Notification

The Syllabus of Post Graduate Courses in Para Medical Science has been approved by the Academic Council of the university in its 16\textsuperscript{th} meeting held on 09.11.2019 is hereby notified.

This is subject to grant of permission to start/run the said Course by the State Government.

By order of the Vice-Chancellor
Sd/-
Registrar (I/c)
Aryabhatta Knowledge University, Patna

Memo no. : 012/Acad/01-08/AKU/2019-4826 Date:13.12.2019

Copy to:
(i)PA to the Vice-Chancellor, (ii) Pro Vice-Chancellor's Office, (iii) Registrar's Office, (iv) Controller of Examinations, AKU, Patna with copy of Syllabus AKU, Patna for information and (v) Shri Vishal Ratan Kumar with copy of Syllabus for uploading the information on University website.

Registrar (I/c)
Aryabhatta Knowledge University, Patna
SYLLABUS

Master of Medical Laboratory Technology Course

FIRST YEAR

Paper - I - General Pathology & Haematology.
Paper - II - Bio-chemistry
Paper - III - Microbiology
Paper - IV - Project Paper

SECOND YEAR

Paper - I - Immunology & Clinical Pathology
Paper - II - Histopathology & Cytology
Paper - III - Recent Advancement in Pathology & Lab Management.
Paper - IV - Project Paper
Master of Medical Laboratory Technology Course

FIRST YEAR

GENERAL PATHOLOGY

Paper - I

1. Cellular Injury :-
   (a) Necrosis
   (b) Ischemic and Hypoxic Injury
   (c) Apoptosis
   (d) Hyperplasia
   (e) Hypertrophy
   (f) Atrophy
   (g) Metaplasia
   (h) Gangrene

2. Inflammation and Repair :-
   (a) Acute Inflammation
   (b) Chronic Inflammation
   (c) Wound Healing

3. Neoplasia :
   (a) Definition of Neoplasm
   (b) Classification of Tumour
   (c) Nomenclature - Benign Tumour & Malignant Tumour
   (d) Grading and Staging of Tumours
   (e) Spread of Tumour

4. Embolism :- Type & Effects

5. Thrombosis Edema, Hyperemia

6. Derangement of Fluids :- Pathogenesis, Different Type & Clinical manifestation

7. Amyloidosis :- Chemical & Physical Nature, Special Stain & Pigment
1. Erythropoiesis: - Development of RBC. Control of Erythropoiesis, Biosynthesis of Hb.


5. Bone Marrow Examination.

6. Hemorrhagic Disorders: - Definition, Clinical features, Classification, Vascular Disorders, Platelets Disorders, Coagulation Disorders, Fibrinolysis. Test of Vascular and Platelet functions - Bleeding time, Clot reaction Platelet count.


8. Thrombotic Disorders: - Classification, Pathogenesis & Investigations.

9. Lympho Proliferative Disorders: - General Features, Classification and Investigation.


11. Haemoparasites.


13. Leukemia Disorders: - Leukemia, Classification, Lab Diagnosis.
FIRST YEAR

Master of Medical Lab Technology

Paper - II  BIO-CHEMISTRY

I) Amino Acids & Proteins, Enzymes - Cardiac Markers (LDH, SGOT, SGPT, Alkaline Phosphatase).

II) Electrolytes, Sodium, Potassium, Calcium, Chloride, Bicarbonate & Phosphorus.

III) Lipids & Lipoproteins, Vitamins (Fat Soluble & Water Soluble and their Deficiency disorders, Hemoglobin & Myoglobin.

IV) Renal Function, Liver Functions, Pancreatic (Exocrine and Endocrine) Functions, Gastro-Intestinal Functions.

V) Diseases of New Born and their Complications.

VI) Laboratory Safety: - Toxic, Chemical and Bio-Hazards. Quality Control.


VIII) Bloodsugar, Urea, Uric acid, Creatinine, Cholestoral, Triglyceride, High Density Lipoproteins, Low Density Lipoprotein.

IX) Liver Function test: - Serum Bilirubin, Total Protein, AG Ratio, Electrophoretic Separation of Protein.
FIRST YEAR

Master of Medical Lab Technology

Paper - III  MICROBIOLOGY

1) Study of Systemic Bacteriology: Haemophilus, Pseudomonas, Mycobacterium, Brucella, Clostridia, Rickettsia, Chlamydia, Neisseria.

2) Principles and Procedures of Serologic test: Widal, CRP, Agglutination test and ASO Titre Estimation, VDRL.


4) Serological Test of Viral Infections.

5) Collection and Processing of clinical specimens for Fungi.

6) Hepes viruses, Enteroviruses, Human Immunodeficiency viruses.
SECOND YEAR
Master Degree in Medical Lab Technology

Paper - I  IMMUNOLOGY & CLINICAL PATHOLOGY

1. Immune Deficiency Disorders.

2. **Immuno, Hematologic Disorders:** Transfusion Reactions, Hemolytic Diseases, Agranulocytosis, Thrombocytopenic purpura.

3. **Connective Tissue Diseases:** SLE, Dermato Myosis, Rheumatic Fever, Rheumatoid Arthritis.

4. **Atopic anaphylactic Reactions:** Food Allergy, insect Allergy, Viral Infections, Atopic Eczema, Delayed hyper sensitivity reactions.

5. **Allergic Diseases:** Encephalomyelitis, Multiple Sclerosis, Oœchitis, Thyroiditis.

6. Immunology of AIDS, Tumor Markers, Tumor.

7. Immunity against Viral, Bacterial and Parasitic Infections.

8. Granulomatous reactions - T.B., Leprosy


**CLINICAL PATHOLOGY**

1) Urine Examination - Physical, Chemical & Microscopic.

2) Renal Function Tests.

3) Sputum Examination - Physical, Microscopic & Chemical Examinations.

4) Gastric Analysis.

5) CSF - Indications, Examination of CSF

6) Body Fluids - Microscopical Exam.

Pleural, Pericardial, Ascitic, Peritoneal Fluids.
SECON D YEAR
HISTO PATHOLOGY & CYTOLOGY

Paper - II

(i) Tissue Processing of Histological Tissues, Dehydration, Cleaving, Wax Preparation.


(iii) Identification & demonstration of Different Metabolic Compounds, Mounting and Mounting Media.

(iv) Ph, Buffer, Acid Base Equilibrium.

(v) Labeling of Histology Specimens, Fixations and Various Fixatives & their Preparation.

CYTOLOGY :-

(a) Fine Needle Aspiration Technique & Staining.

(b) Cytology - Criteria of Malignancy.

(c) Cytology in Cervical, Endometrial & Ovarian Cancer.

(d) Tumor Marker (Malignant)

(e) Cytology of C.S.F.


[Signatures]
SECOND YEAR

RECENT ADVANCEMENT IN PATH & LAB MANAGEMENT.

Paper - III

1. Molecular Analysis of Chromosomal aberrations in leukemia and lymphomas; Molecular diagnosis of genetic diseases.

2. Histo Pathology:
   (a) Fixation of Tissues, classification of Fixation.
   (b) Section Cutting- Microtome & Knives, Techniques of Section Cutting,
   (c) Tissue Processing, Collection, Step of Fixation.


4. Hormones: - Thyroid Hormones, Growth Hormones, Insulin.

5. Handling and Quality Control of Lab: - Sterilization and Autoclave Tech, Disinfection Techniques and Waste Disposal.

6. Molecular Analysis of Chromosomal Alteration in leukemia and Lymphomas; Diagnosis of Molecules.

7. Care of Lab, Glassware, Equipments, Chemicals.

8. Laboratory Safety Programmes.

9. Care of Laboratory Glassware Equipments, Instruments & Chemicals.

10. First aid in Laboratory.

11. Planning for Hospital Lab Services.

12. Laboratory Hazards.
MASTER OF OPERATION THEATRE TECHNOLOGY

SUBJECTS OF FIRST ACADEMIC YEAR:
1. PAPER 1 - Surgical and anaesthetic equipments
2. PAPER 2 - Operation theatre management
3. PAPER 3 - General surgery
4. PROJECT WORK

SUBJECTS OF SECOND ACADEMIC YEAR:
1. PAPER 1 - Clinical anaesthesia
2. PAPER 2 - Clinical surgery
3. PAPER 3 - Critical care and ICU
4. PROJECT WORK
MASTER OF OPERATION THEATRE TECHNOLOGY

SYLLABUS AND COURSE DESCRIPTION

SUBJECT: Surgical and anaesthetic equipments- PAPER 3 (FIRST YEAR)

Care, maintenance, sterilization and use of various equipments in surgery and anaesthesia:

- Micro surgical and titanium instruments
- Power surgical equipments
- General and specialized surgical instruments
- Endoscopes- laparoscopes, gastroscopies, duodenoscopes, sigmoidoscopes, colonoscopes, cystoscopes, hysteroscopes, colposcopes, arthoscopes
- Robotic equipments
- Laser and electric cautery
- Breathing circuits and ECG channels
- Boils apparatus, suction pump, nebulizer
- Laryngoscope
- Oropharyngeal airway
- Endotracheal tube and LMA
- Face mask and ambu bag
- Tracheostomy tube
- Gas cylinders and pipeline gas system
- Pulse oximeter, cardiac monitor, ventilator, defibrillator
- Cardio pulmonary bypass machine, cardiac pacemaker
- Vascular equipments
- Syringe pumps
- Infant warmer
- Newborn resuscitation set
- Fetal monitor
- Splint sets
• Source of infection in OT, infection process, portal of entry and exit, mode of transmission
• Neonatal infection
• Hospital infection control programme
• Infection control policy in theatre area
• Use of antiseptic agents in OT
• OT sterilization, fumigation of OT
• OT light
• Ventilation and electric supply in OT
• Designing zone, types and layout of operation theatres
• Safety measures in Operation theatre
• Septic theatre, prevention and management of infected surgical patients
• Modular operation theatre.
MASTER OF OPERATION THEATRE TECHNOLOGY

SUBJECT- GENERAL SURGERY-PAPER 3. (FIRST YEAR)

- Preoperative, OPERATIVE, POST OPERATIVE CARE OF SURGICAL PATIENTS
- Wounds and ulcer
- Abscess, carbuncles, tetanus and gas gangrene
- Lipoma, sebaceous cyst, dermoid cyst and warts
- Breast abscess and breast neoplasm
- Electrolytes and nutrition
- Shock, hemorrhage and blood transfusion
- Burns
- Trauma- TRIAGE, bullet injury, blast injury
- Hand and foot infection
- Amputation
- Transplants-renal, liver and bone marrow
- Bites and stings
MASTER OF OPERATION THEATRE TECHNOLOGY

SUBJECT: Clinical anaesthesia - PAPER 1 (SECOND YEAR)

- Review of anatomy and physiology of respiratory system
- Pre anaesthetic assessment of patients
- Diagnostic preparation of patient before surgery
- Types and technique of anaesthesia
- Drugs used in anaesthesia
- Drugs used in resuscitation
- Anaesthesia in emergency surgery
- Anaesthesia in camps and field
- Anaesthesia in radiology and endoscopy
- Anaesthesia in obese and medical disease
- Labour analgesia
- Balance anaesthesia
- Difficult intubation
- Induced hypotension
- Care of patient during anaesthesia
- Respiratory failure
- Oxygen therapy

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MASTER OF OPERATION THEATRE TECHNOLOGY

SUBJECT- CLINICAL SURGERY - PAPER 2(SECOND YEAR)

- Review of anatomy and physiology of different systems of body
- GI SURGERY- vagotomy and pyloroplasty, gastrectomy, Whipple's operation, pancreatectomy, drainage of pancreatic cyst, cholecystectomy and laparoscopic cholecystectomy, resection of small bowel, colectomy, hemi and total colectomy, closure of colostomy, rectopexy, laparotomy, liver transplant, herniotomy, splenectomy, special and laparoscopic instruments used in GI SURGERY
- Obstetric surgery- normal labour, abnormal labour, third stage complication like PPH, inversion of uterus and retained placenta, rupture of uterus, cord prolapse, LSCS, hysterectomy, ectopic pregnancy, MTP and D and E.
- Orthopedic surgery- fractures, open reduction and internal fixation of different types of fractures, arthroscopy, external fixation, traction, slabs and casts, amputation, joint replacement, operations on spine like laminectomy, instruments used in orthopedic surgery.
- Urological surgery- cystectomy, cystotomy, pyelolithotomy, pyeloplasty, ureterolithotomy, nephrolithotomy, PCNL, illeal conduit, operations on vesical fistula, renal transplant, proctectomy
- Neurosurgery- review of nervous system, types of neurosurgery, craniotomy, ventriculoperitoneal shunt, cerebral abscess, equipments used in brain surgery, classification and management of nerve injury, carpal tunnel syndrome
- Cardio-thoracic surgery- cardiac surgery OT setup, preoperative assessment, valve replacement surgery, cardio pulmonary bypass surgery, pace maker and cardiac catheterization, thoracotomy, thoracoplasty, intercostals drainage, lobectomy, pericardiocentesis
- Plastic surgery
MASTER OF OPERATION THEATRE TECHNOLOGY

SUBJECT- CRITICAL CARE AND ICU- PAPER 3 (SECOND YEAR)

- CPR, BLS and ACLS, post resuscitation life support, resuscitation of newborn
- ICU- definition, duties and responsibilities, design of ICU, types of ICU, infection control in ICU, equipments in ICU, nutrition in ICU
- Airway management- definition, indication, roots of insertion, types of tubes, airway assessment and procedures
- Pain management-definition, types, signs and symptoms, pathophysiology of pain and management of pain
- Casualty management of patient- shock, dehydration, burns, and accidents
- Fluid and blood transfusion
- Management of head injuries and other neurological emergencies
- Management of unconscious patients
- Management in intensive cardiac care
- Intensive care of newborn and neonates
- Management of respiratory failure and heart failure, ARDS
- Management of metabolic acidosis and alkalosis
- Management of electrolyte imbalance
- Management of organophosphorus poisoning and corrosive poisoning
- Management of acute kidney and liver failure
- Management of electrical injuries
Reference books for master of operation theatre technology

1. Textbook for operation theatre- PARMILA BHALLA
2. Textbook on operation theatre nursing- 1 CLEMENT
3. Short textbook of anaesthesia- AJAY YADAV
4. Operation theatre technique and management- DR G N SHARMA, DR A L AGRAWAL
5. Operation room technique- BRIGDEN
6. Operation room technique- BERRY AND KOHN'S
7. The operating room aids- CAREER PUBLISHERS
8. Operating theatre nursing- MC WARREN
9. Perioperative nursing- LINDA SHIELDS, HELEN WERDER

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MASTER OF OPTOMETRY & OPHTHALMIC TECHNOLOGY (MOOT)
Year 1st

Paper: - 1

A> Ocular diseases.

Paper: - 11

A> Optics and refraction.

Paper: - 111

A> Ophthalmic Instruments and Investigations.

Project: - 1
Year 11nd

Paper:-1
A> Contact lenses, I.O.L implant and refractive surgeries.

Paper:-II
A> Advance ocular diseases.

Paper:-III
A> Community Ophthalmology.

Project:-2
DETAILED SYLLABUS

INSTRUCTIONAL METHOD: Personal contact programmes, Lectures (virtual and in-person), Assignments, Labs and Discussions, Learning Projects, Industrial Training Programmes and Dissertation.

Year: 1

Paper: 1  **OCULAR DISEASES**

(A) OCULAR ANATOMY & PHYSIOLOGY

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      General Anatomy of the Eye and Orbit  
      General Shape of the Eye  
      Layers of the Eye  
      General Concepts of the Structures within the Eye  
      Embryology of Eye  
      Specific Embryological Stages of Eye  
      Embryology of Specific Ocular Structures  
      Growth and Development of Eye  
      Anatomy of the Outer Coat of the Eye: Introduction  
      Anatomy of the Outer Coat of the Eye: Conjunctiva  
      Coat of Eye  
      Anatomy of Cornea  
      Anatomy of Sclera  |
| 2    | Anatomy of the Middle Coat of the Eye: Introduction  
      Anatomy of Uveal Tract  
      Anatomy of Iris  
      Anatomy of Ciliary Body  
      Anatomy of Choroid  |
<p>| 3    | Anatomy of Anterior and Posterior Chambers  |
| 4    | Anatomy of Lens: Introduction  |</p>
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| 1    | Disease of Lid:  
      | Disease of Lid |
| 2    | Disease of Conjunctiva:  
      | Inflammation, Trauma, Degeneration, Tumors |
| 3    | Disease of Lacrimal apparatus:  
      | Congenital, Inflammation of lacrimal sac, Tumors of lacrimal sac |
| 4    | Diseases of Cornea  
      | Keratitis and Corneal ulcer, Corneal degeneration, Keratocomeus |
| 5    | Sclera  
      | Inflammation, Scleritis, Episcleritis |

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

A. The Eye Book: Eyes and Eye Problems Explained by Ian Grierson


### C. EYE DISEASE – II

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      | Etiopathogenesis  
      | Clinical features  
      | Routine investigation  
      | Types of uveitis  
      | Vascular and circulating disturbances  
      | Degeneration, Congenital abnormalities |
| 2.   |Lens:  
      | Etiopathogenesis of cataract, Symptoms of cataract, Age related or senile cataract,  
      | Cataract associated with ocular disease, cataract associated with systemic disease, cataract due to other causes  
      | Development of cataract  
      | Management of cataract  
      | Complication of cataract surgery, secondary cataract |
3. Retina:
   Examination of Fundus
   Vascular-retinopathies
   Inflammation of retina
   Degeneration of retina, Detachment of retina

LEARNING SOURCE: Self Learning Materials

ADDITIONAL READINGS:
A. The Eye Book: Eyes and Eye Problems Explained By Ian Grierson
B. Textbook of Ophthalmology by H V Nema

<table>
<thead>
<tr>
<th>Unit</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Electro-Physiology of the Eye: Introduction</td>
<td></td>
</tr>
<tr>
<td>Electro-retinogram</td>
<td></td>
</tr>
<tr>
<td>Visual Evolved Response</td>
<td></td>
</tr>
<tr>
<td>Electro-oculogram</td>
<td></td>
</tr>
</tbody>
</table>


ADDITIONAL READINGS:
A. Ocular Anatomy and Physiology -- By Al Lens, Count Comt. Sheila Coyne Nemeth, Janice K. Ledford-Shock Incorporated
B. Ophth Assistant Vol-V (Community Ophth) -- Dr. L.P. Agarwal

Paper-II (OPTICS AND REFRACTION)

(A) NATURE OF LIGHT

<table>
<thead>
<tr>
<th>Unit</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Current concept of Light:</td>
<td></td>
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<tr>
<td>Origin of light</td>
<td></td>
</tr>
<tr>
<td>Travel of light</td>
<td></td>
</tr>
<tr>
<td>Arrival of light</td>
<td></td>
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<tr>
<td>Visible Light:</td>
<td></td>
</tr>
<tr>
<td>Visible-light origin</td>
<td></td>
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<tr>
<td>Visible light sensing</td>
<td></td>
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<tr>
<td>Visible light receptor and ocular media</td>
<td></td>
</tr>
<tr>
<td>Light sensitivity</td>
<td></td>
</tr>
</tbody>
</table>

109
**Visible light receptor and ocular media**

- Light sensitivity
- The receptor as light guide, Transparancy or Diopteric Media

**Physical Optics:**
- Intracocular scattering
- Diffraction effects
- Polarization Phenomenon
- Eye, Colors
- The Doppler shift

**Light damage to Eye:**
- Ultraviolet light, Biochemical mechanism of light damage, Clinical example of ocular light damage, Light protectors

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**LEARNING SOURCE:** Self-Learning Materials

**ADDITIONAL READINGS:**

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**(B) OPTICS OF NORMAL EYE**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Contents</th>
</tr>
</thead>
</table>
| 1    | Individual optical elements of eye:  
|      | Normal eye  
|      | Abnormal eye  
|      | Danded eye  
|      | Reduced eye |
| 2    | Visual Acuity Testing  
|      | For Distance-  
|      | Snellen’s test  
|      | Keeler Elliot test  
|      | Kay Picture test  
|      | Ffooks Symbols  
|      | For Near-  
|      | Jaeger test  
|      | Reduced Snellen’s test  
|      | Visual acuity testing in children |
**LEARNING SOURCE**: Self-Learning Materials

**ADDITIONAL READINGS**:
A. *Optics of the Human Eyes* By David A. Atchison, David A. Atchison
   George Smith – BH

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**TABLE: SPECTACLES & LENSES**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Lens Material</td>
</tr>
<tr>
<td>2.</td>
<td>Types of Spectacle Lenses:</td>
</tr>
<tr>
<td></td>
<td>Spherical lens</td>
</tr>
<tr>
<td></td>
<td>Cylindrical lens</td>
</tr>
<tr>
<td></td>
<td>Concave lens</td>
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<tr>
<td></td>
<td>Convex lens</td>
</tr>
<tr>
<td></td>
<td>Plano-concave lenses</td>
</tr>
<tr>
<td></td>
<td>Plano-convex lenses</td>
</tr>
<tr>
<td></td>
<td>Miscellaneous</td>
</tr>
<tr>
<td>3.</td>
<td>Fresnel Lenses &amp; Prisms</td>
</tr>
<tr>
<td>4.</td>
<td>Prism Correction</td>
</tr>
<tr>
<td>5.</td>
<td>Absorptive Lenses</td>
</tr>
<tr>
<td>6.</td>
<td>Safety Lenses</td>
</tr>
<tr>
<td>7.</td>
<td>Frames</td>
</tr>
<tr>
<td>8.</td>
<td>Dissatisfied Patients</td>
</tr>
<tr>
<td>Unit</td>
<td>Contents</td>
</tr>
<tr>
<td>------</td>
<td>----------</td>
</tr>
</tbody>
</table>
| 1.   | Corneal Measurement:  
Measuring the corneal surface, Measuring corneal thickness  
The specular microscope  
Retinoscope-Plane mirror, Persistent Streak, Streak  
Automated objective refractometer  
The lensometer |
| 2.   | Ophthalmoscope:  
Indirect Ophthalmoscope  
Direct Ophthalmoscope  
Pupils camera  
Magnify device |
| 3.   | Investigations:  
Gonioscopy, Tonometry, Ultrasound biomicroscopy  
Ancillary investigations  
Fluorescein Angiography  
Indocyanine Green Angiography  
Ultrasonography  
Computerized Axial Tomography-CAT  
Magnetic Resonance Imaging-MRI  
Electrophysiological Response  
Electrooculogram |

**LEARNING SOURCE:** Self-Learning Materials

**ADDITIONAL READINGS:**

A. Spectacle Lenses: Theory and Practice By Colin Fowler, Colin Fowler Keziah Batham Peire

B. Lenses, spectacles, eyeglasses and contacts: The story of vision aids - Alberta Kelley

**PAPER - III**

**OPHTHALMIC INSTRUMENT & INVESTIGATIONS**
Magnetic Resonance Imaging-MRI
Electrophysiological Response
Electrooculogram
Electroretinogram
Visual evoked potential
Binocular vision & stereo acuity
Electromyography
Electronystagmography

Colour Vision:
- Theory of colour vision
- Disorder of colour vision
- Testing of colour vision

Ophthalmic Instruments:
- Synoptophore
- Adaptation & Adaptonometry
- Ocular Photography
- Pachymetry

**LEARNING SOURCE:** Self-Learning Materials

**ADDITIONAL READINGS:**
A. Textbook of Ophthalmology by H V Nema
B. Moorfields manual of Ophthalmology By Timothy L. Jackson

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2nd Year (CONTACT LENSES, IOL - IMPLANT, AND REFRACTIVE SURGERY)

**Paper - I**

(A) CONTACT LENS-LVA AND VISUAL FUNCTIONS ASSESSMENT

<table>
<thead>
<tr>
<th>Unit</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Introduction, History, Lens types, Optics of contact lenses</td>
</tr>
<tr>
<td>2.</td>
<td>Eye examination procedure in contact lens</td>
</tr>
<tr>
<td>3.</td>
<td>Lens care</td>
</tr>
<tr>
<td>4.</td>
<td>Material used for contact lens</td>
</tr>
<tr>
<td>5.</td>
<td>Type of contact lens</td>
</tr>
<tr>
<td>6.</td>
<td>Fitting of contact lens</td>
</tr>
<tr>
<td>7.</td>
<td>Extended wear contact lens</td>
</tr>
<tr>
<td>8.</td>
<td>Bandage contact lens</td>
</tr>
<tr>
<td>9.</td>
<td>Visual acuity</td>
</tr>
<tr>
<td>10.</td>
<td>MARC maximum angle of resolution</td>
</tr>
<tr>
<td>11.</td>
<td>Field of vision – Confrontation test, Perimetry, Kinetic Perimetry,</td>
</tr>
</tbody>
</table>
**B. INTRAOCULAR IMPLANT & REFRACTORY SURGERIES**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Contents</th>
</tr>
</thead>
</table>
| 1    | Optics of Intraocular Implants: Introduction  
Optical effects of intraocular implants  
Calculating implant power  
Types of implants  
Material used for implants  
Implant decentering  
Implant tilt & Astigmatism  
Implants for Presbyopia, Bifocal IOL, Multifocal IOL, Foldable IOL |
| 2    | Optics of Corneal Refractive Surgery:  
Corneal radius and index  
Optical zone size  
Corneal refractive surgery procedures i.e. Radial Keratotomy PRK, LASIK, IV, LASEK,  
Optical results of refractive surgery  
Surgical correction of Astigmatism  
Corneal incision in Myopia and hypermetropia. Surgical correction for Presbyopia |

**LEARNING SOURCE**: Self-Learning Materials  
**ADDITIONAL READINGS**:  
A. Ocular Anatomy and Physiology - Al Lens, Comt Comt, Sheila Coyne Nemeth, Janice K. Lefford-Slack Incorporated
### Opthalmology & Plectroptics

<table>
<thead>
<tr>
<th>Unit</th>
<th>Contents</th>
</tr>
</thead>
</table>
| 1.   | Motor apparatus of eye:  
      | Anatomy of ocular muscles  
      | Actions of extra ocular muscles  
      | Nervous control of ocular movement |
| 2.   | Binocular Vision:  
      | Versions, Grading of binocular vision |
| 3.   | Fixation: Fixation |
| 4.   | Convergence & Accommodation |
|      | Esotropia  
      | Exotropia  
      | Comitant Strabismus  
      | Etiology of comitant strabismus  
      | Symptom of comitant strabismus  
      | Investigation  
      | General principal of management of strabismus  
      | Latent squint (strabismus) (Heterophoria)  
      | Maddox Rod  
      | Maddox Wiag  
      | Heterotropia or manifest strabismus  
      | A.V. Pattern |
| 5.   | Esotropia Treatment  
      | Comitant strabismus  
      | Paralytic Strabismus  
      | Aetiology Investigations-Diptopia, charting  
      | Types of ocular muscle paralysis  
      | restrictive strabismus, Synkinesis, Synaptophore |

**Learning Source:** Self Learning Materials  
**Additional Readings:**  
A. Clinical Opthalmics By Fiona J. Rowe-Wiley Blackwell
## (A) EYE DISEASE

<table>
<thead>
<tr>
<th>Unit</th>
<th>Contents</th>
</tr>
</thead>
</table>
| 1.   | Glaucoma: Introduction  
Primary adult glaucoma  
Intracocular-Prism changes in glaucoma  
Field changes in glaucoma  
Secondary glaucoma: optic nerve based drugs  
Secondary glaucoma  
Pediatric glaucoma  
Treatment of glaucoma |
| 2.   | Eye Injury:  
Chemical Injury  
Conceessional Injury  
Penetrating injury  
Sympathetic Ophthalmitis |
| 3.   | Disease of Optic Nerve:  
Papilledema, Disturbances of circulation, Optic neuritis, Optic atrophy |
| 4.   | Intraocular Tumors:  
Tumors of visual tract, Tumors of retina |

**LEARNING SOURCE:** Self-Learning Materials

**ADDITIONAL READINGS:**

A. The Eyebook: Eye and Eye Problems Explained by Ian Grierton

## (B) NEURO OPHTHALMOLOGY

<table>
<thead>
<tr>
<th>Unit</th>
<th>Contents</th>
</tr>
</thead>
</table>
| 1.   | Visual pathways (Normal):  
Neurological disorder, Hemicrania, Lesions of various level of visual pathway, Optic nerve, Optic tract, Optic Chiasma, Nuclear lesion, Cortical lesion |
| 2.   | Ocular motor system & Neurological disorder  
Extraocular muscle paralysis, Nystagmus |
| 3.   | Vascular Disorder  
Intracranial Aneurysms, AV fistula, Sub Arachnoid Haemorrhage, Ischemic Syndrome, Cerebral Haemorrhage & thrombosis |
<table>
<thead>
<tr>
<th>Unit</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>Diabetes &amp; Eye Diabetic Changes: Diabetes &amp; Eye Diabetic Changes</td>
</tr>
</tbody>
</table>

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

A. Handbook of Pediatric Eye and Systemic Disease by Kenneth Weston Wright - Springer

B. The eye and systemic disease by Frederic A. Mausolf. Illustrated Publisher Mosby, 1975.
# PAPER - III

**COMMUNITY OPHTHALMOLOGY**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Contents</th>
</tr>
</thead>
</table>
| 1.       | Blindness;  
          | Definition, Causes, Aetiology, Control of blindness. |
| 2.       | Eye Care types:  
          | Primary eye care, secondary eye care, Tertiary eye care |
| 3.       | Mobile eye services |
| 4.       | Specific cause of blindness and approach to prevention of Blindness; Cataract, Glaucoma, Diabetic retinopathy, Childhood blindness, Nutritional Blindness, Trachoma, Onchocerciasis, Macular disorder. |
| 6.       | Ocular anaesthesia:  

**LEARNING SOURCE:** Self Learning Materials

**ADDITIONAL READINGS:**

A. Community Ophthalmology – P.J. Graham
B. Textbook of Ophthalmology by H V Nema
Masters of Radio Imaging Technology

Course Curriculum -

First Year
Paper I - Radiation Physics
Paper II - Radiographic Technique and procedure
Paper III - Radiation safety and Dark Room
Project Work

Second Year
Paper I - Technique of CT scan and Mamography
Paper II - Technique of MRI and Ultrasonography
Paper III - Nuclear Medicine and Advance Radiology
Project Work
Course Curriculum

First Year

Paper 1  Radiation Physics

Radiological Physics

Introduction

1. X-rays: Discovery of x-rays, X-ray production and properties, Bremsstrahlung radiations, Characteristics of X-rays, factors affecting X-ray emission spectra, X-ray quality and quantity, HVL measurements, heel effect, soft and hard X-rays, added and inherent filtration, reflection and transmission, targets.


3. Interaction of X- and gamma rays: Transmission through matter, law of exponential attenuation, half value layer, and linear attenuation coefficient, coherent scattering, photoelectric disintegration, photoelectric interactions, Interactions of X rays and Gamma rays in the body, fat-soft tissue-bone contrast media-total attenuation coefficient-relative clinical importance.

4. Radiation intensity and exposure, photon flux and energy flux density.

5. X-ray tube: Historical aspects, construction of X-ray tubes, requirements for X-ray production (Electron source, target and anode material), tube voltage, current, speed charge, early X-ray tubes (Coolidge tubes, tube envelop and housing), cathode assembly, X-ray production efficiency, advances in X-ray tubes, anode angulation and rotating tubes-line focus principle, space charge effect, tube cooling, Modern X-ray tubes-stationary anode, rotating anode, grid controlled X-ray tubes, heel effect, off focus radiation, tube insert and housing tube rating-Quality and intensity of x-rays factors influencing them.

7. Heat dissipation on methods, tube rating, heat units, operating conditions and maintenance.


9. Physical quantity, its unit and measurement: Fundamental and derived quantity, SI unit, various physical/radiation quantity used in Diagnostic Radiology and its unit (for example, KVP, mA, mAs, Heat unit (HU)).


Conventional Radiological and Imaging Equipment

1. Production of x-rays: X-ray tube, gas filled x-ray tube, construction working and limitations; stationary anode x-ray tube; construction, working, O methods of cooling the anode, rating chart and cooling chart; rotating anode x-ray tube: construction, working rating chart, speed of anode rotation, angle of anode inclination, dual focus and practical consideration in choice of focus, anode heel effect, grid controlled x-ray tube; effect of variation of anode voltage and filament temperature; continuous and characteristics spectrum of x-rays, inherent filter and added filter, their effect on quality of the spectrum.

2. High tension circuits: H.T. generator for x-ray machines, three phase rectifier circuits, three phase six rectifier circuit, three phase 12 rectifier circuit, high and medium
frequency circuits; capacitance filter control and stabilising equipment; mains voltage compensator, mains/transformer and stabiliser, compensation for frequency variation, control of tube voltage.

3. **Meters and exposure timers:** Moving coil galvanometer: construction and working; conversion to milliammeter, ammeter and voltmeter, meters commonly used in diagnostic x-ray machines.

4. **Interlocking circuits:** Relays: description and working, use of relays in diagnostic machines for over load protection, circuit diagram; simplified circuit and block diagrams illustrating sequence of events from mains supply to controlled emission of x-rays.

5. **Control of scattered radiation:** Beam limiting devices: cones, diaphragms, light beam collimator, beam centring device, methods to verify beam centring and field alignment; grids; design and control of scattered radiation, grid ratio, grid cut-off, parallel grid, focused grid, crossed grid, gridless cassettes, stationary and moving grid potter bucky diaphragms, various types of grid movements; single stroke movement, oscillatory movement and reciprocating movement.

6. **Fluoroscopy:** Fluorescence and phosphorescence - description; fluorescent materials used in fluoroscopic screen, construction of fluoroscopic screen and related accessories, tilting table, dark adaptation. Image intensifier - Construction and working, advantages over fluoroscopic device; principles and methods of visualising intensified image, basic principles of closed circuit television camera and picture tube.
Radiographic Technique and Procedure

Anatomy Related to Radiology

1. Skeletal system:
   a. Upper limb: Technique for hand, fingers, thumb, wrist joint carpal bones, forearm, elbow joint, radio-ulnar joints and humerus supplementary techniques for the above, eg. carpal tunnel view, ulnar groove, head of the radius, supracocondylar projections.
   
   b. Lower limb: Technique for foot, toes, great toe; tarsal bones, calcaneum, ankle joint, lower leg, knee, patella & femur. Supplementary techniques: Stress view for torn ligaments. Subtalar joint and talo calcaneal joint, inter condylar projection of the knee joint tibiale; Length measurement technique.
   
   
   d. Vertebral column: Technique for atlanto-occipital joint, cervical spine, cervico-thoracic spine, thoracic spine, thoraco-lumbar spine, lumbo-sacral spine, sacrum and coccyx. Supplementary techniques to demonstrate: Scoliosis, Kyphosis, Spondylolisthesis, disc lesion, union of spinal girdle. Adaptation of techniques to demonstrate specific pathologies.
   

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g. Skull: Basic projections for cranium, facial bones, nasal bones and mandible. Technique for Petrovius temporals for mastoids, Internal auditory canal, Accessory nasal sinuses, Temporal-mandibular joint, Orbits and optic foramen, Zygomatric arches, Styloid process, Pharyngeal fossa, Jugular foramen.

2. Dental Radiography: Technique for intra oral full mouth, Occlusal projections, Extra oral projections including orthopantomography, Supplementary techniques.


4. Lungs and Mediastinum: Technique for routine projections,

5. Supplementary projections: Antero-posterior, obliques, lordotic, apical projection, use of penetrated postero-anterior projection, Expiration technique, Technique for pleural fluid levels and adhesions.

6. Abdominal viscera: Technique for plain film examination, Projection for acute abdomen patients, Technique to demonstrate: Foreign bodies, Imperforate anus.

7. Radiography using mobile X-ray equipment: Radiography in the ward, Radiography in the specialized unit, such as: Intensive care unit, Coronary care, Neonatal unit, Radiography in the operating theatre.


11. Soft tissue Radiography including Mammaryography: its techniques, equipment, advancements and applications.

12. Localization of foreign bodies: Various techniques

13. Operation theatre techniques: General precautions, Asepsis in techniques, Checking of mains supply and functions of equipment, selection of exposure factors, explosion risk, radiation protection and rapid processing techniques.
14. Trauma-radiography/Emergency radiography,
15. Neonatal and Paediatric Radiography,
16. Tomography and Tomosynthesis
17. Dual energy X-ray absorptiometry
18. Forensic Radiography

Radiological and Imaging Procedures

1. Special Radiographic /Radiological procedures

2. Selection of Fluoroscopy Equipment, general considerations, responsibility of radiographers, Patient Preparation, Indications Contraindications Technique Post Care and Preparation of Drug Trolley/Tray, Radiation Safety. Contrast Media - Positive and Negative, I onic & Non - I onic, Adverse Reactions To Contrast Media and Patient Management, Emergency Drugs in the Radiology Department & Aseptic technique for the following procedures.

Special techniques for specific disease to be examined. Including water soluble contrast media - eg. Gastrografin.


7. Reproductive system: All the Techniques relating to Male and Female reproductive system including Hysterosalpingography.


10. Sinography: Routine technique and procedure.


Radiation safety in diagnostic Radiology

1. Introduction to Radiation protection-Need for protection, Aim of radiation protection.

2. Limits for radiation exposure: Concept of ALARA, maximum permissible dose, exposure in pregnancy, children, Occupational Exposure Limits - Dose limits to public.


5. Radiation Quantities and Units: Radiation, Radioactivity, Sources of radiation - natural radioactive sources, cosmic rays, terrestrial radiation, manmade radiation sources, Kerma, Exposure, Absorbed dose, Equivalent Dose, Weighting Factors, Effective Dose.


7. Radiation detection and Measurements: Ionization of gases, Fluorescence and Phosphorescence, Effects on photographic emulsion, Ionization Chambers, proportional counters, G.M counters, scintillation detectors, liquid semiconductor detectors, Gamma
ray spectrometer. Measuring systems: free-air ionization chamber, thimble ion chamber, condenser chamber, Secondary standard dosimeters, film dosimeter, chemical dosimeter, thermoluminescent Dosimeter, Pocket dosimeter, Radiation survey meter, wide range survey meter, zone monitor, contamination monitor - their principle function and uses. Advantages & disadvantages of various detectors & appropriateness of different detectors for different type of radiation measurement.

8. Dose and Dosimetry, CT Dose Index (CTDI, etc.), Multiple Scan Average Dose (MSAD), Dose Length Product (DLP), Dose Profile, Effective Dose, Phantom Measurement Methods, Dose for Different Application Protocols, Technique Optimization. Dose area product in fluoroscopy and angiography systems, AGD in mammography.


10. Planning consideration for radiology, including Use factor, occupancy factors, and different shielding materials. Protection for primary radiation, work load, use factor, occupancy factor, protection from scatter radiation and leakage radiation, X-Ray/Fluoroscopy/Mammography/Intervention/DSA/CT room design, structural shielding, protective devices.

12. NABH guidelines, AERB guidelines, PNDT Act and guidelines

Dark Room Procedures

(a) Dark Room-Size and Installation; Ventilation, Electric Wiring, Pass Box; Entrance, Illumination, Dry and Wet Side
(b) Film Construction, Types of Film, Intensifying Screens, Screen Characteristics, Rare Earth Screen; Fluorescopic Screen, Luminescence, Safety in Dark Room
(c) Manual and Automatic Processing
(d) Faults in Radiography and Remedy
(e) Green Sensitive Films, Dry vs. Laser Films, Day Light Processing
SECOND YEAR

Paper – I

Technique of CT Scan and Mammography

Technical Aspect of CT Scan – Includes

A – (1) Basic Computed Tomography - Basic principles of CT, generation of CT, CT instrumentation, image formation in CT, CT image reconstruction, Hounsfield unit, CT image quality, CT image display.

2. Advanced Computed Tomography - Helical CT scan: Slip ring technology, advantages, multi-detector array helical CT, cone-beam geometry, reconstruction of helical CT images, CT artifact, CT angiography, CT fluoroscopy, HRCT, post processing techniques: MPR, MIP, Min IP, 3D rendering: SSD and VR, CT Dose, patient preparation, Imaging techniques and protocols for various parts of body, CT contrast sensitive protocols - CT angiography - (Aortogram, selective angiogram head, neck and peripheral) image documentation and Filing, maintenance of equipment and accessories.

B – (1) Technical Aspect of Mammography.

(2) Mammography and its clinical application.
Paper II

Technique of MRI

A - Technique of MRI Includes

1. Advanced technique & instrumentation of MRI
2. Basic Principle: Spin - precession - relaxation time - pulse cycle - T1 weighted image - T2 weighted image - proton density image.
3. Pulse sequence: Spin echo pulse sequence - turbo spin echo pulse sequence - Gradient echo sequence - Turbo gradient echo pulse sequence - Inversion recovery sequence - STIR sequence - SPIR sequence - FLAIR sequence - Echo planar imaging - Advanced pulse sequences.
5. Image formation: 2D Fourier transformation method - K-space representation - 3D Fourier imaging - MIP.

B - Ultrasonography Technique Includes:

3. Ultrasond display modes: A, B, M
4. Real-time ultrasound: Line density and frame rate, Real-time ultrasound transducers, mechanical and electronic arrays, ultrasound artifacts, ultrasound recording devices, and Distance, area 3D volume measurements.

5. Techniques for imaging different anatomic areas, ultrasound artifacts, biological effects and safety.

6. Doppler Ultrasound - Patient preparation for Doppler, Doppler artifacts, vascular sonography.
Radionuclide Imaging - Nuclear Medicine

(A) Principles: Physics of Radioactivity, Types of Radiation, Cyclotron, Radionuclide Generator, Detectors, Collimators, Imaging Device, Radiopharmaceuticals, Important Other Nuclear Medicine Imaging, SPECT, PET Scanner, Clinical Application, Cardiac Imaging, Bone and Liver Scanning, Neuro Psychiatric Application, Epilepsy, CVS, Thallium, Stress Testing, Perfusion Imaging, Ga LT Imaging, etc.

(B) Elementary of General Pathology of Health and Disease.
Degeneration, Repair of wound Inflammation, Tumor - Definition, Classification, Spread.

(C) Newer, Developments in Advanced Imaging Technology
1. In addition to existing Radiological and Imaging Modalities - Newer Developments in Digital Imaging CT, MRI, US and any other modality.
3. Computed Tomography Introduction to Newer Developments/Newer Technology innovations, software and its applications.
4. MRI Introduction to Newer Developments/Newer Technology innovations, software and its applications.
5. Advanced Ultrasonography Newer Developments/Newer, Technology innovations, software and its applications. Elastography, HIFU, ABVS, etc.
6. Fusion Imaging - PET CT & PET MRI
7. Teleradiology, HIS, RIS, PACS, Imaging Processing and Archiving.