

**MRSPTU (B. SC. OPTOMETRY) SYLLABUS BATCH 2020 ONWARDS  
(4 YEARS COURSE)**

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Semester 1 <sup>ST</sup>		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.		
BOPTS1-101	Geometrical Optics (Optics I)	3	1	0	40	60	100	4
BOPTS1-102	Physiology (General)	3	1	0	40	60	100	4
BOPTS1-103	Anatomy (General)	3	1	0	40	60	100	4
BOPTS1-104	Basics of Biochemistry	3	1	0	40	60	100	4
BOPTS1-105	Professional communication in English	2	1	0	40	60	100	3
BOPTS1-106	Geometrical Optics-1 LAB	0	0	4	60	40	100	2
BOPTS1-107	Physiology (General)-LAB	0	0	2	60	40	100	1
<b>Total</b>		-	-	-	320	380	700	22

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**GEOMETRICAL OPTICS-I**

**Subject Code: BOPTS1-101**

**L T P C**  
**3 1 0 4**

**Duration: 60 (Hrs.)**

**Course Objectives:**

- After completing this module students will be able to work problems involving the laws of reflection and refraction. Students will be able to use the mirror equation to predict the position and magnification of real and virtual images formed by flat, concave, and convex mirrors

**Course Outcomes:**

- The student will learn to use the geometrical approximation, including Fermat's principle, the ray equation and paraxial matrix formalism for refractive and reflective surfaces. The student will be introduced to the design of optical systems and aberrations, with an emphasis on image forming systems

**Unit:1.**

**(16 hrs)**

- What is light- dual nature- particle & wave nature, speed, wave length & frequency of light.
- Fermat's principle- laws of relation & refraction at a plane surface using Fermat's principle.
- Snell's law, relative and absolute refractive indices, total internal reflection and Critical angle, refraction by plane parallel slab of glass.
- Geometrical path length & optical path length of rays, Concept of wave fronts & rays, concept of vergence- divergence, convergence.

**Unit: 2.**

**(14 hrs)**

- Refraction by spherical surfaces- convex & concave, Derivation of vergence equation, focal points, decenter power, image point, lateral & axial magnification, simple numerical.
- Thin Lens- shapes, derivation of lens makers' formula, thin lens vergence equation, equivalent focal length of two thin lenses separated by a distance & placed in contact, lateral magnification of thin lenses in contact, simple numerical, concept of reduced systems.

**Unit: 3.**

**(16 hrs)**

- Thick Lens- Cardinal points & planes, front & back vertex power, matrix theory in paraxial Optics to locate positions of cardinal planes. Different types of aberrations & their effects
- Prism- Dispersion of prism, reflecting prisms, prisms diopters.
- Geometrical theory of optical fibers. Uses of optical fibers.
- Eye and Vision: Spectroradiometric curve-  $V_{\lambda}$  curve- photopic and scotopic vision CIE standard observer.

**Unit: 4.**

**(14 hrs)**

- Photometric quantities and units- Luminous Flux, Lumen- Illuminance, lux Luminous intensity, Candela Luminance, Candela/m<sup>2</sup>. Inverse square law and Cosine law of illumination (Illuminance).
- Calculation- Application of inverse square law and Cosine law- Matt surfaces.

**Reference books-**

1. Geometrical optics- r.s.longurst, optics- e.hech.

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**PHYSIOLOGY (General)**

**Subject Code: BOPTS1-102**

**L T P C**

**Duration: 60 (Hrs.)**

**3 1 0 4**

**Course Objectives:**

- Human physiology aims to introduce the students to the Physiological concepts of homeostasis and control mechanisms.
- To study the functions of body systems- with emphasis on clinical relevance.

**Course Outcomes:**

- Demonstrate knowledge of general overall physiological principles associated with metabolic processes; musculoskeletal system; cardiovascular system; aerobic and anaerobic program design

**Unit: 1.**

**(15 Hrs.)**

- **Genetics:** Nucleic acids-structure of DNA and RNA, their types, properties, replication of DNA, genetic code. Chromosomal aberration-structural and numerical aberration, gene mutation-definition and classification c. Application-genetics of colour blindness, ocular albinism, practical application of mutation.
- **Blood vascular system:** Structures and functions of blood vessel types and their differences. Composition and functions of blood. Plasma proteins-types, origin, normal values, functions. Bone marrow-types and functions. Formed elements of blood-origin, formation, function, life span and fate, abnormalities of formed elements (both size and number) and related disease. Haemoglobin- structure, function and types of haemoglobin, abnormal haemoglobin and related diseases. Blood coagulation-factors, process, anticoagulants, CT and BT. Blood groups-ABO system, Rh factors, blood transfusion and consequences of incompatible blood transfusion. Terminologies-TC, DC, ESR, PCV, MCV, MCH, MCHC, ESR and their significances.

**Unit: 2.**

**(15 Hrs)**

- **Cardio vascular system:** Structure and functions of heart. blood circulation types. special junctional tissues of heart and their importance. ECG. Cardiac cycle. Heart sounds. Cardiac output. blood pressure-definition, types, measurement method, significance of blood pressure measurement, controlling factors and regulation of blood pressure.
- **Renal system:** Structure and functions of kidney. Structure and functions of nephron. Formation of urine (filtration, reabsorption, secretion). Anomalies of urine concentration. Counter current system of urine concentration.

**Unit: 3.**

**(15 Hrs)**

- **Neuro-physiology:** Structure and functions of neuron /nerve cell. Neuroglia. Myelinated and unmyelinated nerve fibre with their conduction velocity. Properties of nerve fibre. synapse-structure, types, synaptic transmission, synaptic. Potential, neurotransmitter. ANS- Introduction, types, comparison of autonomic and somatic nervous system. NMJ-structure and events in transmission.

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- **Muscular physiology:** Microscopic structure of skeletal, smooth and cardiac muscles and their differences. Properties of muscle. Red and white muscle. Single unit and multi unit smooth muscles. Motor point. Slow and fast muscle fibers. Isotonic and Isometric contractions. The Sarcotubular system. Muscle contraction-E.C.Coupling, Rigor mortis.

**Unit: 4.**

**(15 Hrs)**

- **Basic principles of Biology (Biophysical) and its application:** Diffusion-definition, factors affecting diffusion, biomedical or biological application of diffusion, Fick's law of diffusion.
- **Osmosis-** definition, factors affecting osmosis, biomedical or biological application of osmosis, laws of osmosis.
- Acids, Bases, Ph-general overview
- **Colloids:** Definition, classification, properties-optical and electro kinetics, biological application or significance of colloids.
- **Chromatography-** principles and application Electrophoresis-definition, principle, types and application g.Ultracentrifugation-definition, types Adsorption-Definition and types
- Gibb's – Donnan equilibrium
- **Radioactivity-** Definition, biological application, radio isotopes, Radio-Immuno-Assay (RIA).
- **Surface tension-** definition, factors affecting surface tension, biomedical application of surface tension. 1. Viscosity- definition, factors affecting viscosity, biomedical significance of viscosity.

**Reference books:**

- Human physiology: vol 1 and vol 2-c.c.chatterjee
- Principles of anatomy and physiology- tortora,

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**ANATOMY (General)**

**Subject Code: BOPTS1-103**

**L T P C  
3 1 0 4**

**Duration: 60 (Hrs.)**

**Course Objectives:**

- The student will be able to identify the key concepts of the structure and function of human anatomy. The student will be able to build communication skills while involved in peer teaching of clinical anatomy.

**Course Outcomes:**

- The aim of this course is to provide students with a comprehensive overview of the morphology and functional anatomy of the human body. The course incorporates normal structure and function of the human body and provides an insight to the implications of disruption of normal structure and function.

**Unit: 1.**

**(15 hrs )**

- **Introduction of anatomy – gross human anatomy & their relations:** The skeleton – axial & appendicular (over view), Cavities of body- (cranial, thoracic, abdominal, pelvic). Structure of bone, Type & function of bone, Blood & nerve supply of the bone. Planes of the body. Anatomical terminology.
- **Skull** – General features, cranial bones (frontal, parietal, temporal, occipital, sphenoid, ethmoid). Facial bone– (nasal, maxilla, zygomatic, lacrimal, palatine, inferior nasal conchae, vomer, mandible). Special feature of the skull (sutures, paranasal sinuses, foramina, fontanelles, nasal septum).
- **Joints** – classification, fibrous joints, cartilaginous joints, synovial joints ( structure & types). Types of movement at sinovial joints.

**Unit: 2.**

**(15 hrs )**

- **Anatomy of muscular system:** Skeletal muscle structure, Important skeletal muscle (muscles of facial expression, mastication. Muscle that move the head). Over view of Trunk muscles, upper limb muscles, lower limb muscles.
- **Anatomy of nervous system:** spinal cord anatomy (external & internal anatomy). Connection & distribution of spinal nerves-overview (Branches, plexuses. Intercostal nerves). Overview of brain organization & blood supply. Brief anatomical idea on – brain stem, cerebellum, diencephalon, cerebrum. Cranial nerves.

**Unit:3.**

**(15 hrs )**

- **Embryology – general:** Gametogenesis(spermatogenesis & oogenesis) –Structure of testis,ovary &sperm –Phases of embryonic development – formation of three germ layers-derivatives of germ layers –Embryonic or Foetal membrane (chorion, amnion, allantois, yolk sac) &placenta & its functions.

**Unit:4.**

**(15 hrs )**

- **Cell Structure:** Ultra structure and functions of cell - Plasma membrane- Nucleus – Mitochondria- Centrosome-Ribosome -Endoplasmic reticulum- Golgi body & lysosome. Nucleus – Ultra structure & functions.

- **Cell Division**: Amitosis- Mitosis- Meiosis- Significance of mitosis & meiosis- Cell cycle.
- **Tissues**:- Structure, position and functions of epithelial, connective, muscular & nervous tissue.

**Reference books:**

- Principles of anatomy and physiology- tortora,
- Essentials of anatomy & physiology- martini, essentials of anatomy- i. Singh.
- Ross and wilson, 'anatomy & physiology.
- Clark, 'anatomy and physiology: understanding the human body'.

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**BASICS OF BIOCHEMISTRY**

**Subject Code: BOPTS1-104**

**L T P C  
3 1 0 4**

**Duration: 60 (Hrs.)**

**Course Objectives:**

- Biochemistry Majors will gain proficiency in basic laboratory techniques in both chemistry and biology, and be able to apply the scientific method to the processes of experimentation and hypothesis testing.

**Course Outcomes:**

- The course aims to provide an advanced understanding of the core principles and topics of Biochemistry and their experimental basis, and to enable students to acquire a specialized knowledge and understanding of selected aspects by means of a stem/branch lecture series and a research project.

**Unit:1.**

**(15 hrs )**

- **Carbohydrate and its metabolic pathways :** Definition, classification and functions of carbohydrate. Glycolysis, TCA cycle, Glycogenolysis, HMP shunt pathways with their significances

**Unit:2.**

**(15hrs)**

- **Amino acid, Protein and metabolic pathways :** Amino acid-definition, classification, function, properties. Protein-definition, classification and function. Primary, secondary, tertiary, quaternary structures of protein. Non protein nitrogen. Nitrogen balance. Transamination and Deamination.
- **Oxygen transporting protein:** Structure, types, compounds , derivatives and functions of haemoglobin. Myoglobin. Oxygen transporting mechanism of haemoglobin affinity for oxygen. Bohr's effect.

**Unit:3.**

**(15 hrs )**

- **Lipid:** Definition, classification, function. Fatty acid-definition, classification, function Process of beta oxidation of unsaturated fatty acids. Overview of alpha and omega oxidation.
- **Enzymes :** General characteristics, classification of enzyme. Factors affecting enzyme activity. Kinetics of enzyme-k<sub>m</sub>, Michaelis-Menten equation, Line Weaver Burk Plot. Enzyme inhibition-Reversible and Irreversible. Allosteric enzyme.

**Unit:4.**

**(15 hrs )**

- **Hormone :** Physical and chemical characteristics of hormone. types of hormone. general mechanism of hormone action. sources, functions and disorders for deficiency or excessive secretion(hypo/hyper secretions wherever applicable).

**Reference books:**

- Biochemistry- debajyoti das, biochemistry-u.satyanarayan and u. Chakrapani.
- Applied biochemistry professional publications; first edition.
- Fundamentals of applied biochemistry auris publishing.

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**PROFESSIONAL COMMUNICATION IN ENGLISH**

**Subject Code: BOPTS1-105**

**L T P C  
2 1 0 3**

**Duration: 45 (Hrs.)**

**Course Objectives:**

- Develop your confidence and fluency when speaking English for HR purposes as well as professional communication skills, such as presenting, participating in meetings and negotiating on HR topics

**Course Outcomes:**

- Students will develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others. Such skills could include communication competencies such as managing conflict, understanding small group processes, active listening, appropriate self-disclosure

**UNIT:1.**

**(15 Hours )**

- Grammar-structure of sentences etc.
- Business Communication Skills with focus on speaking - Conversations, discussions, dialogues, short presentations, pronunciation.
- Essay- Descriptive-Comparative-Argumentative etc.
- Drafting of email & letter writing

**UNIT: 2.**

**(5 Hours )**

- Reading Comprehension from recommended text etc. biodata, Resume-curriculum vitae etc.
- Report writing-structure, types of reports etc.

**UNIT-3.**

**(15 Hrs)**

- Teaching the different methods of writing like letters, E-mails, report, case study, collecting the patient data etc. Basic compositions, journals, with a focus on paragraph form and organization.
- Basic concepts & principles of good communication

**UNIT-4.**

**(10 Hrs)**

- Special characteristics of health communication
- Types & process of communication
- Barriers of communication & how to overcome

**Reference books:**

- Communication (mark mccormack)
- How to write reports (john metchell)
- Business correspondence and report r.c. sharma & k.mohan (tata mc graw, new delhi 1984).



**GEOMETRICAL OPTICS-1 LAB**

**Subject Code: BOPTS1-106**

**L T P C  
0 0 4 2**

**Duration: 30 (Hrs.)**

**Course Objectives:**

- After completing this module students will be able to work problems involving the laws of reflection and refraction. Students will be able to use the mirror equation to predict the position and magnification of real and virtual images formed by flat, concave, and convex mirrors

**Course Outcomes:**

- The student will learn to use the geometrical approximation, including Fermat's principle, the ray equation and paraxial matrix formalism for refractive and reflective surfaces. The student will be introduced to the design of optical systems and aberrations, with an emphasis on image forming systems.

**Experiments:**

- Determination of the focal length & hence the power of a convex & Concave lens by displacement method.
- Determination of the refractive index of a transparent liquid by using a travelling microscope.
- Determination of the refractive index of the material of a convex lens measuring its focal length, using the lens & a plane mirror.
- Determination of refractive index of the material of a prism by minimum deviation method.
- To draw  $i$ - $\delta$  curve of a prism by a spectrometer & hence to find out the angle of minimum deviation.
- Calibrate the given physical photometer consisting of a photocell & a micrometer for at least five luminous intensities & three external circuit resistances. Use the calibrated photometer to determine C.P. of the given lamp.

**PHYSIOLOGY (General) LAB**

**Subject Code: BOPTS1-107**

**L T P C  
0 0 2 1**

**Duration: 15 (Hrs.)**

**Course Objectives:**

- Human physiology aims to introduce the students to the Physiological concepts of homeostasis and control mechanisms and to study the functions of body systems- with emphasis on clinical relevance.

**Course Outcomes:**

- Demonstrate knowledge of general overall physiological principles associated with metabolic processes; musculoskeletal system; cardiovascular system; aerobic and anaerobic program design.

**Experiments:**

- Identification of fixed histological slides – nerve tissues (cerebellum, cerebral cortex, neurons, spinal cord, nodes of Ranvier, corneal cell space), renal tissues. Blood vessels (artery & vein), skin, Tongue, Liver.
- Identification of histological tissues: Epithelial tissue-squamous, columnar, cuboidal , Connective tissue-skeletal muscle, cardiac muscle, smooth muscle.
- Hemoglobin estimation.
- Determination of blood pressure.
- Determination of BT, CT, ESR
- Blood film making & identification of different blood corpuscle.
- ECG wave identification
- Measurement of TC of RBC & WBC & DC of WBC.
- Determination of Blood Group (ABO; Rh).