectures	• Quiz • Class Participation • Final Examination
4.	**Separating media used in dentistry**	• Enlist the various different types of separating media used in dentistry • Express their clinical and laboratory indications and applications.	• Lectures	• Class Test • Final Examination

Course Topic 8: Dental Cements and their Applications

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
1.	**Introduction and classification**	• Classification of dental cements; phosphoric acid, resin modified glass ionomer, poly acid and resin based cements. • Differentiate between temporary & final cements.	• Lectures • Tutorial • Laboratory practical	• Class Participation • Individual Assignment • Final Examination
2.	**Manipulation and setting characteristics**	• Manipulate and mix the following; • Zinc phosphate cement – luting and as a base. • Glass ionomer cement – luting consistency. • Calcium hydroxide – cavity lining. •	• Lectures	• Class Participation • Individual Assignment • Final Examination
3.	**Application of dental cements**	• State the different types of dental cements used in dentistry as lintra pulpal medicaments, bases, lining, luting and restorative purposes. • Requirements of dental cements for cavity lining, luting, endodontic and orthodontic purposes.	• Lectures	• Class Participation • Individual Assignment • Group Assignment • Final Examination

Course Topic 9: Metals and Alloys

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
1.	**Introduction; Structure and properties**	• Define and develop concepts related to- microleakage, creep, galvanism, tarnish, corrosion etc. • Name the different methods of metal shaping in dentistry. • Illustrate the cubic crystal structure, along with examples and its significance in dentistry. • Define annealing. • Recall the properties of alloys. • Define eutectic alloys and their significance. • Discuss the crystallization process in metals. • Elaborate coring, homogenization and different solid state reactions occurring in alloys.	• Lectures • Tutorial	• Class Test • Class Participation • Final Examination

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
2.	**Gold and alloys of noble metals**	• Demonstrate an understanding of pure gold fillings and the casting gold alloys. • Restate their composition, classification, types, and properties. • Elaborate the concepts relevant to; heat treatments, soldering and brazing materials used for noble metals and correlate them with their properties.	• Lectures • Tutorial	• Quiz • Class Participation • Final Examination
3.	**Base Metal Casting Alloys**	• Recognise the different types of base metal casting alloys used in dentistry. • Review the properties that make them suited to their particular clinical indications as intra oral metallic prostheses.	• Lectures • Tutorial	• Quiz • Class Participation • Individual Assignment • Final Examination
4.	**Steel & Wrought Alloys**	• Identify the different types of wrought alloys • Develop an understanding of Steel; Stainless Steel; Cold Working; Annealing; Welding Soldering • Correlate their properties w/ clinical applications. • Construct alphabets A, B, G, S using 0.7 mm SS wire on given outline. • Construct clasp for partial denture. • Apply the given task with standard protocol.	• Lectures • Tutorial • Laboratory practical	• Quiz • Class Participation • Final Examination

Course Topic 10: Investment Materials and Casting

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
1.	**Investment materials**	• Differentiate b/w the different types of investment materials. • Review the composition and the physicochemical properties required to manipulate them to their best effect for intended use.	• Lectures • Tutorial	• Quiz • Final Examination

2.	**Casting**	• Illustrate how the investment mould is formed. • Express and illustrate the concept pertaining to replacement of the wax pattern by alloy using a casting process/ lost wax technique. • Describe faults in casting and correlate these to incorrect selection of materials or faulty technique.	• Lectures • Tutorial	• Quiz • Individual Assignment • Final Examination

Course Topic 11: Ceramics and Porcelain Fused to Metal

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
1.	**Composition and Properties**	• Categorize the major types of ceramics used in dentistry. • Distinguish and describe how they differ in composition, physical properties, optical properties and how these affect their manufacture, clinical applications and performance.	• Lectures • Tutorial	• Quiz • Class Test • Class Participation • Individual Assignment • Group Assignment • Final Examination
2.	**Preparation of porcelain and Types of Ceramic**	• Compaction and firing • State the various types of ceramic restorations such as aluminous porcelain, cast glass and porcelain fused to metal. • Recall the principles of preparation when restorations based on these materials are planned.	• Lectures • Tutorial	• Quiz • Class Test • Class Participation • Individual Assignment • Group Assignment • Final Examination
3.	**CAD CAM restorations**	• Develop an appreciation of the fundamental concept s behind computer aided prosthesis design.	• Lectures • Tutorial	• Quiz • Class Participation • Group Assignment • Final Examination

Course Topic 12: Dental Amalgam

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
1.	**Introduction**	• Requirements of direct filling/ restorative materials and historical perspective • Quote the primary purpose of each component of amalgam alloy. • Relate the importance of the role of mercury/alloy ratio and its influence/effect on the setting reaction and restorative procedures. •	• Lectures • Tutorial	• Quiz • Class Presentation • Class Participation • Individual Assignment • Final Examination
2.	**Setting characteristics and Properties**	• Understand and conceptualise the core setting chemistry at the heart of producing dental amalgam and associated properties.	• Lectures • Tutorial	• Quiz • Class Presentation • Class Participation • Individual Assignment • Final Examination
3.	**Clinical Handling and Manipulative variables**	• Appreciate the core ideology and concept behind Black's cavity design, and recognise this system as the unchallenged baseline upon which further information pertaining to material selection, placement and cavity site and size systems has been added and subsequently refined over the years. • Cavity design considerations and concept of matrices in line with the properties of the material • Recall the manipulative parameters of amalgam and correlate them with the properties of the final restoration.	• Lectures • Tutorial	• Quiz • Class Presentation • Class Participation • Individual Assignment • Final Examination
4.	**Environmental Considerations - Dental Amalgam scrap handling and mercury safety**	• State the hazards of incorrect handling of mercury. • Review the importance of mercury hygiene and proper, safe techniques for mercury/amalgam scrap handling and disposal at chair side.	• Lectures • Tutorial	• Quiz • Class Presentation • Class Participation • Individual Assignment • Final Examination

Course Topic 13: Dental Composite Resin based Restorative Materials

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
1.	**Introduction**	• Definition and general components of dental composites. • Recognise the use of resin based dental composite materials for restorative procedures. • Classification • Review their; Historical pretext, composition and classification	• Lectures • Tutorial	• Quiz • Class Test • Class Presentation • Individual Assignment • Final Examination
2.	**Properties and Setting Characteristics**	• Review general properties	• Lectures • Tutorial	• Quiz • Class Test • Class Presentation • Individual Assignment • Final Examination
3.	**Clinical Handling and Manipulative variables**	• Correlate filler particle size, setting reaction and method of manufacture of dental composite resin based restorative materials with properties and behavior of the material in situ. • Develop an appreciation of how to use these materials to achieve the desired best esthetic and mechanical effect in vivo. • Briefly review new resin based restorative materials variants available in the market	• Lectures • Tutorial	• Quiz • Class Test • Class Presentation • Individual Assignment • Final Examination

Course Topic 14: Adhesion

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
1.	**Introduction**	• General concept of adhesion • Illustrate the general mechanistic aspects and approaches to adhesion. • Review the concept of acid etching, conditioning & priming.	• Lectures	• Quiz • Class Participation • Final Examination
2.	**Bonding systems and Smear layer**	• Enamel & Dentin bonding agents; Bonding systems • Define smear layer and enumerate possible constituents of this layer. • Underline the importance of smear layer as a determinant of the clinical success of dental composites.	• Lectures	• Quiz • Class Participation • Individual Assignment • Final Examination
3.	**Bonding at the tooth-restoration interface; Hybridisation**	• Describe the concept of hybridization in relation to dental composites. • Appreciate the phenomenon of dental composite adhesion to tooth structure based on the principles of micromechanical attachment.	• Lectures	• Quiz • Class Participation • Individual Assignment • Final Examination

Course Topic 15: Glass ionomer restorative materials

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
1.	**Introduction**	• Review the historical importance of glass ionomer cements as restorative cements. • Discuss the significance of their constituents. • Composition and Properties	• Lectures • Tutorial	• Quiz • Class Test • Class Participation • Individual Assignment • Final Examination
2.	**Setting Characteristics and Manipulative variables**	• State the mechanism of setting reaction, fluoride release and ion exchange, the interaction between GIC and the external environment and tooth interface. • Recall properties of the set material and their relationship to clinical manipulation and performance • Dimensional stability.	• Lectures • Tutorial	• Quiz • Class Test • Class Participation • Individual Assignment • Final Examination
3.	**Modified GIC restorative materials**	• Describe the concept and rationale behind developing resin-modified glass ionomers. • Appraise the significance of their constituents, the influence on the properties and the impact on the material's clinical performance • Cermet; properties, performance and clinical indications.	• Lectures • Tutorial	• Quiz • Class Test • Class Participation • Individual Assignment • Final Examination

Course Topic 16: Endodontic Materials

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
1.	Introduction	• Describe the concept of root canal treatment. • List the various endodontic materials (i.e irrigants, lubricants, intra canal medicaments, obturating materials).	• Lectures • Tutorial	• Quiz • Class Participation • Final Examination
2.	Irrigants & lubricants	• Intra-canal medicaments and filling materials; $CaOH_2$ cements, GP • Depict the clinical handling characteristics that may lead to achieving optimal endodontic outcomes.	• Lectures • Tutorial	• Quiz • Class Participation • Final Examination

Course Topic 17: Artificial teeth

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
1.	**Properties and Clinical applications**	• Techniques for manufacturing artificial teeth • Differentiate the types of materials used as artificial teeth. • Comparison between acrylic & porcelain teeth • List their requirements and optimal selection in relation to the clinical applications. • Recognize the types of artificial teeth. • Identify the type of wax on the teeth strip. • Select the appropriate teeth for the given model for teeth set up. • Adequately demonstrate the technique for teeth set up.	• Lectures • Tutorial	• Class Participation • Final Examination

Course Topic 18: Finishing & Polishing materials

S. No	Lecture Topic	Topic Objectives	Mode of Teaching	Assessment Tools
1.	**Introduction and General Concepts**	• General concept s in finishing and polishing of dental prostheses and restorative materials • Recognize the various types of abrasives, burs and discs employed for the refinement, finishing & polishing of the different types of dental restorations.	• Lectures • Tutorial	• Quiz • Class Participation • Individual Assignment • Final Examination