STUDY GUIDE

FOR

B.SC. VISION SCIENCES

Department of Home & Health Sciences

Allama Iqbal Open University

By

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INSTRUMENT OPTICS

C. Code – 494 **Half Credit**

LIST OF CONTENTS

INTRODUCTION TO THE STUDY GUIDE

Dear students, the 1st semester of B.Sc. Vision Sciences is very important, as you have to understand many new concepts and acquire many skills. However, your task will become easy if you work hard. This study guide is going to facilitate your learning process throughout the semester. It is worth mentioning here that the objectives given with each study unit have been formulated on the basis of suggestions given in a National level workshop organized by PICO that was conducted to design and direct this course in the right way. Experts from all over Pakistan and with international repute in the relative fields participated in this workshop. The study guide will help you in understanding what is expected of you at this level and will guide you about the relevant reading. The prescribed reading given at the end of each study unit is compulsory while the suggested reading will help those who want to further add to their knowledge. The self- evaluation exercises given at the end of each unit will help you in improving your knowledge and skills.

I hope that this effort is going to be fruitful and, I wish you good luck.

INTRODUCTION TO THE COURSE

Dear students, in future, you have not only to deal with patients but also to handle the instruments and take care of the instruments used in ophthalmology in different clinical settings. Therefore, it is very important that you are well-acquainted with these instruments and know how to handle and maintain these. This entire course is aimed at imparting to you the knowledge and skills that you are going to need as a professional in future.

AIMS AND OBJECTIVES OF THE COURSE:

After studying this course, you should be able to:

1. Explain the basic working principles of the ophthalmic instruments.
2. Use the ophthalmic instruments in proper way.
3. Maintain the ophthalmic instruments in proper working condition.

UNIT–1

THE DIRECT AND INDIRECT OPHTHALMOSCOPE

INTRODUCTION

Ophthalmoscopes, especially the direct ophthalmoscopes are the most commonly used instruments to examine the ocular media and fundus. Simple ophthalmoscopic examination can give valuable information regarding the diagnosis and consequent management of the patient. Therefore, this unit is designed to help the students attain the knowledge and skills to handle the ophthalmoscopes properly.

LEARNING OBJECTIVES

After studying this unit, you should be able to:

1. Describe the basic working principles of ophthalmoscopes.
2. Know the uses of ophthalmoscopes.
3. Use the ophthalmoscopes in prescribed way when needed.
4. Maintain the ophthalmoscopes in proper working condition.

INDICATIVE CONTENT

1.1 Ophthalmoscope, direct and indirect
1.2 Optical principles
1.3 Clinical uses
1.4 Advantages / disadvantages of each

PRESCRIBED READING

1. Dr. Sajjad Haider. Instrument Optics. (C. Code 494) Department of Home and Health Sciences, Allama Iqbal Open University, Islamabad, p 1-24.

2. Harold A. Stein, Bernard J. Slatt,Raymond M. Stein. Preliminary examination. The Ophthalmic Assistant, A Guide for Ophthalmic Medical Personnel. Seventh Edition. P 164-166.

SUGGESTED READING

1. Tyree Carr. Direct and Indirect ophthalmoscopy. Ophthalmic Medical Assisting. The Foundation Of The American Academy Of Ophthalmology, third edition, 1999, p 52-55,239-240.

2. Johnn P. Perry and Andrew B. Tullo. Examination of the Eye. Care of the ophthalmic patient. Second edition, 1995, p 197-199.

SELF ASSESSMENT EXERCISES

Given in the reference text.

UNIT– 2

THE RETINOSCOPE

INTRODUCTION

Clinical refraction is an important skill that can play vital role in decreasing the burden of low vision in a developing countries. Retinoscope is the instrument used for refraction. Therefore, it is of extreme importance that the students of BSc. Vision Sciences have a clear understanding of the basic working principles and uses of retinoscope. This unit tries to serve the purpose.

LEARNING OBJECTIVES

After studying this unit, you should be able to:

1. Explain the basic working principles of retinoscope.
2. Know how to use the retinoscope.
3. Maintain the retinoscope in proper working condition.

INDICATIVE CONTENT

2.1 Optical principles of retinoscope.
2.2 Clinical uses of retinoscope

PRESCRIBED READING

1. Dr. Sajjad Haider. Instrument Optics. (C. Code 494) Department of Home and Health Sciences, Allama Iqbal Open University, Islamabad, p 25-38.
2. Harold A. Stein, Bernard J. Slatt,Raymond M. Stein. Understanding ophthalmic equipment, The Ophthalmic Assistant, A Guide for Ophthalmic Medical Personnel. Seventh Edition. P 176-178.

SUGGESTED READING

1. Tyree Carr. Direct and Indirect ophthalmoscopy. Ophthalmic Medical Assisting. The Foundation .Of The American Academy Of Ophthalmology, third edition, 1999, p 91-92.
2. John P. Perry and Andrew B. Tullo. Examination of the Eye. Care of the ophthalmic patient. Second edition, 1995, p 161—162.

SELF ASSESSMENT EXERCISES

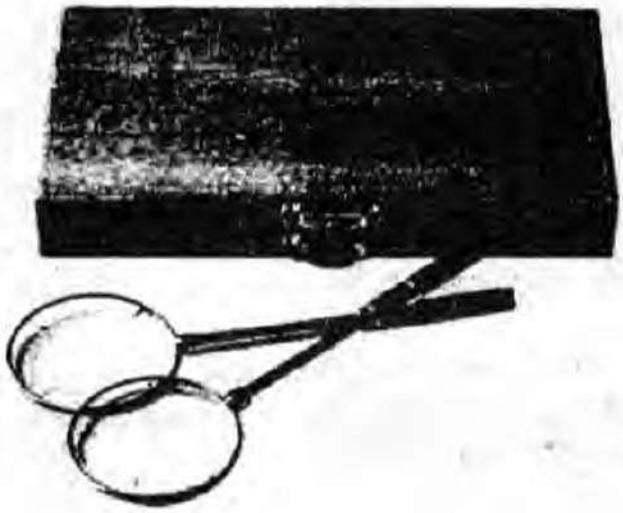
Given in the reference text.

UNIT – 3

CROSS CYLINDER

INTRODUCTION

The cross cylinder is an important instrument regarding refraction. Basically, it is a refining instrument. It is used to confirm the exact axis of the astigmatic error and also the exact power of the correcting cylinder. Therefore, it is essential for a refractionist to know the instrument.



AIMS AND OBJECTIVES

After studying this unit, you are expected to:

1. Be able to explain the basic principles of Cross cylinder.
2. Be able to use the cross cylinder properly.
3. Be able to maintain the cross cylinder in proper working condition.

INDICATIVE CONTENTS

3.1 Optical principles
3.2 Clinical uses

PRESCRIBED READING

1. Harold A. Stein, Bernard J. Slatt,Raymond M. Stein. Understanding the ophthalmic equipment.The Ophthalmic Assistant, A Guide for Ophthalmic Medical Personnel. Seventh Edition. p 178.

2. Harold A. Stein, Bernard J. Slatt,Raymond M. Stein. Refrective errors and how to correct them. The Ophthalmic Assistant, A Guide for Ophthalmic Medical Personnel. Seventh Edition. p 221.

SUGGESTED READING

1. Theodore P. Grosvenor. Subjective Refraction. Primary Care Optometry. Second Edition. P 262-264.

2. Duke-Elder's Practice of Refraction. Subjective verification of the refraction, and testing of muscle balance. Tenth Edition. P 181-183.

3. Tyree Carr. Optics and refractive states of the eye. Ophthalmic Medical Assisting. The Foundation Of The American Academy Of Ophthalmology, third edition, 1999, p 54-55.

SELF-EVALUATION EXERCISES

Given in the reference texts.

UNIT – 4

SNELLEN'S VISUAL DRUM, MADDOX ROD AND MADDOX WING

INTRODUCTION

Testing visual acuity is no doubt the very basic and the most important test in a patient with eye disorders. Snellen's charts are the most common type of test used to determine the visual acuity. A refractionist ought to know the principle and method of this test.

Maddox rod is an instrument used to detect ocular muscle imbalance. It is important for the students to understand the basic principle and methods of using this instrument in patients with muscle imbalance disorders of the eye.

Maddox wing test is one of the best tests available to assess muscle balance of near vision. Therefore, this too has to be understood by the students.

LEARNING OBJECTIVES

After studying this unit you should be able to:

1. Describe the basic principles of Snellens visual drum, Maddox rod and Maddox wing.
2. Use the Snellens visual drum, Maddox rod and Maddox wing properly.
3. Maintain the Snellens visual drum, Maddox rod and Maddox wing in proper working condition.

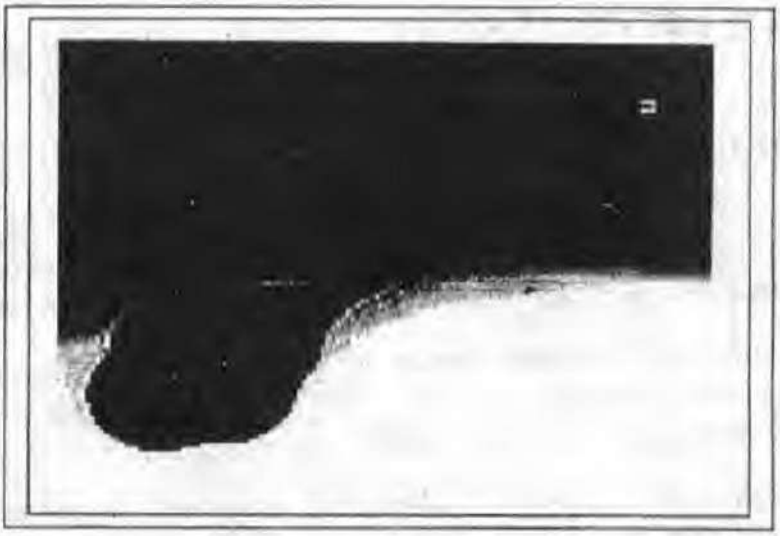
INDICATIVE CONTENTS AND SUMMARY OF MAIN TOPICS

4.1 Optical principles and Clinical uses of Snellen's visual drum.

Snellens visual chart

4.2 Optical principles and Clinical uses of Maddox rod.

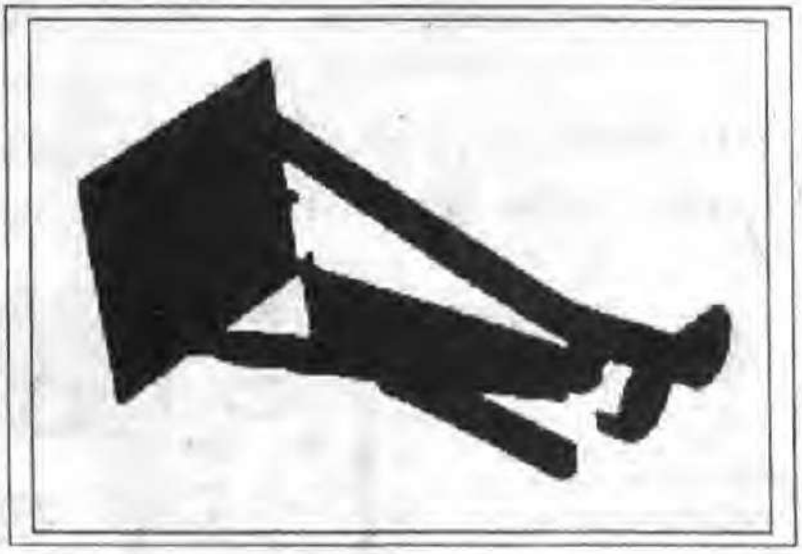
Maddox rod



4.3 Optical principles and clinical uses of Maddox wing

This test is used to test the muscle balance of near vision. Maddox wing acts by separating the visual fields presented to each eye by a diaphragm and this way it dissociates them. Every type of heterophoria is investigated at a distance of one-third of a metre.

Maddox wing



The patient looks through the two slit-holes in the eye- pieces of the instrument. The fields that are exposed to each eye are separated by a diaphragm in such a way that they guide tangentially into each eye. The right eye sees a white arrow pointing vertically

upwards and a red arrow pointing horizontally to the left. The left eye sees a horizontal row of figures in white and a vertical row in red; these are calibrated to read in degree of deviation. It is important that the white arrow pointing to the horizontal row of figures and the red arrow pointing to the vertical row should both be at zero. Any deviation will indicate an eso-or exophoria or, a hyperphoria, the amount of which can be read off on the scale.

PRESCRIBED READING

1. Harold A. Stein, Bernard J. Slatt,Raymond M. Stein. Preliminary examination. The Ophthalmic Assistant, A Guide for Ophthalmic Medical Personnel. Seventh Edition. p 129- 135..

2. Harold A. Stein, Bernard J. Slatt,Raymond M. Stein. Understanding the ophthalmic equipment. The Ophthalmic Assistant, A Guide for Ophthalmic Medical Personnel. Seventh Edition. p 180-182.

SUGGESTED READING

1. Duke-Elder's Practice of Refraction. Tenth Edition. P 145-153,189-191.

2. Theodore P. Grosvenor.Primary Care Optometry. Second Edition. P 11-15, 283.

3. Tyree Carr. Optics and refractive states of the eye. Ophthalmic Medical Assisting. The Foundation Of The American Academy Of Ophthalmology, third edition, 1999, p 54-55.

UNIT– 5

SLIT LAMP AND ITS ACCESSORIES

INTRODUCTION

Slit lamps are widely used ophthalmic instruments to examine the anterior segment of the eye and the adnexa. It allows close examination and detection of pathology of the lids, lashes, conjunctiva, cornea, Iris, tear film, lens and fluids within the eye. Slit lamp can also be used while performing applanation tonometry. It is therefore required that the students understand the working of this instrument.

LEARNING OBJECTIVES

After studying this unit, you should be able to:

1. Explain the basic working principles of the slit lamp and its accessories.
2. Know how to use these.
3. Maintain these in proper working condition.

INDICATIVE CONTENT

5.1 Optical principles of slit lamp and its accessories.
5.2 Clinical uses of slit lamp and its accessories.

PRESCRIBED READING

1. Dr. Sajjad Haider. Slit lamps, Instrument Optics. (C. Code 494) Department of Home and Health Sciences, Allama Iqbal Open University, Islamabad, p 102-114.

2. Harold A. Stein, Bernard J. Slatt, Raymond M. Stein. Understanding ophthalmic equipment. The Ophthalmic Assistant, A Guide for Ophthalmic Medical Personnel. Seventh Edition. p 188-192.

3. Harold A. Stein, Bernard J. Slatt, Raymond M. Stein. Maintenance of ophthalmic equipment and instruments. The Ophthalmic Assistant, Understanding ophthalmic equipment. A Guide for Ophthalmic Medical Personnel. Seventh Edition. P 529—530.

SUGGESTED READING

1. Tyree Carr. Comprehensive eye examination. Ophthalmic Medical Assisting. The Foundation Of The American Academy Of Ophthalmology, third edition, 1999, p 90-91.

2. Theodore P. Grosvenor. The ocular health examination. Primary Care Optometry. Second Edition. P 175-185.

SELF-EVALUATION EXERCISES

Given in the reference text.

UNIT– 6

TONOMETERS

INTRODUCTION

Tonometers are instruments used to measure the Intra-ocular pressure (IOP). Tonometry is widely used by the ophthalmologists and the Mid-level Eye Care Personnel in assisting the diagnosis of the cases of glaucoma and also to monitor the management of such cases once they are on treatment. Obviously, the students should be well equipped with the knowledge and skills to handle a tonometer.

LEARNING OBJECTIVES

After studying this unit, you should be able to:

1. Explain the basic working principles of the tonometers.
2. Know how to use the tonometers.
3. Maintain the tonometers in proper working condition.

INDICATIVE CONTENT

6.1 Working principles of Tonometers.
6.2 Clinical uses of tonometers.

PRESCRIBED READING

1. Dr. Sajjad Haider. Compound Microscope and Tonometers. Instrument Optics. Department of Home and Health Sciences, Allama Iqbal Open University, Islamabad, p 71-101.

2. Harold A. Stein, Bernard J. Slatt,Raymond M. Stein. Glaucoma. The Ophthalmic Assistant, A Guide for Ophthalmic Medical Personnel. Seventh Edition. p 489-501.

3. Harold A. Stein, Bernard J. Slatt,Raymond M. Stein. Maintenance of ophthalmic equipment and instruments. The Ophthalmic Assistant, A Guide for Ophthalmic Medical Personnel. Seventh Edition. p 527-529.

SUGGESTED READING

1. Tyree Carr. Comprehensive eye examination. Ophthalmic Medical Assisting. The Foundation Of The American Academy Of Ophthalmology, third edition, 1999, p 84-89.

2. Theodore P. Grosvenor. The ocular health examination. Primary Care Optometry. Second Edition. p 163-165.

SELF-EVALUATION EXERCISES

Given in the reference text.

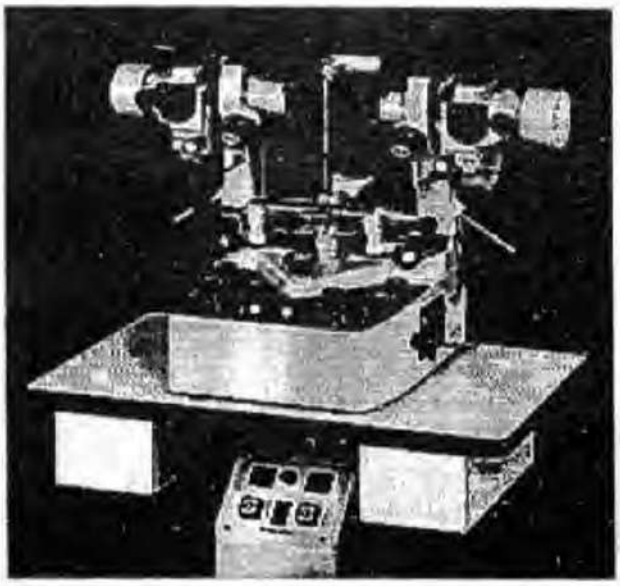
UNIT – 7

SYNOPTOPHORE

INTRODUCTION

Synoptophore is an instrument used to measure the fusion range of the eyes. This is important in assessing the Binocular Vision in cases with strabismus. Therefore, it is included in this course.

A modern Synoptophore



LEARNING OBJECTIVES

After studying this unit, you should be able to:

1. Explain the basic working principles of the synoptophore.
2. Know how to use the synoptophore.
3. Maintain the synoptophore in proper working condition.

INDICATIVE CONTENT

7.1. Working principles of synoptophore.
7.2 Clinical uses of synoptophore.

PRESCRIBED READING

Harold A. Stein, Bernard J. Slatt,Raymond M. Stein. Ocular motility and Binocular vision. The Ophthalmic Assistant, A Guide for Ophthalmic Medical Personnel. Seventh Edition. p 659-662.

SUGGESTED READING

1. John P. Perry and Andrew B. Tullo. Orthoptics. Care of the ophthalmic patient. Second edition, 1995, p 413-414.

2. Duke-Elder's Practice of Refraction. Tenth Edition. p 115-118.

SELF-EVALUATION EXERCISES

Given in the reference text.

UNIT – 8

FOCIMETER, KERATOMETER, AUTOREF, PHOROPTER

INTRODUCTION

Focimeter (lens meter) is an instrument used to measure the prescription of an optical lens. It is vital to know the previous prescription of a patient.
Keratometer is an instrument that is used to measure the anterior curvature of the cornea. It is of great value for detecting and measuring corneal astigmatism.
Automated refractors (autoref) are quite common nowadays. However, these perform an automatic retinoscopic or objective refraction. The results thus obtained have to be refined by a subjective refraction. These save a lot of time in busy places.
A Phoropter (Refractor) consists of entire trial set of lenses mounted on a circular wheel. It makes it easier to bring each lens set before the viewing system when needed just by turning the dial.

This very brief account makes it obvious that the students need to know the basic principles of working and uses of these instruments.

LEARNING OBJECTIVES

After studying this unit, the students should be able to:

1. Explain the basic optical principles of the Focimeter,Keratometer, Autorefractor and Phoropter.
2. Know how to use these.
3. Maintain these in proper working condition.

INDICATIVE CONTENT

8.1 Optical principles and uses of Focimeter.
8.2 Optical principles and clinical uses of Keratometers.
8.3 Optical principles and clinical uses of Autorefractor.
8.4 Optical principles and clinical uses of Phoropter.

PRESCRIBED READING

1. Dr. Sajjad Haider. Keratometers.. Instrument Optics. (C. Code 494) Department of Home and Health Sciences, Allama Iqbal Open University, Islamabad, p 39-61.

2. Harold A. Stein, Bernard J. Slatt,Raymond M. Stein. Preliminary examination.. The Ophthalmic Assistant, A Guide for Ophthalmic Medical Personnel. Seventh Edition. p 4139-146.

UNIT– 9

OPTICS OF LOW VISION AIDS

INTRODUCTION

The students should realize that they would be playing important role in the visual rehabilitation of the patients with low vision. Therefore, they should be acquainted with the basic knowledge and skills involved in managing such patients. Low vision aids comprise a group of instruments that are prescribed to patients with low vision in order to improve their quality of life. These have revolutionized the lives of patients with low vision all over the world. Therefore, these are part of this course.

LEARNING OBJECTIVES

After studying this unit, you are expected to:

1. Be able to understand the basic principles and clinical uses of Hand and Stand magnifiers and telescopes.
2. Know the uses of these.
3. Should be able to maintain these in proper working condition.

Summary of main topics

9.1 Optical principles and clinical uses of hand and Stand Magnifiers.

9.2 Optical principles and clinical uses of telescopes.

PRESCRIBED READING

Harold A. Stein, Bernard J. Slatt,Raymond M. Stein. Visual aids for the partially sighted. The Ophthalmic Assistant, A Guide for Ophthalmic Medical Personnel. Seventh Edition. P 717-727.

SUGGESTED READING

1) Theodore P. Grosvenor.Primary Care Optometry. Prescribing optical aids for low vision. Second Edition. P 483-497.

1) Duke-Elder's Practice of Refraction. Visual aids. Tenth Edition. P 273.282.

SELF-EVALUATION EXERCISES

Given in the reference text.