



NUMS

NATIONAL UNIVERSITY
OF MEDICAL SCIENCES

2nd Year
BDS Curriculum
(Revised 2019-20)

National University of Medical Sciences
Pakistan

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BDS PROGRAMME AT NUMS

Vision:

To be recognized as a leader in dental education, research, patient care and service.

Mission:

To be known for innovative dental education, commitment to cultural diversity, discovery, transfer of scientific knowledge, the superior skills of our graduates and the highest degree of patient care and service, through core values of:

- Excellence
- Integrity
- Collaboration
- Courtesy
- Compassion
- Diversity
- Professionalism

Guidelines: 2nd Year BDS Curriculum

Preamble.

This curriculum meets the standards of Pakistan Medical and Dental Council, Higher Education Commission of Pakistan, and World Federation of Medical Education, so that our students, on completion of program have required competencies as defined worldwide in a graduate doctor. The curriculum for 2nd year BDS has been reviewed by faculty of constituent/affiliated colleges in collaboration with Academic Directorate of NUMS

Contact Hours

Total Contact Hours of each subject as per PM&DC is under: -

Subject	Contact Hours
General Pathology	250
General Pharmacology	250
Sciences of Dental Materials	300
Community and Preventive Dentistry	190
Pre-clinical Operative Dentistry	100
Pre-clinical Prosthodontics	100
*Behavioral Sciences	10

***Behavioral Science may be taught as a part of community & Preventive Dentistry**

Educational strategies:

The educational strategies overarching the curriculum shall be:

Student centered

Integration

Problem based

Structured

With component of community based and electives

Teaching and Learning methods (MIT)

Multiple learning strategies are used. Interactive lectures are used to provide students entrance to topic needing much effort by the student to understand subject matter. We have used Problem based learning to integrate basic and clinical sciences, and give a learning experience that is contextual, realistic, and relevant. Small group discussions encourage students to social learning bring their concepts and learning to be discussed and schemas corrected and refined. Working in labs provides experiential, hand on learning.

Time table / Structured Training Program

The colleges shall make their own structured training program, taking care of recommended teaching hours in a subject as described by PM&DC.

Internal Assessment.

The weightage of internal assessment shall be 10 % in 2nd professional BDS Examination.

Examination.

There will be two mid-term & term examinations followed by a pre-Annual and an annual examination each year.

The structure of the paper of all the term examinations and pre-annual will be same as that for annual examination though syllabus will be different.

The structure of Mid-term exam will be exactly half of the term exam. The syllabus for mid-term & term examinations will be announced by the department at least 02 weeks prior to examination.

Pre-annual examination will be from whole syllabus.

The date sheet for mid-term, term and pre-annual examinations will be published by Examination branch of college while the examinations will be conducted by respective department.

The result will be submitted to examination branch for record.

The University shall take the 2nd professional Examination as per PM&DC guidelines at the end of the academic year. Annual Theory & Practical Examination shall be of 100 marks each in; **Community & Preventive Dentistry, Science of Dental Materials, Gen Pathology & Microbiology, Pharmacology& Therapeutics, Pre-clinical Operative Dentistry Pre-clinical Prosthodontics.** The pass score shall be 50% in theory and practical separately.

Second Professional BDS Exam

(Distribution of Marks)

Overview

S.No	Subject	Theory				Practical			Grand Total
		MCQs	SAQs/ SEQs	Internal Assess	Sub Total	Oral &Practical	Internal Assess	Sub Total	
1.	Community & Preventive Dentistry	45	45	10	100	90	10	100	200
2.	Science of Dental Materials	45	45	10	100	90	10	100	200
3.	Gen Pathology & Microbiology	45	45	10	100	90	10	100	200
4.	Pharmacology & Therapeutics	45	45	10	100	90	10	100	200
5.	Pre-clinical Operative Dentistry & Pre-clinical Prosthodontics	45	45	10	100	90	10	100	200
Total									1000

**COMMUNITY
AND
PREVENTIVE
DENTISTRY**

COURSE OUTLINE:

SECTION I

INTRODUCTION TO PUBLIC HEALTH AND DENTAL PUBLIC HEALTH

- Changing Concepts of Health and Prevention of Disease
- Introduction to Public Health Dentistry/dental public health

SECTION II

ETIOLOGY, EPIDEMIOLOGY AND PUBLIC HEALTH ASPECT OF ORAL DISEASES AND DISORDERS

- Basic/General Epidemiology
- Dental Caries and Epidemiology of Dental Caries
- Epidemiology of Periodontal Disease
- Epidemiology and Etiology of Oral Cancer
- Epidemiology and Etiology of Malocclusion
- Etiology of dental trauma
- Wasting Diseases of Teeth
- Dental Indices

SECTION III

FLUORIDES AND PREVENTIVE DENTISTRY

- Fluorides in Dentistry
- A global perspective on application of fluoride technology
- Dental Fluorosis and its Prevention
- Pit and Fissure Sealants
- Atraumatic Restorative Treatment
- MID
- Prevention of Dental Caries
- Prevention of Periodontal Disease
- Prevention of oral cancer
- Prevention of Malocclusion
- Prevention of Dental Trauma

SECTION IV

ORAL HEALTH PREVENTION AND PROMOTION

- Introduction and principles of preventive dentistry
- Health Education and Dental Health Education
- Oral Health Promotion
- Occupational Hazards in Dentistry
- Infection Control in Dentistry

- Environment and Health
- Nutrition and Oral Health
- Dental Plaque
- Plaque Control /oral hygiene aids
- Diet and Dental Caries
- Caries Risk Assessment
- Caries Activity Tests
- Cariogram
- Dental Caries Vaccine
- Ergonomics in Dentistry

SECTION V

DENTAL HEALTH CARE DELIVERY SYSTEMS

- Primary Health Care
- Health Agencies of the World (international and national)
- Public health aspects of dental services
- Hospital administration
- Health Planning and Health Management
- Problems in access and 5 A's
- Dental needs and resources
- Dental Auxiliaries
- Finance in Dentistry
- Quality Assurance in Oral Healthcare and Role of Clinical Audit
- Planning and Evaluation in oral health
- Dental Practice Management
- Consumer Protection (complaint and consent)
- Comprehensive Dental Care

SECTION VI

BEHAVIORAL SCIENCE

- Sociology as Applied to Dental Public Health
- Child Psychology
- Behavior Management in Community Dentistry
- Patient doctor communication
- Patient doctor relationship
- Ethics in Dentistry

SECTION VII

RESEARCH METHODOLOGY

- Biostatistics
- Scientific research methods in public health dentistry

- Surveying and Oral Health Survey Procedures
- School Dental Health Programs
- Computers in Dentistry
- SPSS
- Endnote
- Systematic review
- Critical analysis
- Writing a research proposal
- Evidence based dentistry

CURRICULUM (NUMS)

INTRODUCTION

- ◆ Community Dentistry, also called Dental Public Health aims to educate students on the art and science of preventing oral disease, promoting oral health and improving the quality of life of the population with the organized efforts of the society
- ◆ It helps students to understand public health programmes
- ◆ Basic research methods and statistical principles required in dental research and epidemiology are also covered

1. INTRODUCTION TO PUBLIC HEALTH AND DENTAL PUBLIC HEALTH

AIM:

- Understand various concepts of health; disease and illness and factors affecting these states.
- Introduction to Public Health Dentistry/dental public health
- Role of preventive dentistry in community health
- Public health aspect of oral disease and disorders
- Role of forensic odontology

Learning Outcomes:

By the end of this section the students would be able to

- know the about the basic concepts of community and dental public health

- Demonstrate the knowledge and understanding of the concept of public health and dental public health
- Understand the determinants of health
- Explain methods to eliminate inequalities in oral health
- Comprehend the implications of dental public health in their profession
- How dentistry play a role in forensics

2. ETIOLOGY, EPIDEMIOLOGY AND PUBLIC HEALTH ASPECT OF ORAL DISEASES AND DISORDERS

AIM:

- To make the students learn the community dentistry concepts about etiology, natural history and epidemiology of oral diseases
- Make the students learn about the diseases of oral health significance

Learning Outcomes:

By the end of this section the students would be able to learn

- Current concepts about etiology, natural history and epidemiology of oral diseases and conditions having public health implications.
- Learn definitions, uses and principles of epidemiology.
- Apply principles of assessment of disease risk and predictive tests, such as oral health assessment indices.
- Learn to know the Oral diseases of public health significance
 1. Dental caries
 2. Periodontal disease
 3. Oral cancer, screening
 4. Malocclusion
 5. Dental trauma
 6. Developmental enamel defects
 7. Fluorosis

8. Dentofacial irregularities
9. Root caries
10. Wasting of teeth

3. FLUORIDES AND PREVENTIVE DENTISTRY

AIM:

Making the students understand fluorides in dentistry and prevention of diseases like caries, periodontal diseases, oral cancers, malocclusion, dental trauma, dental fluorosis

Learning Outcomes:

By the end of this section the students would be able to learn

- **Fluorides and water fluoridation**
 - Understand fluorides, their usage, mode of action and classification
 - Understanding global perspective on application of fluoride technology
 - Use of systemic and topical fluorides
 - Understand what is water fluoridation
- **Fluoridation**
 - Understand dental fluorosis, its prevention and defluoridation
 - Legal framework and decision making about fluoridation
 - The ethics of water fluoridation
 - Fluoridation case studies
- Learn to know Pit and fissure sealants
- Learn to know Atraumatic Restorative Treatment
- Learn to know how minimal invasive dentistry plays a preventive role in dentistry
- Learn to know the preventive methods for the following preventable diseases
 - Prevention of Dental Caries
 - Prevention of Periodontal Disease
 - Prevention of oral cancer
 - Prevention of Malocclusion

- Prevention of Dental Trauma

4. ORAL HEALTH PREVENTION AND PROMOTION

AIM:

Making the students understand know the of levels prevention, principles of health promotion and specific protection

Learning Outcomes:

By the end of this section the students would be able to learn

- They will get to know the of levels prevention, principles of health promotion and specific protection
- Learn the significance of infection control protocols and protection from radiation and mercury hazards in dental practice.
- Role of Environment on Health
- Role of Ergonomics in Dentistry
- Learn the role of diet and nutrition in oral health.
- Effect of nutrition and diets and value of teeth in nutrition
- Nutritional dietary guideline and food policy in oral health
- Sugar consumption
- Learn to know about relationship between Diet and Dental Caries
- Learn to know Caries Risk Assessment
- How to perform Caries Activity Tests
- Learn to know the significance of aCariogram
- Role of Dental Caries Vaccine in preventing caries
- Understand the role of dental plaque in the etiology of dental diseases and methods of plaque control.
- Care of the teeth of the child during all stages of growth right from infancy
- Principles and strategies of dental scaling
- Principles and strategies of dental health education and promotion
- Principles of oral health behavior and health education

5. Dental healthcare delivery system

AIMS:

Make the students understand different health services, planning and evaluation of health service and basics of health economics

Learning Outcomes:

By the end of this section the students would be able to learn

- Learn the Public health aspects of dental services
- Understand the structure and financing of dental care at international and national levels and in the armed forces.
- Administration of dental services
- Principles of health economics
- Development of socio dental indicators
- Identify the role of dentists, dental auxiliaries and general health workers in oral health care.
- Use of health needs assessment to plan oral health care
- Learn to know health needs, quality and ethical issues in dental care.
- Learn about the principles and elements of primary oral health care
- Identify the dental care of primary oral health care of people with special needs including the elderly, the handicapped, HIV/AIDS patients, school children.
- Learn to know the Health Agencies of the World (international and national)
- Learn to know the Health Planning and Health Management
- Learn to know Quality Assurance in Oral Healthcare and Role of Clinical Audit
- Learn to know Dental Practice Management
- Learn to know how to take consent from patients
- Learn how to handle a complaint in a dental setup
- Learn to know what is Comprehensive Dental Care

6. BEHAVIORAL SCIENCE

AIMS:

Make the students understand health behavior, its determinants and behavior management

Learning Outcomes

By the end of this section the students would be able to learn

- Understand the meaning and significance of learning behavioral science in dental practice
- Health behavior and its determinants, attitudes, beliefs and values about health and illness, theories of health behavior, health behavior models
- Learn about dentist – patient communication, management of stress, fear and anxiety in dentistry.
- Understand behavior management and modification techniques, counseling, motivation and compliance.
- Understand the role of a dentist in managing different behaviors in a dental office
- Learn the desirable attitudes in medical/dental professionals
- Explain the meaning and function of emotion and its regulation
- Understand the concept of positive emotions
- Understand how are culture and emotions linked
- Understand how intelligence testing is developed
- Understand what is successful intelligence
- Have enough knowledge to handle children with behavioral difficulties in their clinics and guide their parents
- Dental ethics

6. RESEARCH METHODOLOGY

AIM:

To make them understand the epidemiological designs, conducting a school dental survey, tools of measurement

Learning Outcomes:

- Understand research designs; dental surveys; clinical trials;
- Learn to know the epidemiological study designs
- Learn to conduct school dental survey
- Learn to write research proposal
- Learn to do systematic review

- Learn to do critical analysis
- Learn to know basics of computers
- Learn to know about SPSS
- Learn to know endnote
- Learn to know about hypothetical testing and P value
- Get an introduction to bio-statistics: Types of variables, frequency distribution, measures of central tendency and variability in data and bias
- Understand the methods of sampling, sampling error, probability, normal distribution
- Illustrating presentations and publication
- Evidence based dentistry

PRACTICALS:

A. Clinical Oral Examination

i Exercise on Models and Extracted teeth

ii Exercise on patients in out patients department

- Ergonomics basics
- History taking and examination
- indic: DMFT,CPITN

iii Examination of institutionalized population like school children

- Ergonomics basics
- History taking and examination
- indic: DMFT,CPITN

B. Questionnaire / interview study

i. Designing a questionnaire

ii. Pilot testing the questionnaire

iii Data coding, processing, analysis

iv Data entry softwares: SPSS, ENDNOTE

C. Planning and conducting a dental health education (D.H.E.) session:

i. Designing D.H.E. material

ii Planning, conducting and evaluating (D.H.E) sessions

D. Chairside preventive dental procedures

i High fluoride gel application, varnish application

ii Fissure sealing

iii Dietary counseling, OHIs

iv Plaque disclosing

v Instructions about Oral Hygiene measures

- Tooth Brushing demonstration
- Flossing techniques
- Inter-dental cleaning
- Chemical control of dental plaque

E. Dental instruments and dental materials

F. Cross infection control:

i. hand washing, PPE,

ii. Needle stick injury & immunization,

iii. disinfection and sterilization,

iv. waste disposal,

v. disinfection of dental unit

E. Poster competition

F. Presentations

G. Assignments

H. DMFT, CPITN cases

I. Quiz competition

Recommended readings:

- Textbook of Preventive and Community Dentistry. 2nd edition. SS Hiremath
- A Textbook of Public Health Dentistry. CM Marya
- Essential Dental Public Health. 2nd edition. Blanaid Daly

**GENERAL
PATHOLOGY
AND
MICROBIOLOGY**

Second Professional BDS
Syllabus & Course

GENERAL PATHOLOGY AND MICROBIOLOGY

Cell Injury and Cellular Adaptations

Introduction

Causes of cell injury

Ischemic and hypoxic injury

Free radicals and cell injury

Cell death (necrosis) types of necrosis; pathogenesis and clinical examples of each

Gangrene dry, wet and gas gangrene with clinical examples

Intracellular accumulations

Fatty change – pathogenesis and manifestations of fatty change in liver and kidneys

Pigments endogenous and exogenous; disorders of pigmentation with special emphasis on oral pigmentation

Cellular adaptations of growth and differentiation; hypertrophy, hyperplasia, atrophy, hypoplasia, metaplasia and dysplasia

Calcification – metastatic and dystrophic

Hyaline change

Brief interpretation of Liver function tests and Lipid profile

Brief overview of metabolic disorders: Lipid disorders, steatosis of liver, hyperlipidemia; Protein disorders; Carbohydrate disorders

Diabetes mellitus; Normal blood glucose levels and diagnostic tests Of Diabetes mellitus (HbA1C and Glucose tolerance test)

Inflammation

Introduction

Acute inflammation cellular and vascular events

Mononuclear phagocytes system

Chronic inflammation

Chronic granulomatous inflammation

Giant cells

Morphologic patterns in acute and chronic inflammation

Systemic effects of inflammation

Brief interpretation of CBC and ESR

Healing and Repair

Introduction

Regeneration

Repair by connective tissue

Healing of skin wounds

Complications of wound healing

Mechanisms involved in repair

Factors affecting healing – local as well as systemic

Healing in specialized tissues (Bone)

Abnormalities of fracture healing

Hemodynamics

Hyperemia and congestion

Edema

Shock – types with pathogenesis and stages

Burns

Thrombosis

Embolism

Infarction

Pathological laboratory diagnosis of Myocardial infarction

Brief interpretation of bleeding and clotting time (PT, aPTT, INR)

Immunology

Introduction

Antigens

The cellular basis of immune reaction

Antibodies

Complement system

Cytokines

The immune response

Transplantation and major histocompatibility antigen

Immune deficiency – congenital and acquired clinical significance of common immunodeficiencies

Hypersensitivity reactions; pathogenesis and clinical examples

Autoimmunity; pathogenesis and clinical examples

Amyloidosis; classification, pathogenesis and clinical examples

Vaccination

Blood groups

Genetic Basis of Disease

Introduction

Mutations

Mendelian disorders

Disorders of defects in enzymes (Gout, Phenylketonuria, Galactosemia, Lysosomal storage diseases, Glycogen storage diseases)

Cytogenetic disorders molecular diagnosis

Diagnosis of genetic diseases (Brief overview)

Neoplasia

Introduction

Classification of tumors

Nomenclature of tumors

Characteristics of benign and malignant tumors with emphasis on local invasion, anaplasia and metastasis

Differences between benign and malignant tumors

Differences between carcinomas and sarcomas

Biology of tumor growth

Carcinogenic agents and their cellular interactions

Chemical carcinogenesis

Radiation carcinogenesis

Viral oncogenesis

Oncogenes and cancer

Pathogenesis of cancer

Effect of malignant tumors on host

Oral cancer and precancerous lesions

Laboratory diagnosis of cancer

Submission of histopathological specimen

Recommended Books

Pathological basis of disease Cortan, Kumar, Collins (Robbins)

Text book of Pathology by Waiter and Israel

Microbiology

Cell types: prokaryotes, eukaryotes

Structure of bacteria

Culture media

Basic properties of micro-organisms and their mechanisms of pathogenicity

Common bacteria and their pathogenicity: cocci, bacilli, spirochetes: Staphylococcus aureus, Streptococcus pneumoniae, Beta hemolytic Streptococcus Group A & B, Diphtheria species, Bordetella species, Bacillus anthracis, Clostridium perfringens, Clostridium botulinum, Clostridium difficile, Clostridium tetani, Actinomyces israelii, Nocardia asteroides, Neisseria meningitidis, Neisseria gonorrhoea, Gardnerella vaginalis, Hemophilus influenzae, Mycobacterium tuberculosis, Mycobacterium leprae, E. Coli, Klebsiella, Proteus, Salmonella, Shigella, Yersinia pestis, Pseudomonas, Vibrio cholerae, Vibrio parahaemolyticus, Campylobacter jejuni, Helicobacter pylori, Legionella, Mycoplasma pneumoniae, Chlamydia, Treponema pallidum, Leptospira, Rickettsia

Structure and properties of viruses and an overview of common viral infections: Mumps, Herpes, Measles, Influenza, Parainfluenza, Respiratory syncytial virus, Hepatitis A, B, C, D, E, Rota, Cytomegalovirus, Epstein bar virus, Rubella, Chicken pox, Human immunodeficiency virus, Rabies, Dengue virus, Congo virus

Structure and properties of fungi and an overview of common fungal infections: Cryptococcus neoformans, Candida albicans, Histoplasma, Coccidioides, Aspergillus, Mucor and Rhizopus, Dermatophytes

Structure and properties of protozoa and an overview of common protozoal infections: Plasmodium species, Giardia lamblia, Entamoeba histolytica, Cryptosporidium, Leishmania species, Trichomonas vaginalis, Toxoplasma gondii, Pneumocystis carinii, Trypanosoma

Structure and properties of parasites and an overview of common parasitic infections: Ascaris lumbricoides, Ancylostoma duodenale, Trichinella, Trichuris trichiura, Enterobius vermicularis, Filariala species (Wuchereria bancrofti), Strongyloides, Schistosoma species, Echinococcus species, Taenia solium, Taenia saginata, Diphyllbothrium latum, Hymenolepsis nana, Onchocerca, Loa loa

The mode of action of chemotherapeutic agents

Mechanisms of resistance in bacteria

Hospital infections

Disinfection and sterilization

The spread of infectious diseases in dentistry

Transportation of microbiological specimen

Recommended books

Essentials and Applications of Microbiology Larry Mckane Judy Kandel

Microbiology by Jawetz

Course out line and practical break up for General Pathology and Microbiology for 2nd year BDS

LECTURE PLAN OF PATHOLOGY – 2ND YEAR BDS

S/No	Topics	No of Lectures
1.	General Pathology and Special Pathology	46
2.	Microbiology	56
3.	Hematology	04
4.	Evaluation in Exams	01
	Total=	107

Lecture Hours =107

Practical = 74

Total = 181

DISTRIBUTION OF GENERAL PATHOLOGY TOPICS – 2ND YEAR BDS

S/NO	Topics	No of Lectures
1.	Cell Injury	08
2.	Inflammation and Repair	07
3.	Hemodynamic	05
4.	Amyloidosis	01
5.	Neoplasia	07
6.	Immunology	07
7.	Genetics	06
8.	Environmental pathology	02
	Tutorials =	06
	Total =	48

CELL INJURY

TOTAL NO OF LECTURES – 08

S/NO	TOPICS
1.	Introduction, Aetiology And Types
2.	Mechanisms of free radical, chemical, reversible, irreversible cell injury
3.	Necrosis
4.	Apoptosis
5.	Pigmentation, intracellular accumulation, fatty change
6.	Calcification
7.	Adaptation to cell injury – I
8.	Adaptation to cell injury – II

Tutorial

INFLAMMATION AND REPAIR

TOTAL NO OF LECTURES – 07

S/NO	TOPICS
1.	Definition, aetiology, events of acute inflammation
2.	Chemical mediators of inflammation, sequelae of acute inflammation
3.	Chronic inflammation – Definition, aetiology, cells of chronic inflammation, granulomatous inflammation
4.	Wound healing and tissue repair

Tutorial

HEMODYNAMICS

TOTAL NO OF LECTURES – 05

S/NO	TOPICS
1.	Oedema and Congestion
2.	Haemorrhage
3.	Shock
4.	Thrombosis and embolism
5.	Infarction

Tutorial

AMYLOIDOSIS

TOTAL NO OF LECTURES – 01

S/NO	TOPICS
1.	Amyloidosis

Tutorial

NEOPLASIA

TOTAL NO OF LECTURES – 09

S/NO	TOPICS
1.	Classification of tumors, benign vs malignant tumors, oncogenes and aetiology of tumor
2.	Molecular basis of cancer- Oncogenes
3.	Biology and mechanism of tumor spread
4.	Carcinogenic agents and host defense against tumors
5.	Grading and staging of tumors

Tutorial

IMMUNOLOGY

TOTAL NO OF LECTURES –07

S/NO	TOPICS
1.	Cells of the immune system
2.	Immunoglobulins
3.	Hypersensitivity reactions type I- type IV
4.	Immune deficiency diseases
5.	AIDS

Tutorial

GENETICS

TOTAL NO OF LECTURES – 06

S/NO	TOPICS
1	Terminology
2.	Autosomal disorders
3.	Chromosomal disorders
4.	Sex chromosomes

Tutorial

ENVIRONMENTAL DISEASES - 02

S/NO	TOPICS
1.	Environmental diseases and effects of alcohol and smoking
2.	Hazards of radiation

Tutorial

DISTRIBUTION OF MICROBIOLOGY TOPICS – 2ND YEAR BDS

S/NO	TOPICS	NO OF LECTURES
1.	Introduction to microbiology	01
2.	General microbiology	09
3.	Bacteriology	17
4.	Virology	07
5.	Fungi	05
6.	Parasitological	10
	Total =	49
	Tutorial =	07
	G. Total =	56

LECTURE PLAN OF MICROBIOLOGY

S/NO	TOPICS
1.	Introduction to microbiology/ biohazards in microbiology lab

GENERAL MICROBIOLOGY

TOTAL NO OF LECTURES – 09

S/NO	TOPICS
1.	Bacterial anatomy
2.	Bacterial physiology
3.	Bacterial genetics
4.	Bacterial growth
5.	Sterilization/disinfection physical methods
6.	Sterilization/ disinfection chemical methods
7.	Normal flora

Tutorial

Bacteriology

Total number of lectures - 17

S/NO	Topics
1.	Staphylococcus
2.	Streptococcus, classification, streptococcus pyogenes
3.	Streptococcus pneumonia/enterococcus
4.	Neisseria meningitides
5.	Neisseria gonorrhoea
6.	Coliform bacteria, enterobacteriasis
7.	e. coli, klebsiella
8.	Salmonella and typhoid
9.	Shigella
10.	Vibrio, pseudomonas
11.	Proteus, providentiamorganella
12.	Haemophilus
13.	Helicobacter
14.	Brucella, pasteniella
15.	Cornibacterium, listeria
16.	Anaerobes- gram +ive
17.	Anaerobes- _ive
18.	Mycobacterium I
19.	Mycobacterium II
20.	Actinomycosis/nocardia
21.	Chlamydia/mycoplasma
22.	Rickettsia
23.	spirochaetes

Tutorial: 03

Virology

Total number of lectures - 7

S/no.	Topics
1.	Hepatitis virus
2.	HIV
3.	Rabies virus
4.	Herpes virus

Fungi

Total number of lectures – 5

S/no.	Topics
1.	Cutaneous mycosis/aspergillus
2.	Deep mycosis
3.	Opportunistic pathogenic fungi

Tutorial = virology/fungi

PARASITOLGY

TOTAL NUMBER OF LECTURES – 10

S/NO	topics
1.	Introduction to parasitology
2.	Amoeba
3.	Giardia/trichomonas
4.	Malarial parasite
5.	Malarial parasite
6.	Toxoplasma
7.	Leishmania
8.	Cestodes-I
9.	Cestodes-II
10.	Ascarislumbricoides
11.	Anclostomadoudenale/necataramericanus
12.	enterobius

Tutorial= 02

LECTURES HAEMATOLOGY TOTAL NUMBER OF LECTURES – 04

S/NO	topics
1.	Anaemias
2.	Leukaemia
3.	Bleeding disorder
4.	Interpretation of CBC

Tutorial

CLINICAL / CHEMICAL PATHOLOGY

S/NO	topics
1.	Handling of lab specimen-I
2.	Handling of lab specimen-II
3.	Interpretation of lab investigation-I
4.	Interpretation of lab investigation-II

EVALUATION IN EXAMS

TOTAL NUMBER OF LECTURES – 01

S/NO	Topics
1.	Evaluation in exams

DISTRIBUTION OF PRACTICAL OF MICROBIOLOGY

2ND YEAR BDS

TOTAL NUMBER OF PRACTICAL-37 (74HRS)

Microbiology		General Pathology	
S/no.	topics	S/no.	Topics
1.	Study of microscope	1.	Hydropic change
2.	Gram stain	2.	Fatty change
3.	Z.N stain	3.	Coagulative necrosis
4.	Culture media	4.	Caseous necrosis
5.	ID of bacteria	5.	Hyperplasia
6.	Sugar tests	6.	Atrophy
7.	Oxidase test	7.	Intracellular accumulations (malignant melanoma haemosiderin pigment)
8.	Catalase test	8.	Calcification
9.	Motility test	9.	Acute inflammation
10.	Stool RE	10.	Granulation tissue
11.	Urine RE	11.	Edema lung
12.	Ova/cyst	12.	Chronic venous congestion (lung/liver)
13.	Malarial parasite	13.	Thrombosis
14.	LD bodies	14.	Amyloidosis
Haematology		15.	Benign tumors-lipoma
1.	Leishman's stain	16.	Benign tumors-leiomyoma
2.	DLC	17.	Malignant tumors-squamous
3.	TLC	18.	Malignant tumors-basal cell Ca.
4.	RBCs morphology	19.	Handling of specimen
5.	ESR	20.	Interpretation of lab

PHARMACOLOGY & THERAPEUTICS

CURRICULUM

2nd Year BDS Class Session 2017-2018

PHARMACOLOGY

Term-1

No	Topic	Mode of Information Transfer	Learning Objectives
1.	Pharmacology: Introduction, Historical overview.	Lecture	Introduction of pharmacology dept/faculty Forecast of activities in full academic year Training modules Forecast of academic landmarks Definition of pharmacology and relevant discussion/historic overview Rational drug therapy Role of Muslims scientist in advancement of pharmacology Modern pharmacology
2.	Pharmacology: Branches/division of Pharmacology, Role in Medicine	Lecture	Definitions of: Pharmacokinetics, pharmacodynamics, therapeutics, chemotherapy, toxicology, clinical pharmacology, Pharmacy, pharmacognosy, pharmacokinetics, pharmacogenomics, pharmacoepidemiology, comparative pharmacology, animal pharmacology, pharmacoeconomics, posology
3.	Active Principles of Drugs	Lecture	Definition; Characteristics with examples
4.	Dosage forms & doses of drugs	Lecture	Definition; explanation with examples of various dosage forms
5.	Routes of drug administration	Lecture	Definition; Explanation and examples of various routes of administration of drugs
6.	Absorption of drugs: processes	Lecture	Definition, Processes, Factors affecting Absorption of Drugs
7.	Factors modifying drug absorption.	Lecture	
8.	Distribution and plasma protein binding of drugs, drug reservoirs	Lecture	Definition, Inter relationship among distribution, absorption, metabolism and elimination of drug, factor affecting drug distribution, PPB clinical significance, drug reservoirs, volume of distribution, clinical significance over dosing regimens, loading dose, factor affecting Volume of distribution

9.	Biotransformation of drugs.	Lecture	Definition/aims and types of reactions involved in conversion of drugs into metabolites for excretion
10.	Factors modifying biotransformation	Lecture	Explaining the factors that influence the biotransformation of drugs
11.	Bioavailability: clinical significance and factors affecting.	Lecture	Definition, factors affecting bioavailability of drugs, Significance, Bioequivalence, Therapeutic equivalence, Chemical equivalence
12.	Half-life of drugs: factors affecting and clinical significance.	Lecture	Definition, formula, phases, graphical representation, factors affecting half-life, significance, examples
13.	Excretion of drugs. Drug clearance,	Lecture	Definition/ routes of excretion, Processes involved in renal excretion of drugs, Glomerular function of GFR, Tubular secretion of drugs, Tubular reabsorption of drugs, Elimination of drug by the liver, Minor routes of elimination of drugs, Drug clearance
14.	Mechanism of drug action-I	Lecture	Definition, receptors, types, agonist /antagonist, mechanisms, signaling mechanism, second messenger system
15.	Mechanisms of drug action – II	Lecture	
16.	Factors modifying actions & doses of drugs – I	Lecture	Age, idiosyncratic reaction, hypersensitivity, genetic, drug antagonism, Tolerance and synergism etc
17.	Factors modifying actions & doses of drugs – II	Lecture	
18.	A N S : Introduction-I	Lecture	Parasympathetic NS, synthetic, release transport of NT cholinceptors. Sympathetic NS, synthesis, release transport of NT adrenoceptors
19.	A N S : Introduction-II		
20.	Catecholamines – I Adrenaline.	Lecture	Definition, receptors, classification, chemistry, metabolism, MoA of adrenaline, receptors, pharmacological action on all organ systems, therapeutic uses. NE, receptors, pharmacokinetics, MoA, organ system effects, therapeutic uses, adverse effects. Isoprenaline, dopamine, dobutamine, (MoA, organ system effects, Pharmacokinetics, adverse effects, therapeutic uses)
21.	Catecholamines – II Nor adrenaline, Dopamine & Dobutamine.	Lecture	
22.	Non Catecholamines: Ephedrine,	Lecture	Comparison of catecholamines and non catecholamines, ephedrine, amphetamine, phenylephrine, salbutamol tyramine

	Amphetamines α receptor agonists etc.		,dexmedetomidine, xylometazoline and oxymetazoline (MoA, organ system effects, Pharmacokinetics, adverse effects, therapeutic uses).
23.	Adrenergic Blockers. Alpha- receptor Blockers.	Lecture	Classification, therapeutic indications, untoward effects
24.	Adrenergic Blockers: Beta receptor Blockers – I.	Lecture	Postsynaptic receptors, presynaptic, beta receptors actions, classification, pharmacokinetics, pharmacological actions, therapeutic uses, adverse effects, contraindication
25.	<i>Beta Receptor Blockers- II</i>	Lecture	
26.	Central Sympathoplegics.	Lecture	α methyl dopa, Clonidine, Apra clonidine, Guanfacine (MOA, Uses, Adverse effects)
27.	Cholinergic drugs. Classification, Cholinesters, alkaloids etc.	Lecture	Classification, Cholinceptors, MOA, Pharmacological action, Therapeutic uses, A/E, PK Salient features of individual drugs (carbachol, Methacholine, Bethanechol, Neostigmine, Physostigmine). Diff btw Neostigmine & Physostigmine Myasthenia gravis. Clinical features & Rx. Organophosphate Poisoning & clinical features, Acute & Chronic nicotinic toxicity and treatment
28.	Anti Cholinesterases.	Lecture	
29.	Organophosphate poisoning & Oximes.	Lecture	
30.	Cholinergic blockers; Natural alkaloids. Comparison between Hyoscine & Atropine.	Lecture	Drug interaction, receptors, classification, chemical, therapeutic classification, pharmacokinetics, Mechanism of action, pharmacological action, therapeutic uses
31.	Semisynthetic Anticholinergics.	Lecture	
32.	Skeletal Muscle Relaxants-I	Lecture	Peripherally acting; Non depolarizing neuromuscular blockers (isoquinoline derivatives, steroid derivatives) Depolarizing neuromuscular blockers, Centrally acting; Benzodiazepines, Gaba analogues, Propanediolderivatives, Misc compounds, Directly acting; Dantrolene
33.	Skeletal Muscle Relaxants-II	Lecture	
34.	Central Neurotransmission	Lecture	Types of ion channels, Neurotransmitters
35.	Gen Anaesthetics – I, Classification, Method of administration, Pharmacokinetics of	Lecture	Definition, Gen principles of surgical anesthesia, preanesthetic medications, classification and types of G. A. stages of anesthesia, inhalation anesthetic, mode of delivery of inh. Anesthetics,

	inhalational Anaesthetics		pharmacokinetic characters, affecting induction and recovery. Mechanism of action, individual agent with their specific uses and untoward reaction I/V anesthetic. Comparative studies of advantages and disadvantages of individual agent.
36.	Gen Anaesthetics-II, Pre- anaesthetic medication, Stages of Anaesthesia, Mechanism of action	Lecture	
37.	General Anaesthetics-III, Volatile liquids	Lecture	
38.	General Anaesthetics-IV, Gases	Lecture	
39.	General Anaesthetics-V, Intravenous anesthetics	Lecture	
40.	<i>Local Anaesthetics-I</i>	Lecture	Physiology of pain, Chemistry of LA, Classification to acidity Therapeutic uses /chemical & Duration of action MOA/ Factors affecting LA action Advantages of addition of Vasoconstriction Differential Sensitivity of nerve fibers to LA P/K, salient features of Lignocaine & Spinal Analgesia & A/E & uses. How to prevent toxicity of LA.
41.	<i>Local Anaesthetics-II</i>	Lecture	
42.	<i>Local Anaesthetics-III</i>	Lecture	
43.	Sedative & Hypnotics – I Introduction & Classification	Lecture	Introduction and classification, Benzodiazepines, mechanism of action, clinical uses, adverse effects, Buspirone, zolpidemzaleplon, Clinical uses of barbiturates upto date
44.	Sedative & Hypnotics –II Barbiturates	Lecture	Introduction and classification, Benzodiazepines, mechanism of action, clinical uses, adverse effects, Buspirone, zolpidemzaleplon, Clinical uses of barbiturates upto date
45.	Sedative & Hypnotics- III. Benzodiazepines.	Lecture	
46.	Antiepileptic drugs-I .Classification, hydantoin derivatives,	Lecture	Introduction, type of seizures and classification of drugs, Carbamazepine, valproic acid, Barbiturates, succinimides, benzodiazepines and newer drugs

47.	Antiepileptic drugs- II. Carbamazepine, valproic acid.	Lecture	
48.	Antiepileptic drugs- III. Barbiturates, succinimides, Benzodiazepines, Newer drugs	Lecture	
49.	Anti-depressants Introduction and Classification	Lecture	Salient features of Depression, Classification SSRI,S, SNRIP/K, A/Es
50.	Drugs treatment of Migraine.	Lecture	Classification and pharmacokinetics/pharmacodynamics of drugs used in treatment of migraine
51.	Analgesics –I: Introduction, Classification	Lecture	
52.	Analgesics;-II Morphine	Lecture	Introduction and classification, Semi synthetic/synthetic, opioids and opioid analgesic, Therapeutic uses, adverse effects and contraindication
53.	Analgesics – III: Semisynthetic/ synthetic opioids & opioid antagonists	Lecture	
54.	NSAIDs: Classification, Mechanism of Action.	Lecture	Non Selective cyclo-oxygenase Inhibitors, Cyclo-oxygenase-2 Selective Inhibitors, MOA, Uses, Adverse effects, Aspirin, Paracetamol (Pharmacokinetics, MoA, clinical uses, adverse effects).
55.	Aspirin & other Salicylates.	Lecture	
56.	Propionic acid, Acetic acid der. & Paracetamol	Lecture	

Term Test-1**Term-2**

57.	Physiology of Heart	Lecture	Electrophysiological properties of heart, types of heart failure, physiological mechanism in heart failure, classification of drug used in heart failure, cardiotonic drugs Digoxin, bipyridines & resynchronization therapy.
58.	Drugs used in CCF-I	Lecture	
59.	Drugs used in CCF-II		
60.	Anti anginal drugs	Lecture	Types of angina, Organic Nitrates, Calcium Channel Blockers, Beta antagonists, Potassium channel Activators, Newer Anti anginal Drugs. Drugs used in management of IHD/MI.
61.	Drug Treatment of MI	Lecture	
62.	Antihypertensive drugs- I Sympatholytic drugs.	Lecture	
63.	Antihypertensives drugs-II Diuretics. Ca ⁺⁺ Channel blockers.	Lecture	Diuretics, sympatholytics, calcium channel blockers, drugs acting on renin angiotensin system, vasodilators
64.	Antihypertensives drugs-III. ACE inhibitors, AT receptor Antagonist Directly acting vasodilators	Lecture	
65.	Anti arrhythmic drugs	Lecture	
66.	Diuretics: Introduction, Classification.	Lecture	Normal electrophysiology of heart, mechanism of and types of arrhythmias, mechanism of drug action in arrhythmias, classification of drugs, Class-I antiarrhythmic (Na ⁺ channel blockers), Class-II drugs (beta blockers) class-III drugs (K ⁺ channel blockers) class-IV drug (Ca ⁺² channel blockers), Misc (digoxin, adenosine, Mg ²⁺ & K ⁺) comparison of all groups, treatment of important arrhythmias.
67.	Diuretics: Thiazides.	Lecture	
68.	Diuretics: Loop. K ⁺ sparing, Osmotic & Misc groups,	Lecture	
			Physiology of Nephron, Classification, CAI (PK, MOA, Uses, A/E, C/I, Drugs Interaction), Loop Diuretics, Thiazides, K ⁺ sparing, Osmotic Diuretics, ADH antagonists (Names & Salient features)

69.	Introduction, General Principles of Chemotherapy,	Lecture	Def, antimicrobial antibiotics, bacteriostatic, bactericidal, conc and time dependent killing, post antibiotic effect, narrow, extended & broad spectrum antibiotics. Ten principles of chemotherapy, classification of antimicrobials
70.	Mechanism of Resistance	Lecture	Innate, acquired resistance, due to genetic alteration and altered expression protein and their mechanisms, single step mutation, Multi-step mutation, cross resistance, complete & Partial cross resistance. Prevention of resistance.
71.	Sulfonamides	Lecture	Historic overview, Chemistry of sulfonamides/MoA, Classification, PK/PD & toxicities/uses, Sulfonamides combinations, Cotrioxazole, Trimethoprim/sulfonamides, PK/PD, uses & toxicity of co-trimoxazole
72.	Trimethoprim & Cotrimoxazole	Lecture	
73.	Antibiotics, Penicillins.	Lecture	Classification, structure, mechanism of action, mechanism of resistance, pharmacokinetics, Dose, therapeutic uses & adverse effects.
74.	Antibiotics, Penicillins – Semisynthetics.	Lecture	
75.	Antibiotics, Cephalosporins.	Lecture	Classification, structure, spectrum, P/K (Pharmacokinetics), mechanism of action, therapeutic uses, A/E
76.	Macrolides. Antibiotics: Broad spectrum	Lecture	Spectrum/clinical uses adverse effects, mechanism of action & resistance
77.	Antibiotics: Broad spectrum, Tetracyclines.	Lecture	Classification, Pharmacokinetics of Tetracycline, Spectrum of activity, MOA & resistance, A/Es, Therapeutic Uses, Drug Interaction & Contraindications
78.	Chloramphenicol.	Lecture	Spectrum, clinical uses, adverse effect and MOA & resistance
79.	Antibiotics: Aminoglycosides	Lecture	MoA, PK, uses and untoward reaction
80.	Quinolones.	Lecture	MoA, PK, classification, uses, spectrum and untoward reactions.
81.	Antituberculosis drugs – I.	Lecture	Introduction, Features of mycobacterium TB, classification, First line drugs, structure, mechanism of action, therapeutic uses, adverse effects. Dose, (contraindications) 2 nd line drugs Structure, mechanism of action, therapeutic uses,
82.	Antituberculosis drugs – II.	Lecture	

			Adverse effects, dose, MAC, Definition, introduction, treatment, DOT, WHO recommended regimens
83.	Anti fungal drugs-I	Lecture	Classification, spectrum of individual class, MoA, uses, PK and untoward action.
84.	Anti fungal drugs-II	Lecture	
85.	Anti viral drugs –I	Lecture	Structure, life cycle, classification, acyclovir, valacyclovir, famciclovir, penciclovir, gancicloverfoscarnet, cidofovir, (MoA, pharmacokinetics, therapeutic uses, adverse effects). Amantadine, rimantadine, zanamiviroseltamivir, ribavirin, antiretroviral agents, NRTIS, NNRTIS, Protease inhibitors, fusion inhibitors, integrase inhibitors, drug treatment of hepatitis C (interferon ribavirin, sofosbovir) drug treatment of hepatitis B, (Lamivudine, adefovir, telbivudine,)
86.	Anti viral drugs II.	Lecture	
87.	Anti Malarial	Lecture	Species/life cycle of plasmodium, Malaria symptoms, Therapeutic classification, Chemical classification, Chloroquine MoA/PK/PD/uses; Quinine MoA/PK/PD/uses; Mefloquine/Primaquine/atovaquone, Lamofantrine, Drugs used in chloroquine resistant malaria, Chemoprophylaxis of malaria
88.	Anti Amoebics-I	Lecture	Amoebiasis, life cycle of entamoabahistolytica , pathogenesis, classification, mechanism of action, P/K, Pharmacodynamics, spectrum, dose, adverse effects, contraindication, regimens
89.	Anti Amoebics-II	Lecture	
90.	Antineoplastics Therapeutic classification. Alkylating agents Antimetabolites, Vinca alkaloids, antibiotics and hormones. Chemotherapeutic agents used in dentistry	Lecture	Classification, antimetabolites, methotrexate (MoA, PK, Therapeutic uses, adverse effect resistance, Purine antagonism, 6-mecptopurine, thioguaninePyrimidine, antagonist, 5Flurouracil, Cyclophosphamide, nitrosoreas, platinum analogs, vinca alkaloids, taxanes, and related drugs.Epipodophyllotoxins, (Etoposide, teniposide, anthracyclines, monoclonal antibodies, hormones, antihormones).

91.	Antidiabetic drugs: Introduction Classification,	Lecture	Overview of DM/Sign symptoms, Types of DM, Insulin Structure/releaseClassification/ Pharmacokinetics, MOA, Method of administration, clinical condition when Insulin to be uses, DKA Pathophysiology & Rx overview, A/Es of Insulin, How to manage Hypoglycemia, Oral Ant diabetic Drugs Classification, Pharmacokinetics & Most uses A/Es of Sulfonylureas/Biguinides/Thiazide diuretics Meglitinide / Nateglimide
92.	Antidiabetic drugs:, Insulins, Oral antidiabetic agents	Lecture	
93.	Antithyroid drugs-I	Lecture	Thyroid, MoA of thyroxine, S/S of hyperthyrodism, hypthyrodism, Pharmacokinetics of thyroxine, Levo, liothyroxine, liotrx, therapeutic uses. Classification, thioamides, anion inhibitor, iodides, radioactive, iodine iodates, contrast media, beta blockers, management of thyroid storm.
94.	Antithyroid drugs-II	Lecture	
95.	Corticosteroids-I	Lecture	Synthesis, release, feedback , mechanism, HPA, classification, P/K, Pharmacodynamics, adverse effects, dose.
	Corticosteroids-II	Lecture	
96.	Hormonal contraceptives.	Lecture	Types and doses and classification, mechanism of action, pharmacological actions, adverse effects, benefits, contraindications.
97.	Haematinics	Lecture	How to diagnose & different b/w Microcytic & Macrocytic anemia, Iron absorption Physiology, Iron Storage, transport, elimination, Factor affecting absorption, Therapeutic Indications, A/Es, Preparation & Content of Iron, VB12 Folic acid absorption / distribution / transports / Storage, Essential biochemical reactions Req VB12 & Folic acid, Consequence of VB12 & Folic acid, Erythropoietin, Different Preparations, Indication of use
98.	Anticoagulants. Introduction, Classification. Heparin.	Lecture	Physiology of coagulation (coagulation cascaded), pathology of thrombosis, (Predisposing conditions), structure of clot, structure of thrombus, classification, parenteral agent (heparin, low molecular weight heparins, heparinoids, direct acting agents, fondaparinux, oral agent (warfarin) direct acting agent.
99.	Oral Anticoagulants.	Lecture	

100.	Thrombolytic, Antiplatelet drugs	Lecture	Classification, mechanism of action, dose, therapeutic uses, adverse effects.
101.	Anti emetics.	Lecture	Gastrointestinal motility/enteric nervous system, Nausea & vomiting/summary of events, Emetic -----/CTZ/receptors involved Input/out of emetic, Classification of antiemetic drugs, metoclopramide/domperidone, Ondanstrone/5-HT receptors antagonists Cannabinoid receptor antagonist/dronabinol, NK/ receptor antagonist /Aprepitant, Misc agents/corticosteroids/antiemetics
102.	Antidiarrhoeals.	Lecture	Definition/clinical cause/types of diarrhea, Pathophysiology/complication of diarrhea, Management of mild/moderate/severe diarrhea, ORS and role of antibiotics/ I/V rehydration, Antidiarrheal classification, Diphenoxylate PK/PD, uses, Operamide PK/PD,uses, Bismuth subsalicylate/methylcellulose/ ispaghula husk, Kaolin & pectin/attapulgate, Octreotide PK/PD & uses/MoA
103.	Purgatives/laxatives.	Lecture	Definition of constipation, Causes of constipation, Classification of purgatives, Bulk purgatives/MoA, Stimulant purgatives/MoA, Osmotic laxatives/MoA, Stool softness, 5-HT4 agonists/MoA
104.	Drugs used in Peptic Ulcer – I.	Lecture	Antacids, H2 receptor antagonist, proton pump inhibitors, Mucosal protective sucralfateetc
105.	Drugs used in Peptic Ulcer – II.	Lecture	
106.	Expectorants & Antitussives.	Lecture	Cough, pathophysiology, classification, therapeutic uses, opioids, derivatives, pholcodine, dextromethorphan, levopropoxyphene, antihistamines, peripheral antitussives, bronchodilatation, mucokinetics, expectorants.
107.	Antiasthmatics– I.	Lecture	Definition/epidemiology/etiology of asthma, Atopy/allergy and pathophysiology of asthma, Symptoms/diagnosis /types of asthma, Asthma severity classification, Classification of Antiasthmatics drugs, Approach to treatment of asthma, Asthma
108.	Antiasthmatics – II.	Lecture	

			control assessment, Bronchodilators/sympathomimetic drugs, Methylxanthines, Anticholinergic drugs, Leukotriene receptor antagonists, Mast cell stabilizer & corticosteroid, Management of severe acute asthma
109.	Antihistamines	Lecture	Classification, Pharmacokinetics, Pharmacodynamics, Diff b/w 1 st and 2 nd generation, uses, adverse effects.
110.	Antiseptics and Disinfectants used in dentistry	Lecture	Classification with explanation of drugs and their clinical relevance
111.	Drug – Drug interactions	Lecture	Pharmacokinetic level & Pharmacodynamic level interactions with examples
112.	Adverse Drug Reactions	Lecture	Examples/discussion of various types of reactions

Term Test-2

SCIENCE OF DENTAL MATERIALS

SCIENCE OF DENTAL MATERIALS

List of Topics

SECTION I GENERAL CLASSES AND PROPERTIES OF DENTAL MATERIALS

1. Classification and overview of different preventive and restorative materials
2. Structure of matter and principles of adhesion
3. Physical and chemical properties related to material sciences
4. Surface chemistry
5. Biocompatibility

SECTION II DIRECT RESTORATIVE MATERIALS

1. Dental amalgam
2. Dental cements
3. Restorative resin composite
4. Denting bonding agents and adhesive dentistry

SECTION III INDIRECT RESTORATIVE MATERIALS

1. Denture base acrylic resins
2. Denture relining and rebasing materials
3. Tissue conditioners
4. Dental ceramics
5. Metals used in dentistry
6. Soldering and welding
7. Dental implants

SECTION IV AUXILIARY DENTAL MATERIALS

1. Gypsum products
2. Impression materials
3. Dental waxes
4. Casting investments and casting procedures
5. Finishing and polishing materials
6. Separating media

SECTION V PREVENTIVE DENTAL MATERIALS

1. Dentifrices

2. Fluoride agents
3. Pit and fissure sealants

SECTION VI ENDODONTIC MATERIALS

CURRICULUM (NUMS)

INTRODUCTION

The subject of science of dental materials at undergraduate level enables the students to recognize the clinical, technical and scientific rationale for the use of materials in clinical dental practice. The course curriculum is designed to introduce dental materials science to students and facilitate their study of physical and chemical properties that are related to selection of these products by the dentist and to identify characteristics of materials that affect their biological safety. The practical component of the course involves hands-on experience of the materials and their manipulation in the laboratory.

SECTION I GENERAL CLASSES AND PROPERTIES OF DENTAL MATERIALS

This section introduces students to the general classification and brief overview of different types of preventive and restorative materials used in dentistry. It illustrates the terms and principles involved in describing the clinical behavior of these materials based on their physical, chemical and mechanical properties. It also highlights the knowledge of appreciation of certain biological considerations for use of dental materials in oral cavity and hazards associated with them.

Aims

The section aims to provide basic background knowledge regarding structure of matter and to provide a comprehensive account of relationship between general properties of dental materials and their clinical performance. Another aspect of importance is the potential of this information to predict clinical performance under biological limitations and to allow the students to develop a critical understanding of the factors that determine the safe and correct use of materials in dentistry.

1. Classification and overview of different preventive and restorative materials

Learning outcomes :

By the end of a unit, students will be able to:

- Understand basic classification of dental materials i.e. metals, ceramics, polymers and composites.

2. **Structure of matter and principles of adhesion**

Learning outcomes :

By the end of a unit, students will be able to:

- Describe the structure of matter and explain the principles of adhesion among dental materials

3. **Physical and chemical properties related to material sciences**

Learning outcomes :

By the end of a unit, students will be able to:

- Demonstrate knowledge of the fundamental biological, chemical and physical principles that make the foundation of the clinical behavior and application of dental materials.

4. **Surface chemistry**

Learning outcomes :

By the end of a unit, students will be able to:

- Understand the principles involving surface interaction of dental materials in biological environment.

5. **Biocompatibility**

Learning outcomes :

By the end of a unit, students will be able to:

- Demonstrate knowledge of the range of biological consideration regarding the selection and performance of dental materials for clinical applications.
- Understand the knowledge of safety, biocompatibility and biomechanics as they relate to the correct clinical use of dental materials.

SECTION II DIRECT RESTORATIVE MATERIALS

This section familiarizes students with a number of key themes and subjects regarding different types of direct restorative materials used in dentistry. It is designed to provide detailed information regarding historical background, types, properties, biological consideration, clinical applications, limitations and selection criteria of direct restorative materials.

Aims

The aim of this section is to allow students to develop scientific knowledge, understanding and competence in the area of direct restorative materials. Based on the information regarding their clinical behavior and selection criteria students will be able to grasp the scientific rationale for use of these materials for their clinical applications. To differentiate between the various types of direct restorative materials and their respective properties. To Understand the risks , hazards , technological advances and current trends in direct restorative materials.

1. Dental amalgam

Learning outcomes :

By the end of a unit, students will be able to:

- Describe the history, composition and classification of dental amalgams.
- Understand the setting mechanism of different types of dental amalgams.
- Understand and explain the properties of dental amalgams.
- Understand and demonstrate clinical manipulation and factors affecting the properties of dental amalgams.
- Understand the issues related to amalgam hygiene in clinical practice.
- Explain the biocompatibility issues relating to dental amalgams
- Identify recent advancements in dental amalgams

2. Dental cements

Learning outcomes :

By the end of a unit, students will be able to:

- Understand the objectives and basic terminologies related to dental cements.
- Understand the general requirements, types and properties of different dental cements.
- Understand and explain the setting mechanism of different dental cements.
- Understand and explain the properties, advantages and disadvantages of different dental cements.

- Understand and describe the clinical applications of different dental cements.
- Understand the concept of bases and liners for different clinical applications.
- Describe luting agents, types and their properties
- Understand the use of temporary restorative materials, properties and their uses.
- Demonstrate techniques for handling and manipulation of various dental cements.
- Define Atraumatic Restorative Technique (ART) and its uses

3. **Restorative resin composite**

Learning outcomes :

By the end of a unit, students will be able to:

- Describe the history and classification of restorative composites.
- Understand and describe the properties of different components of restorative composites.
- Understand the characteristics and clinical applications for composite restorative materials.
- Understand and explain different modifications in relation to restorative composites.
- Understand finishing and polishing procedures for restorative composites.
- Understand the biocompatibility issue related to restorative composites.
- Understand the recent advancements in restorative composites.
- Demonstrate clinical manipulation of restorative composites

4. **Denting bonding agents and adhesive dentistry**

Learning outcomes :

By the end of a unit, students will be able to:

- Understand the concept of bonding and adhesion in dentistry.
- Define enamel and dentine bonding.
- Understand the significance and rationale behind enamel and dentine bonding.
- Understand various types and generations of bonding agents.
- Understand the significance of biodegradation of restorative resins.
- Understand and explore recent advancements in dentin bonding agents.

SECTION III: INDIRECT RESTORATIVE MATERIALS

The section covers detailed information regarding the physical, chemical, and biological properties, manipulation and handling characteristics of indirect restorative materials used in dentistry. This includes detailed study of scientific and clinical properties of materials such as dental acrylic resins, dental ceramics and metals used in restorative dentistry.

Aims

The aim of this section is to allow students to develop scientific knowledge, understanding and competence in the area of direct restorative materials. Based on the information regarding their clinical behavior and selection criteria students will be able to grasp the scientific rationale for use of these materials for their clinical applications. Students will be able to learn the selection criteria, risks, hazards, technological advances and current trends regarding indirect restorative materials.

1. Denture base acrylic resins

Learning outcomes:

By the end of a unit, students will be able to:

- Understand the definition of denture base materials.
- Understand the ideal properties and types of denture base materials.
- Understand the chemical composition and properties of denture base materials.
- Understand the various procedures involved in the fabrication of denture base materials.
- Understand and discuss clinical application, manipulation, processing, and care of dentures for laboratory processed prosthetic resins.
- Understand and describe biocompatibility issues associated with denture base materials.
- Describe various methods of polymerization of denture base materials.

2. Denture relining and rebasing materials

Learning outcomes:

By the end of a unit, students will be able to:

- Understand relining and rebasing procedures for dentures.
- Describe various types of relining and rebasing dental materials.
- Describe manipulation and properties of relining and rebasing materials.

- Understand biocompatibility issues associated with relining and rebasing materials in dentistry.

3. Tissue conditioners

Learning outcomes:

By the end of a unit, students will be able to:

- Understand the definition tissue conditioners.
- Understand various types of tissue conditioners used in dentistry.
- Understand and discuss the properties of various tissue conditioners used in dentistry.
- Understand the steps of clinical manipulation of tissue conditioners.

4. Dental ceramics

Learning outcomes:

By the end of a unit, students will be able to:

- Understand the basic chemistry and composition of ceramics.
- Understand the composition and classification of different dental ceramics systems.
- Understand general procedures involved in fabrication of dental ceramics.
- Understand the concept of metal ceramic bonding.
- Understand metal ceramic restorations, their uses and properties.
- Understand all ceramic restoration, their uses and properties.
- Describe methods of strengthening ceramics.

5. Metals used in dentistry

Learning outcomes:

By the end of a unit, students will be able to:

- Understand the basic concepts related to processing and solidification of dental alloys.
- Understand different types of metals and alloys used in fabrication of dental prosthesis.
- Understand the alloy phase diagrams.
- Explain the types, processing and clinical applications of high noble and noble metal alloys.
- Explain the types, processing and clinical applications of base metal alloys.
- Explain the casting procedures for metal alloys.
- Explain the types, processing and clinical applications of wrought metal alloys.
- Explain the types, processing and clinical applications of stainless steel in dentistry.

- Understand the significance and clinical applications for titanium and its alloys in dentistry.
- Describe the properties and composition of various orthodontic wires.

6. **Soldering and welding**

Learning outcomes:

By the end of a unit, students will be able to:

- Understand the objectives and uses of soldering and welding in dentistry.
- Understand the differences between soldering, brazing and welding.
- Describe the components of dental solders and welding.
- Understand different heat sources for soldering and welding.
- Understand welding and its types.

7. **Dental implants**

Learning outcomes:

By the end of a unit, students will be able to:

- Describe the history of implants in dentistry.
- Define osseointegration and its factors affecting it.
- Explain different types of implants used in dentistry.
- Understand materials used for dental implants.

SECTION IV AUXILIARY DENTAL MATERIALS

The section provides information regarding variety of auxiliary dental materials used in dentistry. Auxiliary dental materials include a range of materials that are involved in the fabrication of different dental prosthesis but that do not become part of the prosthesis.

Aims

The section aims to develop knowledge regarding basic features of auxiliary dental materials used in clinical and laboratory procedures. It involves the study of composition, properties, manipulation of auxiliary dental materials and the manner in which they interact with the environment in which they are applied.

1. **Gypsum products**

Learning outcomes:

By the end of a unit, students will be able to:

- Understand the properties, types, uses, and manipulation of gypsum products.
- Understand the method of manufacturing and properties of gypsum products used in dentistry.
- Understand the setting reactions of different types of dental gypsum products.
- Understand the manipulation factors that affect the setting time and physical and mechanical properties of gypsum products.
- Understand and demonstrate the methods used for the disinfection of dental gypsum models and study casts.
- Understand and demonstrate the proper mixing technique of dental gypsum used for preparing study models and casts.

2. Impression materials

Learning outcomes:

By the end of a unit, students will be able to:

- Understand the significance of impression and impression materials in dentistry.
- Understand the general requirements for an ideal impression material
- Understand the classification, characteristics and properties of elastic and non-elastic impression materials.
- Compare the properties and clinical application of different types of impression materials.
- Understand and demonstrate proper technique for mixing, handling and manipulation of the elastic and non-elastic impression materials.

3. Dental waxes

Learning outcomes:

By the end of a unit, students will be able to:

- Understand the classification and types of waxes used in dentistry.
- Discuss the composition, properties and application of different types of dental waxes.
- Understand and demonstrate manipulation of different types of dental waxes.

4. Casting investments and casting procedures

Learning outcomes:

By the end of a unit, students will be able to:

- Define and explain investment materials used in dentistry.
- Understand different types of investment materials used in dentistry.
- Understand the composition, setting reaction and properties of gypsum bonded investment.
- Understand the composition, setting reaction and properties of phosphate bonded investment.
- Understand the composition, setting reaction and properties of silica bonded investment.
- Understand and compare properties and clinical applications of different types of investments.
- Understand the steps and methods involved in casting procedures.

5. Finishing and polishing materials

Learning outcomes:

By the end of a unit, students will be able to:

- Understand the objectives for finishing and polishing of dental restorations and prosthesis.
- Understand the classification, composition, properties of abrasives and clinical applications for finishing and polishing materials.
- Understand the principles of finishing and polishing of dental materials.
- Understand different types of cutting and abrasive instruments.
- Describe biological hazards associated with dental abrasive and polishing materials.

6. Separating media

Learning outcomes:

By the end of a unit, students will be able to:

- Understand the rationale behind the use of separating media in dentistry
- Describe and identify various types of separating media used in dentistry, including their composition, mechanism of action and properties.
- Understand and demonstrate the steps involved in manipulation of separating media.
- Understand the techniques for application of a separating media.

SECTION V PREVENTIVE DENTAL MATERIALS

The section deals with the introduction and knowledge of various preventive materials used in dentistry. It describes different types of preventive dental materials associated with mechanical tooth cleaning, plaque control, fluorides, and fissure sealants.

Aims

The section aims to introduce students to basic preventive dental materials used in clinical dentistry. It involves the study of composition, properties, manipulation of preventive dental materials and the criteria for proper selection for their clinical application.

1. Dentifrices

Learning outcomes:

By the end of a unit, students will be able to:

- Understand the types, composition and purpose of dentifrices and mouthwashes.

2. Fluoride agents

Learning outcomes:

By the end of a unit, students will be able to:

- Understand and identify different types of fluoride agents, their mode of action and application.

3. Pit and fissure sealants

Learning outcomes:

By the end of a unit, students will be able to:

- Understand the composition, properties, manipulation and clinical application of pit and fissure sealants.

SECTION VI ENDODONTIC MATERIALS

The section focuses on the material used in endodontics that are used to irrigate and disinfect, obturate and seal the root canal system during endodontic treatment.

Aims

The section introduces students to different types of endodontic materials classified according to their intended clinical uses. It involves the study of composition, properties and mode of application of various disinfectants, lubricants, sealants and obturating materials used in endodontics.

SECTION VII LABORATORY PRACTICALS

The practical component covers the manipulative and applied aspects of dental material science.

Aims

The laboratory practical component serves to familiarize students with the range of materials used in dentistry. It involves hands on experience with the materials so that students can understand issues related to dispensing, handling, manipulation and practical application of dental materials.

1. Introduction to laboratory equipment

Learning Objectives:

- To identify and familiarize with instruments and equipment required for handling and manipulation of different dental materials in laboratory

2. Gypsum products

Learning Objectives:

- To identify different types of gypsum products
- To demonstrate the correct dispensing ratio of different gypsum products
- To demonstrate the correct mixing technique for gypsum products
- To make plaster slab

3. Impression materials

Learning Objectives:

- To identify different types of impression materials.
- To demonstrate the correct dispensing, manipulation and application of:
 - i. Alginate
 - ii. ZnO-eugenol paste
 - iii. Impression compound
 - iv. Elastomeric impression materials

4. Dental waxes

Learning Objectives:

- To identify different types of dental waxes.
- To demonstrate the manipulation and application of different:
 - i. Pattern waxes
 - ii. Processing waxes
 - iii. Impression waxes

5. Acrylic resins

Learning Objectives:

- To demonstrate the correct dispensing, manipulation and application of self-cure and heat-cure dental acrylic resin.

6. Dental amalgam

Learning Objectives:

- To demonstrate the correct dispensing, trituration and application of dental amalgam.
- To demonstrate hand mixing and mechanical mixing of dental amalgam.

7. Dental cements

Learning Objectives:

- To identify different types of dental cements.
- To demonstrate the correct dispensing, mixing and application of:
 - i. Zinc phosphate cement
 - ii. Zinc oxide eugenol cement
 - iii. Glass ionomer cement
 - iv. Calcium hydroxide cement

8. Restorative composite resins

Learning Objectives:

- To identify and familiarize with the armamentarium used for composite restorations i.e.
 - i. Visible light cure unit
 - ii. Acid etching gel
 - iii. Bonding agent
 - iv. Restorative composite

9. Metals and alloys

Learning Objectives:

- To identify different indirect metallic restorations
- To identify different orthodontic wire used in dentistry

10. Dental ceramics

Learning Objectives:

- To identify different ceramic restorations

11. Investment materials

Learning Objectives:

- To identify different types of investment materials

12. Endodontic materials

Learning Objectives:

- To identify different endodontic materials used in dentistry

13. Finishing and polishing materials

Learning Objectives:

- To identify different abrasives used in finishing and polishing procedures.

ORATORY PRACTICAL QUOTA

- Plaster slab
- Wax pattern
- Wire work
 - 10 Alphabets
 - Adams clasp

Course Book

- McCabe, John F., and Angus WG Walls, eds. **Applied dental materials**. John Wiley & Sons, 2013.

REFERENCE BOOKS

- Anusavice, Kenneth J., Chiayi Shen, and H. Ralph Rawls. **Phillips' science of dental materials**. Elsevier Health Sciences, 2013. 12th Edition.
- Powers, John M., and Ronald L. Sakaguchi. **Craig's restorative dental materials**, 13/e. Elsevier India, 2006.

PART 1

PRECLINICAL

PROSTHODONTICS

Pre -clinical Prosthodontics

Course Outline

Duration of Syllabus: To be taught in 2nd Year BDS

Course will be divided into Lecture and Practical. One lecture per week followed by 2 practical session in divided batches.

Section A

Complete Dentures

Unit 1: Introduction to Prosthodontics

Introduction of prosthodontics will guide the students of the basic concept of this field. Different branches of prosthodontics. The need for replacement of lost oral structures of the stomatognathic system and how it affects the overall quality of life of an individual.

Learning objectives:

At the end of the lecture, students will be able to:

- Understand and know the definition of prosthodontics
- Differentiate different branches of prosthodontics and their application in everyday life
- Describe implications of not addressing tooth loss at an appropriate time
- Understand effect of prosthetic replacement on the quality of life of an individual.

Unit 2: Complete Dentures

2.1 Anatomical landmarks of maxillary arch

Learning objectives:

At the end of the lecture, students will be able to:

- Identify and name anatomical landmarks of maxillary arch.
- Identify limiting structures
- Differentiate between primary stress bearing area and secondary stress bearing area

2.2 Anatomical landmarks of mandibular arch

Learning objectives:

At the end of the lecture, students will be able to:

- Name the anatomical landmarks of mandibular arch
- Identify limiting or peripheral structures of the mandibular arch
- Locate and identify the primary stress bearing area and secondary stress bearing area

2.3 Impression trays

Learning objectives:

At the end of the lecture, students will be able to:

- Identify the maxillary and mandibular impression trays
- Describe the difference between dentate and edentulous impression trays
- Describe the choice of selection of appropriate size of impression tray
- Describe the difference between a stock tray and custom tray

- Explain the procedure of fabrication of custom tray
- Name different materials used in the fabrication of custom tray

2.4 Dental casts

Learning objectives:

At the end of the lecture, students will be able to:

- Define a dental cast
- Name the types of casts
- Requirements of cast making
- Parts of a cast

2.5 Record bases

Learning objectives

At the end of the lecture, students will be able to:

- Define record bases
- Describe the requirements of record bases
- Describe the types of record bases and their uses

2.6 Occlusion rims

Learning objectives:

At the end of the lecture, students will be able to:

- Define what are occlusion rims
- Describe briefly the uses of occlusion rims
- Describe the dimension of occlusion rims for both the maxillary and mandibular base plates
- Describe briefly the steps in fabrication of occlusion rims
- Describe maxilla-mandibular relations in brief.

2.7 Articulators

Learning objectives:

At the end of the lecture, students will be able to:

- Define an articulator
- Identify between different types of articulators
- Describe briefly the concept behind the use of an articulator
- Define facebow and uses of a facebow.

2.8 Artificial teeth

Learning objectives:

At the end of the lecture, students will be able to:

- Describe the different types of artificial teeth based on type of material and occlusal morphology
- Describe the differences in occlusal morphology and their uses in different situations

- Describe the differences between acrylic and porcelain teeth and their uses

2.9 Occlusion in complete dentures

Learning outcomes:

At the end of the lectures, students will be able to:

- Define dental occlusion
- Describe the difference between occlusion and articulation
- Describe the objectives of establishing occlusion
- Differentiate between natural and artificial occlusion
- Name different types of complete denture occlusal schemes
- Briefly describe the factors affecting occlusion

2.10 Arrangement of teeth – Maxilla

Learning outcomes:

Students will be taught setup of maxillary anterior and posterior teeth for balanced occlusion. They will also be required to perform lab exercise of tooth setup.

2.11 Arrangement of teeth – Mandible

Learning outcomes:

Students will be taught setup of mandibular teeth to achieve balanced occlusion. However, they will be required to complete the setup of teeth on articulated casts for lab exercises.

2.12 Laboratory procedures

Learning outcomes:

This lecture is intended to apprise the students of the laboratory procedures for final curing and finishing of the complete dentures. They will be performing this exercise on their lab exercise dentures. At the end of the lecture, students will be expected to:

- Perform flasking and dewaxing.
- Perform acrylic packing and complete the curing process.
- Divest the mould and complete the finishing and polishing process

2.13 Spot grinding

Learning outcomes:

This lecture aims to guide the students of the importance of spot grinding and achieve balanced occlusion on articulators, as this eventually reduces the chair side time. However, they will be required to perform this exercise on their finished dentures before submitting their exercises.

They will be able to:

- Understand the concept behind spot grinding and occlusal equilibration
- Able to perform spot grinding using BULL's law.

Section B

Removable Partial Denture

Unit 3: Removable Partial Denture

3.1 Introduction to Partial Dentures, Classification of partially edentulous arches

- Definition

- Kennedy's classification
- Applegate's rules

3.2 Components of partial denture – Cast and acrylic

- Saddles
- Major Connectors
- Retainers
- Minor connectors
- Rests

3.3 Direct retainer

- Definition
- Types of clasp – Cast and wrought
- Parts of a clasp
- Fabrication of C clasp (wrought wire)

3.4 Surveying

Learning objectives:

- Students will be required to know the concept of surveying
- They will be taught about undercuts, maximum bulge, supra bulge
- Path of insertion and removal

3.5 Laboratory procedures

- Flasking and curing of partial dentures
- Finishing and polishing procedures

Laboratory Exercises

Introduction to instruments used in prosthodontics

- Wax knife
- Wax carver / lacron carver
- Adam's plier
- Round plier
- Straight plier
- Flask
- Mixing spatula
- Rubber bowl
- Plane line articulator
- Hanau articulator
- Vulcanite Bur
- Finishing
- burs

Complete Denture Exercise

1. Identification of Landmarks on edentulous model
 - a. Anatomical landmarks Maxilla
 - b. Anatomical landmarks mandible

2. Custom tray fabrication – Maxilla & Mandible
 - a. Introduction to acrylic powder and liquid
 - b. Mixing of acrylic
 - c. Manipulation of acrylic at the appropriate stage
 - d. Application of spacer
 - e. Custom tray fabrication
 - f. Sprinkle method of custom tray fabrication

3. Indexing of dental casts
 - a. Groove indexing
 - b. Notch indexing

4. Wax up for base plate – Maxilla & Mandible
 - a. Cast marking
 - b. Wax up thickness
 - c. Peripheral wax thickness
 - d. Finishing of the wax up
 - e. Sealing of the wax pattern

5. Flasking procedure and de-waxing of upper and lower base plates
 - a. Preparation of flask
 - b. Plaster mixing
 - c. Flasking procedure
 - d. De-waxing procedure

6. Packing, curing and finishing of base plate
 - a. Acrylic packing
 - b. Curing procedure
 - c. Retrieval of base plate after curing process
 - d. Finishing and polishing

7. Occlusal rims
 - a. Maxillary Occlusal rims
 - i. Height
 - ii. Width

- iii. Finishing
 - b. Mandibular occlusal rims
 - i. Height
 - ii. Width
 - iii. Finishing of rims
- 8. Articulation of base plates with occlusal rims
 - a. Articulator adjustment
 - b. Sealing of upper and lower occlusal rims
 - c. Articulation procedure
- 9. Tooth setup

Learning objectives:

 - a. Selection of teeth
 - b. Setup of anterior teeth Maxilla
 - c. Setup of anterior teeth Mandible
 - d. Setup of posterior teeth Maxilla
 - e. Setup of posterior teeth Mandible
- 10. Wax up, carving and festooning of dentures
- 11. Flasking procedure of complete denture
 - a. Flasking procedure
 - i. Students will be apprised about the two pour and three pour technique
 - b. De-waxing procedure
 - c. Acrylic packing
 - i. Trial packing and final packing
 - d. Denture retrieval
- 12. Finishing and polishing of denture
- 13. Occlusal adjustment on articulator

Partial Denture

- 1. Wax up of partially edentulous models for acrylic partial denture
 - Students will be required to prepare saddle areas on the dentate models according to the Kennedy's classification assigned by the instructor
 - They will be taught about the difference between complete denture wax up and partial denture wax up
- 2. Articulation of the partially edentulous models
- 3. Tooth setup
- 4. Clasp fabrication
 - Students will be required to make C- clasp (wrought wire) using the Adam's plier, round plier and flat plier and wire cutter

5. Finishing of the wax pattern
6. Laboratory procedure
 - Sealing of the final wax pattern of the partial denture on the cast
 - Flasking
 - Packing of acrylic
 - Curing of acrylic
7. Finishing and polishing of retrieved acrylic partial denture
8. Wax up for Cast partial denture – demonstration only
 - Students will be told about the different types of waxes
 - They will be given a demonstration of wax up for cast partial dentures

PART 2
“COURSE OUTLINE”
PRE-CLINICAL OPERATIVE
2nd YEAR BDS

Pre-Operative Dentistry

- The primary goals of Operative Dentistry include the diagnosis and prevention of disease, the preservation of the natural dentition and the restoration of health, function and esthetics of stomatognathic system.
- This is one year course made up of Didactic and Laboratory technique as Introduction to Operative Dentistry.
- Didactic session will cover important topics of operative dentistry in different lectures
- Lab sessions will be conducted separately to improve their psychomotor skills

SECTION (A) “Didactic Sessions”

SECTION A

Chapter 1: Introduction to Operative Dentistry

Introduction to Operative Dentistry, emphasizes the biologic basis of operative dentistry and presents current statistics that demonstrate the continuing need and demand for it

- FACTORS AFFECTING OPERATIVE TREATMENT
- THE FUTURE DEMAND FOR OPERATIVE DENTISTRY,

Learning Outcomes

By the end of the unit, students will be able to:

- Understand the basic need to study biologic basis of operative dentistry and importance of development of their psychomotor skills

Chapter 2: Introduction to Armamentarium

- HAND INSTRUMENTS FOR CUTTING
- POWERED CUTTING EQUIPMENT
- ROTARY CUTTING INSTRUMENTS
- CUTTING MECHANISMS
- HANDLING OF INSTRUMENTS
- HAZARDS WITH CUTTING INSTRUMENTS and their Prevention

Learning Outcomes

By the end of the unit, Students will be able to:

- Understand the basic equipments used in Operative dentistry clinical procedures
- Understand their clinical uses
- How to avoid hazardous effects of these equipments

Chapter 3: Rubber dam and its Application

- Introduction to isolation methods
- Indications of isolation methods
- Advantages of isolation during operative work
- Rubber dam components and their uses
- Rubber dam Application methods

Learning Outcomes

By the end of the unit, students will be able to:

- Understand the methods of isolation during clinical procedures and their prime importance in the safest use of dental materials and equipment during Operative procedures

Chapter 4: Dental Cariology

- Introduction
- Etiology
- Classification
- Clinical characteristics of the lesion
- Histopathology of caries
- Diagnosis and prevention
- Management of Dental caries

Learning Outcomes

By the end of the unit, Students will be able to:

- Diagnose the most infectious disease of teeth, Dental Caries
- Understand the different methods of Caries prevention and Management

Chapter 5: Principles of Cavity Preparation

- Definition of tooth preparation
- Need for restorations
- classification of tooth preparation
- Objectives of tooth preparation
- Stages and steps of tooth preparation
- Factors affecting tooth preparation

Tooth preparation terminologies

1. Simple, compound, and complex tooth preparations
2. Abbreviated descriptions of tooth preparations
3. Tooth preparation wall
4. Tooth preparation angles
5. Dentino-enamel junction
6. Cemento-enamel junction

7. Enamel margin strength

Learning Outcomes

By the end of the unit, students will be able to:

- Understand the method of cavity preparation according to the extension of lesion
- Understand the requirement of different armamentariums for specific cavity designs
- Understand the principles of long term maintenance of restorations in the oral cavity

Chapter 6: Introduction to Restorative Materials

(Amalgam, Composites, Glass Ionomer, Pit and Fissure Sealants)

- Terminology and classification
- Composition, structure, and properties
- Clinical considerations
- Indications and contraindications
- Advantages and Disadvantages

Learning Outcomes

By the end of the unit, students will be able to:

- Understand the use of different restorative material according to different clinical situation and according to patient aesthetic and functional demands.

Chapter 7: Class I Cavity Preparation for Amalgam Restorations

A.) Conservative Class I amalgam restorations

1. Initial clinical procedures,
2. Tooth preparation
3. Restorative technique

B.) Extensive Class I amalgam restorations,

1. Initial clinical procedures
2. Tooth preparation
3. Restorative technique

C.) Class I occlusolingual amalgam restorations

1. Initial clinical procedures
2. Tooth preparation
3. Restorative technique

Learning Outcomes

By the end of the unit, students will be able to:

- Understand the accurate method of Class I Cavity Preparation for Amalgam
- Understand, how to utilize the principles during cavity preparation

- Understand the manipulation of Amalgam in class I cavity

Chapter 8: Class II CAVITY PREPARATION FOR AMALGAM

- Initial clinical procedures,
- Tooth preparation for Class II amalgam restorations involving only one proximal surface
- Placing a sealer or adhesive system
- Placing a matrix,
- Inserting and carving the amalgam
- Finishing and polishing the amalgam

Learning Outcomes

By the end of the unit, students will be able to:

- Understand the preparation method for Class II cavity preparation for Amalgam Restoration
- Understand the choice of Matrix System for Class II cavity.
- Understand the handling of Amalgam in class II Cavity restoration

Chapter 9: Matrix and Retainer Systems

- Introduction
- Classification
- Different designs of matrix system
- Indications
- Advantages

Learning Outcomes

By the end of the unit, students will be able to:

- Understand the use of different matrix systems according to different clinical situations
- Understand the utilization of advantages of their uses in the buildup of missing walls and regaining the contours of walls properly

Chapter 10: Linings and Bases

- Introduction
- Classification
- Composition, structure and properties
- Indications
- Advantages

Learning Outcomes

By the end of the unit, student will be able to:

- Understand the importance of their clinical use in the restorations of different cavities.

- Understand the method of application of these pulpal protecting agents in deep carious and non-carious cavities

Chapter 11: Class III Cavity Preparation for Composite

- Conventional class III tooth preparation
- Beveled conventional class III tooth preparation
- Modified class III tooth preparation
- Restorative technique
- Etching
- Bonding agent application
- matrix application
- placement and curing of Composite
- finishing and polishing of restoration

Learning Outcomes

By the end of the unit, students will be able to:

- Understand the accurate method of cavity preparation in the aesthetic zones of oral cavity
- Understand the manipulation of tooth colored restoration (composite)
- Understand the importance of polishing of aesthetic restorations

Chapter12: Class IV Cavity Preparation for Composite

- Conventional class IV tooth preparation
- Beveled conventional class IV tooth preparation
- Modified class IV tooth preparation
- Restorative technique
 1. etching, priming, placing adhesive
 2. matrix application
 3. placement and curing of Composite
 4. finishing and polishing of restoration

Learning Outcomes

By the end of the unit, students will be able to:

- Understand the accurate method of cavity preparation in the aesthetic zones of oral cavity
- Understand the manipulation of tooth colored restoration (composite)
- Understand the importance of polishing of aesthetic restoration

Chapter 13: Class V Cavity Preparation

- Conventional class V tooth preparation
- Beveled conventional class V tooth preparation
- Modified class V tooth preparation
- Restorative technique
- Sandwich technique

Learning Outcomes

By the end of the unit, student will be able to:

- Understand the accurate method of class V cavity preparations
- Understand the manipulation of tooth colored restoration, (composite)
- Understand the use of sand-which technique for deep class cavities

Chapter 14: Anterior and Posterior crowns

- Indications
- Contraindications
- Types
- Advantages

Learning Outcomes

By the end of the unit, students will be able to:

- understand the use these crowns in different clinical requirements
- understand the importance of these crowns in maintaining the heavily restored teeth
-

REFERENCE BOOK:

Art and Science of Operative Dentistry

SECTION (B) “Lab Sessions”

SECTION B

TOPICS FOR LAB SESSIONS

Hands on Lab sessions in junior operative Lab; where students will be oriented to different armamentarium used in operative dentistry, followed by hands on procedures on phantom heads and typhodonts.

Sessions will compromise of hands on demonstration by the instructor followed by performance of procedure by students individually on phantom heads under supervision.

1. Introduction to armamentarium used in operative dentistry.

- Identification of instruments
- Classifications
- Uses
- Method to use
- Hands on performance

2. Rubber Dam application

- Introduction to rubber dam kit
- Identification
- Hands on performance to place rubber dam
- Placement of rubber dam in posterior arch/anterior arch/ cross arch and single tooth isolation
- Placement of rubber dam with surgical knots

3. Pits and fissure sealant.

- Hands on performance of pits and fissure sealants.
- Methods of isolation in pediatric patients.
- Application of pits and fissure sealants in posterior teeth both maxillary and mandible arches.

4. Class I Cavity preparation for Amalgam restoration.

- Hands on performance of Class I cavity preparation
- Methods of determining different cavity dimensions
- Methods of isolation in pediatric/adult patients.
- Mixing of different cavity lining materials
- Application of lining materials on teeth.
- Amalgam mixing by pastel and mortar.
- Amalgam mixing by Amalgamator.
- Condensation of amalgam.
- Burnishing of amalgam
- Techniques of Carving of amalgam.
- Finishing and polishing of amalgam.

5. Class II Cavity preparation for Amalgam restoration.

- Hands on performance of Class II cavity preparation

- Methods of determining different cavity dimensions
- Methods of isolation in pediatric/adult patients.
- Methods of placement of different matrix systems
- Ivory matrix / Tofelmier / Palodent matrix
- Wedge placement
- Mixing of different cavity lining materials
- Application of lining materials on teeth.
- Amalgam mixing by pastel and mortar.
- Amalgam mixing by Amalgamator.
- Condensation of amalgam.
- Burnishing of amalgam.
- Techniques of Carving amalgam.
- Finishing and polishing of amalgam.

6. Class III Cavity preparation for Amalgam restoration

- Hands on performance of Class III cavity preparation
- Methods of determining different cavity dimensions
- Methods of isolation in pediatric/adult patients.
- Methods of placement of different matrix systems
- Ivory matrix / Tofelmier / Palodent matrix
- Mixing of different cavity lining materials
- Application of lining materials on teeth.
- Amalgam mixing by pastel and mortar.
- Amalgam mixing by Amalgamator.
- Condensation of amalgam.
- Techniques of Carving Amalgam.
- Finishing and polishing of amalgam

7. Class III Cavity preparation for Composite restoration

- Hands on performance of Class III cavity preparation
- Methods of determining different cavity dimensions
- Methods of isolation in pediatric/adult patients.
- Methods of placement of different matrix systems
- Placement of composite matrix
- Mixing of different cavity lining materials
- Application of lining materials on teeth.
- Techniques of placement of composite material.

- Use of bonding agent and composite led light
- Composite finishing and polishing

8. Class IV Cavity preparation for amalgam restoration

- Hands on performance of Class IV cavity preparation
- Methods of determining different cavity dimensions
- Methods of isolation in pediatric/adult patients.
- Methods of placement of different matrix systems
- Ivory matrix / Tofelmier / Palodent matrix
- Wedge placement
- Mixing of different cavity lining materials
- Application of lining materials on teeth.
- Amalgam mixing by pastel and mortar.
- Amalgam mixing by Amalgamator.
- Condensation of amalgam.
- Techniques of Carving Amalgam.
- Finishing and polishing of amalgam

9. Class IV Cavity preparation for Composite restoration

- Hands on performance of Class IV cavity preparation
- Methods of determining different cavity dimensions
- Methods of isolation in pediatric/adult patients.
- Methods of placement of different matrix systems
- Placement of composite matrix
- Mixing of different cavity lining materials
- Application of lining materials on teeth.
- Techniques of placement of composite material.
- Use of bonding agent and composite led light
- Composite finishing and polishing

10. Class V Cavity preparation for amalgam and Composite restorations

- Hands on performance of Class V cavity preparation
- Methods of determining different cavity dimensions
- Methods of isolation in pediatric/adult patients.
- Mixing of different cavity lining materials
- Application of lining materials on teeth.
- Amalgam mixing by pastel and mortar.

- Amalgam mixing by Amalgamator.
- Condensation of amalgam.
- Techniques of Carving Amalgam.
- Techniques of burnishing of Amalgam
- Finishing and polishing of Amalgam

11. Splinting

- Introduction to splinting
- Wire selection for splinting
- Arch analysis anterior
- Intra-coronal splinting
- Extra-coronal splinting
- Application of composite buttons

REFERENCE BOOK

Art and Science of Operative Dentistry

Table of Specifications

Professional/Pre-Annual/Annual/Supply

2nd Year BDS Examination

Second Professional BDS Examination (2020)
Community and Preventive Dentistry

Table of Specifications for Annual 2nd Professional Examination: Theory

Time Allowed =03 hrs. (Including MCQs)

Marks of theory paper =90

Internal assessment =10

Total marks =100

Pass Marks =50

45 x MCQs (45 Marks) Time =50 min

Q. No. 1,2,3,4,5,6,7,8,9

8 x SAQs/SEQs (Recall) = 05 marks each

1 x SAQs/SEQs (Application) = 05marks each

Total Marks = 45 Marks Time = 2 hours & 10 min

S.No	Topic	NUMBER OF MCQs (45) Recall: 35 Application: 10 1 mark each	NUMBER OF SAQs/SEQs (09) 05 marks each
1.	a. Introduction to public health and dental public health b. Etiology, Epidemiology and Public health aspect of Oral diseases and disorders	04	01
2	Etiology, Epidemiology and Public health aspect of Oral diseases and disorders	10	01
3	Health care delivery system	05	01
4	Fluorides and preventive dentistry	07	02
5	Oral health prevention and promotion	07	02
6	Behavioral sciences	05	01
7	Research methodology	07	01
Total		45 (45 Marks)	09 (45 Marks)

A. Internal Assessment Calculation (Theory Annual)

A	B	C	D
Roll No.	Name	All Modules/ Pre annual Exams or any other exam	Total Marks of internal Assessment out of 10
Total Marks		Sum of Marks obtained x 10 / sum of total marks in all exams	

B. Table of specifications for Annual Professional Exam: Practical

VIVA 50 marks		Practical (OSPE + Clinical Task) 40 marks			Total
Examiner 1	Examiner 2	OSPE	Clinical Task	Practical Notebook	
25 Marks	25 Marks	25 Marks	10 Marks	05 Marks	90 Marks

C. Internal Assessment Calculation (Practical)

A	B	C	D
Roll No.	Name	OSPE/ PTT/ Class tests though out the year/ Pre annual Exams or any other exam	Total Marks of internal assessment Out of 10
Total Marks		Sum of Marks obtained x 10 / sum of total marks in all exams	

GENERAL PATHOLOGY & MICROBIOLOGY (2020)

TABLE OF SPECIFICATIONS FOR BDS SECOND YEAR ANNUAL PROFESSIONAL EXAM: THEORY

Time Allowed	= 03 hrs	<i>(Including MCQs)</i>
Marks of theory paper	= 90	
Internal assessments	= 10	
Total marks	= 100	
Pass Marks	= 50	
45 x MCQs	45 Marks	Time = 1 hour
Q. No. 1,2,3,4,5,6,7,8,9		
3 x SAQs/SEQs (Application):	05 Marks each	(15 Marks)
6 x SAQs/SEQs (Recall):	05 Marks each	(30 Marks)
Total Marks=	45 Marks	Time= 2 hrs

S.No	TOPIC	No. MCQs (45) Recall: 20 Application: 45 1 mark each	Number of SEQs/SEQs (09) 05 mark each
1.	General Microbiology	05	01
2.	Special Microbiology	05	02
3.	Mycology , Virology & Parasitology	09	01
4.	Immunology & Genetics	05	01
5.	Cell Injury & adaption to cell injury	04	01
6.	Inflammation healing and repair	05	01
7.	Hemodynamics	06	01
8.	Neoplasia & environmental diseases/ Tobacco & alcohol abuse	06	01
Total		45 (45 Marks)	09 (45 Marks)

Table of Specification for Practical & Viva Voce
Pre Annual , Annual and Supplementary Examination
Max Marks =100 Pass Marks = 50

Roll No		Gen Viva voce		Practical				Total	Int	Grand Total
		50 marks		40 marks				Viva+Prac	Assess	
College	University	Ext.	Int.	Journal	Gen Path	Spotting	Staining	90	10	100
		25	25	05	15	15	05			

A. Internal Assessment Calculation (Theory)

A	B	C	D
Roll No.	Name	All Modules/ Pre annual Exams or any other exam	Total Marks of internal Assessment out of 10
Total Marks		Sum of Marks obtained x 10 / sum of total marks in all exams	

B. Internal Assessment Calculation (Practical)

A	B	C	D
Roll No.	Name	OSPE/ PTT/ Class tests though out the year/ Pre annual Exams or any other exam	Total Marks of internal assessment Out of 10
Total Marks		Sum of Marks obtained x 10 / sum of total marks in all exams	

Second Professional BDS Examination (2020)
Pharmacology & Therapeutics

Table of Specifications for Annual 2nd Professional Examination: Theory

Time Allowed =03 hrs. (Including MCQs)

Marks of theory paper =90

Internal assessment =10

Total marks =100

Pass Marks =50

45 x MCQs (45 Marks) Time = 50 min

Q. No. 1,2,3,4,5,6,7,8,9

4 x SAQs/SEQs (Recall) = 05 marks each

5 x SAQs/SEQs (Application) = 05marks each

Total Marks = 45 Marks Time = 20 hours & 10 min

S.No	Topic	NUMBER OF MCQs (45) Recall : 27 Application : 18 1 mark each	NUMBER OF SAQs/SEQs (09) 05 marks each
1.	Gen Pharmacology	05	01
2.	ANS	05	01
3.	CNS	05	01
4.	Local Anesthetics	04	01
5.	Chemo	05	01
6.	Opioids/NSAIDs	04	01
7.	CVS/ Diuretics/Blood	05	01
8.	Respiratory/GIT	06	01
9.	Endocrinology	06	01
Total		45 (45 Marks)	09 (45 Marks)

Internal Assessment Calculation (Theory Annual)

A	B	C	D
Roll No.	Name	All Modules/ Pre annual Exams or any other exam	Total Marks of internal Assessment out of 10
Total Marks		Sum of Marks obtained x 10 / sum of total marks in all exams	

Table of Specifications for Annual Professional Exam: Practical

VIVA 50 marks		Practical (OSPE + Practical Note Book) 40 marks		Total
Examiner 1	Examiner 2	OSPE	Practical Notebook	
25 Marks	25 Marks	35Marks	05 Marks	90 Marks

Internal Assessment Calculation (Practical)

A	B	C	D
Roll No.	Name	OSPE/ PTT/ Class tests though out the year/ Pre annual Exams or any other exam	Total Marks of internal assessment Out of 10
Total Marks		Sum of Marks obtained x 10 / sum of total marks in all exams	

Second Professional BDS Examination (2020)
Science of Dental Materials

Table of Specifications for Annual 2nd Professional Examination: Theory

Time Allowed =03 hrs. (Including MCQs)

Marks of theory paper =90

Internal assessment =10

Total marks =100

Pass Marks =50

45 x MCQs (45 Marks) Time =50 min

Q. No. 1,2,3,4,5,6,7,8,9

6 x SAQs/SEQs (Recall) = 05 marks each

3 x SAQs/SEQs (Application) = 05marks each

Total Marks = 45 Marks Time = 2 hours & 10 min

S.No	Topic	Total MCQs = 45 Recall = 30 Application = 15 01 mark each	Total SAQs/SEQs = 09 Recall = 06 Application = 03 05 mark each
1.	<ul style="list-style-type: none"> ➤ Properties Used to Characterize Materials ➤ Requirements of Direct Filling Materials and Historical Perspectives 	06	01
2.	<ul style="list-style-type: none"> ➤ Gypsum Products for Dental Casts ➤ Waxes ➤ Investments and Refractory Dies 	04	01
3.	<ul style="list-style-type: none"> ➤ Metals <ul style="list-style-type: none"> • Metals and Alloys • Gold and Alloys of Noble Metals • Base Metal Casting Alloys • Steel and Wrought Alloys • Implants 	06	01
4.	<ul style="list-style-type: none"> ➤ Ceramics and Porcelain Fused to Metals (PFM) ➤ Castings 	06	01
5.	<ul style="list-style-type: none"> ➤ Prosthetic Polymers <ul style="list-style-type: none"> • Synthetic Polymers • Denture Base Polymers • Denture Lining Materials • Artificial Teeth • Auxiliary Materials : Separating Media 	03	01
6.	<ul style="list-style-type: none"> ➤ Impression Materials <ul style="list-style-type: none"> • Impression Materials : Classification and Requirements 	06	01

	<ul style="list-style-type: none"> • Non Elastic Impression Materials • Elastic Impression Materials : Hydrocolloids • Elastic Impression Materials : Synthetic Elastomers 		
7.	<ul style="list-style-type: none"> ➤ Cements <ul style="list-style-type: none"> • Glass Ionomer Restorative Materials (Polyalkenoates) • Cements Based on Phosphoric Acids • Cements Based on Organometallic Chelates Compounds • Polycarboxylates • Requirements of Dental Cements for Lining , Base and Luting Applications 	05	01
8.	<ul style="list-style-type: none"> ➤ Resin-Based Materials <ul style="list-style-type: none"> • Resin-Based Filling Materials • Bonding of Resin-Based Materials • Resin-Modified and Related Materials 	05	01
9.	<ul style="list-style-type: none"> ➤ Dental Amalgam 	02	01
10.	<ul style="list-style-type: none"> ➤ Miscellaneous Topics <ul style="list-style-type: none"> • Endodontic Materials • Preventive Materials : Dentifrices and Pit and Fissure Sealants 	02	---
Total		45 (45 Marks)	09 (45 Marks)

Internal Assessment Calculation (Theory Annual)

A	B	C	D
Roll No.	Name	All Modules/ Pre annual Exams or any other exam	Total Marks of internal Assessment out of 10
Total Marks		Sum of Marks obtained x 10 / sum of total marks in all exams	

Table of specifications for Annual Professional Exam: Practical

VIVA 50 marks		Practical (OSPE + Wire Work + Plaster slab) 40 marks			Total
Examiner 1	Examiner 2	OSPE	Wire Work	Plaster Slab	90 Marks
25 Marks	25 Marks	30 Marks	05 Marks	05 Marks	

Internal Assessment Calculation (Practical)

A	B	C	D
Roll No.	Name	OSPE/ PTT/ Class tests though out the year/ Pre annual Exams or any other exam	Total Marks of internal assessment Out of 10
Total Marks		Sum of Marks obtained x 10 / sum of total marks in all exams	

Second Professional BDS Examination (2020)
Preclinical Prosthodontics and Operative Dentistry

Table of Specifications for Annual 2nd Professional Examination: Theory

Time Allowed	=03 hrs. (<i>Including MCQs</i>)	
Marks of theory paper	=90	
Internal assessment	=10	
Total marks	=100	
Pass Marks	=50	
45 x MCQs (45 Marks)		Time =50 hour
Q. No. 1,2,3,4,5,6,7,8,9		
6 x SAQs/SEQs (Recall)	= 05 marks each	
3 x SAQs/SEQs (Application)	= 05 marks each	
Total Marks	= 45 Marks	Time = 2 hours & 10 min

Part A – Preclinical Prosthodontics				
01	MCQ	22 (01 mark each)	22 Marks	47 Marks
02	SEQ / SAQ	5 x SAQs	25 Marks	
Part B – Preclinical Operative Dentistry				
01	MCQ	MCQ 23	(01 mark each)	43 Marks
02	SEQ / SAQ	4 x SAQ	20	
Total			90 Marks	
Internal Assessment of both subjects			10 Marks	
Grand Total			100 Marks	

Preclinical Prosthodontics

S. No	Topic	NUMBER OF MCQs (22) Recall: 17 Application: 05 1 mark each	NUMBER OF SAQs/SEQs (05) 05 marks each
1.	Introduction to Prosthodontics	-	01
2.	Anatomical landmarks of Maxilla and Mandible	02	
3.	Dental Casts and Record bases	02	
4.	Impressions and impression trays	02	01
5.	Occlusal Rims, Jaw relations and Articulators	02	
6.	Occlusion, Occlusion in complete dentures	02	01
7.	Artificial teeth	02	
8.	Selection and Arrangement of teeth	02	
9.	Laboratory procedures	02	
10.	Spot grinding	02	-
11.	Classification of partially edentulous arches	02	02
12.	Components of Partial Denture	02	
13.	Surveying		
Total		22 (22 Marks)	05 (25 Marks)
Grand Total		47 marks	

Preclinical Operative Dentistry

S. No	Topic	NUMBER OF MCQs (23) Recall: 18 Application: 05 1 mark each	NUMBER OF SAQs/SEQs (04) 05 marks each
1.	Armamentarium of operative dentistry	04	-
2.	Dental Cariology	04	01
3.	Cavity preparation Class I – Class V	05	01
4.	Liners and bases	04	01
5.	Matrix and retainer system	03	
6.	Restorative materials	03	01
Total		23 (23 Marks)	04 (20 Marks)
Grand Total		43 Marks	

Internal Assessment in each subject i.e Preclinical prosthodontics and Preclinical operative dentistry

Internal Assessment Calculation (Theory Annual) <ul style="list-style-type: none"> • Class Tests and sendup exam
Internal Assessment (Practical) <ul style="list-style-type: none"> • Quota work assigned