FIRST YEAR B.Sc. OPTOMETRY SYLLABUS

- Medical Biochemistry
- Human Anatomy (Sec A) & Physiology (Sec B)
- Ocular Anatomy & Ocular Physiology
- General Optics (Sec B) & Geometric Optics (Sec B)
- Basic Computer Program

MEDICAL BIOCHEMISTRY

SL NO	TOPIC	HOURS
1	Carbohydrate Chemistry ; Definition, general classification with examples, composition, sources, properties and functions of Monosaccharides, Disaccharides, Oligosaccharides and Polysaccharides. Glycosaminoglycans(mucopolysaccharides-in detail)	4
2	Lipid Chemistry ; Definition, general classification Definition, classification, and functions of Fatty acids, Cholesterol, Essential fatty acids , Phospholipids and their importance	3
3	Amino-acid Chemistry ; Amino acid chemistry: Definition, Classification,Peptide bonds, Peptides: Definition, Biologically important peptides. Protein chemistry: Definition, Classification, Functions of proteins, Collagens, Plasma proteins, Muscle proteins	6
4	Enzymes ; Definition, Active site, Cofactor (Coenzyme, Activator), Proenzyme. Classification with examples, Factors effecting enzyme activity, Mechanism of enzyme action. Diagnostic enzymology (clinical significance of enzymes)	5
5	Nucleotide and Nucleic acid Chemistry ; Nucleotide chemistry: Nucleotide composition, functions of free nucleotides in body. Nucleic acid (DNA and RNA) chemistry: Difference between DNA and RNA, Structure of DNA (Watson and Crick model), Functions of DNA. Structure and functions of tRNA, rRNA, mRNA.	3
6	Digestion and Absorption ;General characteristics of digestion and absorption,	3

	Digestion and absorption of carbohydrates, proteins and lipids. Disorders ofdigestion and absorption – Lactose intolerance,	
7	Fundamentals of Biological oxidative reactions-ATP formation	3
8	Carbohydrate Metabolism ; Introduction, Glycolysis – Aerobic, Anaerobic, Citric acid cycle, HMP Shunt pathway,	4
9	Lipid Metabolism ; Introduction to lipid metabolism, Lipolysis, β-oxidation of fatty acids, Ketone body metabolism: Ketone body formation (ketogenesis), utilization (ketolysis), ketosis, Rothera's test. Cholesterol metabolism: degradation, cholesterol transport Hypercholesterolemia and its effects(atherosclerosis and coronary heart diseases) Hypocholesterolemic agents,	5
10	Amino acid and Protein Metabolism ; Catabolism of amino acids - Introduction, transamination, deamination, Fate of ammonia, transport of ammonia, Urea cycle Specialized products formed from amino acids – from glycine, arginine, methionine, phenylalanine and tyrosine.	3
11	Vitamins ; Definition, classification according to solubility, Individual vitamins(Water soluble & fat soluble) - Sources, Coenzyme forms, functions, RDA,digestion, absorption and transport, deficiency and toxicity	8
12	Mineral Metabolism ; Definition, Sources, RDA, Digestion, absorption,transport, excretion, functions, disorder of Individual minerals - Calcium, phosphate, iron, Magnesium, fluoride, selenium, molybdenum, copper. Phosphate, calcium and iron in detail	5
13	Cell Biology ; Introduction, Cell structure, Cell membrane structure and function, various types of absorption. Intracellular organelles and their functions, briefly on cytoskeleton	2
14	Nutrition ; Introduction, Importance of nutrition Calorific values,	8

	Respiratory quotient – Definition, and its significance Energy requirement of a person - Basal metabolic rate: Definition, Normal values, factor affecting BMR Special dynamic action of food Physical activities - Energy expenditure for various activities. Calculation of energy requirement of a person Balanced diet Recommended dietary allowances Role of carbohydrates in diet: Digestible carbohydrates and dietary fibers Role of lipids in diet Role of proteins in diet: Quality of proteins - Biological value, net protein utilization, Nutritional aspects of proteins-essential and non essential amino acids. Nitrogen balance Nutritional disorders	
15	Acid-Base balance ; Acids, bases and buffers, pH. Buffer systems of the body, blood buffers, mechanism of buffer action. H+ and pH measurements.	3
16	Measles and associated eye disorders, low birth weight	2
17	Free radicals – Biological reactions-Oxidants- antioxidants, - diseases – Therapeutic uses of antioxidants	3
	Total	70

GENERAL BIOCHEMISTRY DEMONSTATION; -20 hours

1. Reactions of monosaccharide's-disaccharides- qualitative
2. Estimation of Glucose
3. Estimation of proteins- Ninhydrin
4. Estimation of Vitamin A
5. Estimation of Vitamin c

Total theory hours; 70
Practical- 20

Recommended Text books

1. Text book of Biochemistry Sathyanarayan
2. Text book of Biochemistry A.C Deb
3. Text book of Biochemistry S.K dasgupta
4. Biochemistry of the eye David .R .whilehart

HUMAN ANATOMY (Sec A) PHYSIOLOGY (Sec B)

SLNO	TOPIC	HOURS

1.	Introduction- Anatomy and it's sub-division, planes of the body, terms in relation of structures, Regional Anatomy, organ system, osteology of orbital bones	
2.	Tissues of the body [Histology of the body tissues] 2.1 Epithelium 2.2 Connective tissue 2.3 Bone and cartilage 2.4 Muscles:Skeletal, smooth,cardiac 2.5 Blood vessels 2.6 Neuron, Neuroglia 2.7 Glands, exocrine and endocrine, lacrimal gland indetail 2.8 Skin and appendages 2.9 Lymphoid Tissues 2.10 Ganglian	
3.	Organ systems:[General plan] 3.1 Locomotor system :Bones ,muscles, joints 3.2 Cardiovascular systems: Heart, Regional blood vessels-arteries, veins 3.3 Lymphatic system including immune system 3.4.Digestive system 3.5.Respiratory system 3.6.Reproductory system 3.7.Endocrine system	45

	3.8.Central nervous system- spinal and brain stem, cerebellum, cerebrum,spinal, carnial nerves 3.9 ganglia	
	Total	**45**

RECOMMENDED BOOKS

1. Human anatomy B.D.Chourasia
2. Text book of human anatomy H.Gray
3. Anatomy and Physiology of the eye A.K.Khurana, Indu Khurana
4. Clinical anatomy of the eye S.Snell, A.Lemp
5.Text book of Anatomy Vishram singh

GENERAL PHYSIOLOGY

SLNO	TOPIC	HOURS
1.	1.1. Cell structure and organisation 1.2 Gene action 1.3.Tissue organisation – Epithelium 1.1. Connective tissue - Collagen fibers- elastic fibers- areolar fibers- cartilagebone 1.5. Contractile tissue- striated – skeletal –cardiac- non striated –plain myoepithelial 1.6.General principles of cell physiology 1.7.Electrophysiology of cells 1.8.Physiology of skeletal muscles	

2.	Blood 2.1 Composition 2.2 Volume measurement and variations 2.3 Plasma proteins- classification and functions 2.4 RBC's- development, morphology and measurement- functions and dysfunctions 2.5 WBC's- development – classifications - morphology– functions and dysfunctions 2.6.Platelets –morphology-development, functions and dysfunctions 2.7 Clotting- factors- mechanism- anticoagulants- dysfunctions 2.8.Blood grouping –classifications- importance in transfusion, Rh factor & incompatibility 2.9.Suspension stability 2.10.Osmotic fragility 2.11.Reticulo endothelial system Spleen – lymphatic tissue Thymus - Bone marrow Immune system - cellular - humoral- autoimmune	
3.	Digestion 3.1.General arrangement 3.2.Salivary digestion – functions and regulations	45

	3.3.Gastric digestion –functions and regulations 3.4.Pancreatic digestion- functions and regulations 3.5. Intestinal digestion – functions and regulations 3.6.Liver and Bile 3.7.Absorption 3.8.Motility-deglutition-Gastric-Intestinal-Vomitting-Defecaton 3.9. Functions of large intestine 3.10. Neurohumoral regulations of alimentary functions, summary	
4.	Excretion 4.1. Body fluids – distribution , measurement and exchange 4.2. Kidney –structure of nephron – mechanism of urine formation-composition of urine and abnormal constituents- urinary bladder and micturition	
5.	Endocrine system 5.1. Hormone mechanism – negative feedbacks- tropic action – Permissive action – cellular actions 5.2. Hypothalamic regulation 5.3. Hormones, Actions & Regulations of ✓ Hypophysis ✓ Thyroid ✓ Adrenal Cortex & medulla ✓ Parathyroid ✓ Islets of pancreas ✓ Miscellaneous	

	5.4. Common clinical disorders
6.	Reproduction 6.1. Male reproductive system- control and regulation-semen analysis 6.2. Female Reproductive system- Uterus -ovaries-menstrual cycle- Regulation -Pregnancy and delivery-breast – family planning
7.	Respiration 7.1. Mechanics of respiration 7.2.pulmonary function tests 7.3.Transport of respiratory gases 7.4.neural and chemical regulation of respiration 7.5.hypoxia cyanosis- dyspnoea- asphyxia
8.	Circulation 8.1. Heart: myocardium- innervation- transmission of cardiac impulse-Events during cardiac cycle-cardiac output 8.2.Peripheral circulation: Peripheral resistance- Arterial blood pressure measurements- factors regulating variation – capillary circulation-venous circulation 8.3.Special circulation: coronary – cerebral 4.4.miscellaneous
9.	Nervous system

	9.1. Neuron – conduction of impulse – synapse – receptor 9.2. Sensory organisation- pathways and perception . Reflexes 9.3. cerebral cortex – functions 9.4. Thalamus- basal ganglia – Cerebellum – Hypothalamus 9.5.Autonomic nervous system- motor control of movements, posture and equilibrium- conditioned reflex , Eye hand co-ordination. Sleep, consciousness, behavior , memory	
10.	Environmental Physiology 10.1. Body temperature regulation [including skin physiology] 10.2. Exposure to low and high atmospheric pressure	
11.	Special senses [elementary] 11.1. Olfaction- Taste- Hearing- vision	

GENERAL PHYSIOLOGY - DEMONSTRATION

1.	Microscope & Haemocytometer	
2.	Blood 2.1. RBC count 2.2.Hb 2.3.WBC count 2.4.Differential count 2.5.Hct Demonstration 2.6.ESR	

	2.7.Blood group and Rh type 2.8.Bleeding time and clotting time	
3.	Digestion – Test salivary digestion	
4.	Excretion 4.1. Examination of urine ✓ Specific Gravity ✓ Albumin ✓ Sugar ✓ Microscopic examination for cells and cyst	**20**
5.	Endocrinology & Reproduction 5.1. Dry experiments in the form of cases showing different endocrine Disorders	
6.	Respiratory system 6.1.Clinical examination of respiratory system 6.2.Spirometry 6.3.Breath holding test 6.4.endurance test	
7.	Cardiovascular system 7.1.Clinical examination of circulatory system ✓ Measurement of blood pressure and pulse rate ✓ Effect of exercise on blood pressure and pulse rate	
8.	Central Nervous System 8.1. Sensory system 8.2.Motor system	

	8.3.Cranial system 8.4.Superficial and deep reflexes 8.5.Test for hearing	

RECOMMENDED BOOKS

1. Text book if medical physiology Guyton
2. Human physiology AK Jain, Indu Khurana
3. Human physiology Chatterjee
4. Adler's physiology of the eye Robert.A.Moses, William.M.Hart.Jr
5. Text book ocular anatomy & physiology AK Khurana

OCULAR ANATOMY

SL NO	TOPIC	HOURS
1	1.1 Introduction to anatomical terminologies – cross section of eyeball 1.2 Ocular Adnexa a. Eye Brows b. Eyelids – Structure, Facial spaces, Arterial supply, nerve supply, venous & lymphatic drainage c. Conjunctiva – general arrangements, structure, glands, arteries, veins, caruncle, plica semilunaries 1.3 Lacrimal System – Lacrimal Gland, Drainage, Tear film 1.4 Extraocular Muscles - anatomy, innervations, actions	30
2	Cornea: layers, cellular structures, refractive properties	
3	Coats of eye ball Sclera (Episclera & Sclera) Choroid, Ciliary body, Iris Retina (Detailed anatomy, cellular structure, blood supply and nerve supply)	
4	Aqueous, anterior chamber, Intraocular pressure, vitreous body	
5	Pupil & Pupillary pathway and its lesions	
6	Crystalline lens – structure, suspension, accommodation	
7	Orbit	

	Orbital margin, Walls of orbital cavity Orbital structure & Foramen Surface anatomy, Relations of bony orbit, Orbital Muscles	
8	Cranial Nerves 1.Optic nerve 2. Oculomotor nerve 3. Trochlear Nerve 4. Abducent nerve 5. Facial Nerve (Nuclei, course, relationship with brain, ocular contribution in detail)	
9	Visual Pathway – Definition, anatomy of visual pathway, visual reflexes, Lesions of visual pathway	
10	Ocular Embryology	
	Demonstration 3.1. Practical dissection of Bull's eye 3.2. Practical demonstration of orbital structures	

OCULAR PHYSIOLOGY

SLNO	TOPIC	HOURS
1	Protective mechanisms in the eye.	

2	Precorneal tear film and lacrimation	
3	Extrinsic ocular muscles, their action and control of their movements.	
4	Coats of the eyeball	
5	Corneal physiology – Hydration, Metabolism, Corneal wound healing, Transparency, Permeability	
6	Aqueous Humour - Production, Circulation, Drainage and Intra ocular pressure	
7	Vitreous Humour	
8	Iris – pupil reaction	
9	Crystalline Lens	30
10	Retina – Physiology of RPE, Scotopic & Photopic vision, neural signal, retinal synapses, Photo transduction, Information processing, Retinal metabolism	
11	Pigments of the eye and photo chemistry	
12	Vision- general aspects of sensation	

13	The visual stimulus, refractive errors	
14	Visual acuity and its principle of measurements	
15	Visual perception- binocular vision, stereoscopic vision, optical illusion	
16	Visual pathway, central & cerebral connections, lesions of pathways & effects	
17	Colour vision, Colour vision defects and diagnostic tests	

RECOMMENDED BOOKS

Adler's physiology of the eye Robert.A.Moses, William.M.Hart.Jr

Ocular Anatomy & Physiology A.K.Khurana

General Optics & GEOMETRIC OPTICS

Sec (A) Physical Optics

SLNO	TOPIC	HOURS
1	Light – Nature & Properties - :An overview Corpuscular Theory, Wave Theory, quantum theory and dual Nature	02
	Simple Harmonic Motion Definition, Mathematical representation, energy in SHM, Combination of two SHMs (along a line and at right angles). Waves : Transverse and Longitudinal, mathematical representation of a wave, wave fronts, path difference and phase difference, coherent waves, Numerical.	10

	Interference of light Theory of interference-Conditions for interference, Young's double slit experiment, Expression for fringe width, Intensity distribution of the double slit interference pattern, condition for good contrast.	05
	Interference in thin films: Reflection phase shifts, optical path length. Interference in thin parallel films of uniform thickness, variable thickness (air wedge, Newton's rings), their applications to antireflection coatings, optical flatness of reflecting surfaces, determination of : wavelength, refractive index, thickness of thin films, radius of curvature, Michelson interferometer, Numerical	05
2	Diffraction – Introduction, Fresnel and Fraunhofer diffraction. Fresnel diffraction: Rectilinear propagation of light, Zone plate, Theory of Fresnel's half period zone. Numerical. Fraunhofer Diffraction: Diffraction pattern from single slit, Double slit. Diffraction pattern due to N slits-Theory of plane	05

	transmission grating. Resolving power of the diffraction grating. Numerical.	
3	Polarization – Review of light as a transverse wave. Polarization phenomenon due to reflection, refraction and scattering Brewster's and Malus' laws. Polaroids. Double refraction, retardation plates, Nicol prism as a device to produce polarized light, dichroism, equation to polarization ellipse, elliptical, circular and linear polarizations, their production and detection Optical activity, Lorentz half shade polarimeter, determination of specific rotation	05
4	Absorption and scattering : General and selective absorption, Distinction between absorption and scattering, absorption by solids, liquids and gases, scattering : Rayleigh, Mie and Raman Scattering.	05
5	Radiometry and Photometry – Electromagnetic spectrum, Radiometry, Photometry, sources of optical radiation and detectors of radiation.	05
6	Laser basics : Introduction, Einstein quantum theory of radiation,	04

	Essentials of a laser, Ruby laser, Holography,Numerical	
7	Fiber Optics :Structure, Optics of propagation, Attenuation, Distortion, Numerical.	03
8	The particle nature of radiation :Photoelectric effect, Compton effect(no derivation of compton shift equation), Numerical	04

PHYSICAL OPTICS - PRACTICAL

Any 10 of the following experiments

SLNO	TOPIC	HOURS
	EXPERIMENTS 1. Air wedge 2. Newton's rings 3. Biprism 4. Michelson's interferometer 5. Refractive index of a liquid using a hollow prism 6. Refractive indices of an anisotropic crystal	**30**

	7. Variation of refractive index with wavelength 8. Diffraction grating – minimum deviation/normal incidence method 9. Resolving power of a telescope 10. Polarimeter 11. Photo diode characteristics 12. Ultrasonic interferometer 13. Numerical aperture of optical fibres 14. Wave length of a laser light using grating. 15. Photoelectric effect. **16.** Planck's constant	

Sec (B) GEOMETRICAL OPTICS – THEORY

SL NO	TOPICS	HOURS

1	Properties of light :Classification of optics based on the nature and properties of light. The rectilinear propagation of light, Umbra and Penumbra, Speed of light in vacuum and in a stationary media, Beam, pencil and ray of light, Laws of reflection and refraction, Refractive index, Optical path, Graphical construction for refraction, Principle of reversibility, Fermat's principle (only qualitative discussion), Colour dispersion.Numerical	08
2	Plane surfaces and Prisms : Parallel beam, The critical angle and total reflection, Plane parallel plate, Refraction by a prism, Minimum deviation, Thin prisms, Graphical method of ray tracing, Direct vision prisms, Reflection of divergent rays,Refraction of divergent rays, Images formed by paraxial rays.ophthalmic prisms.Numerical.	08
3	Spherical surfaces : Introduction, Focal points and focal lengths, Image formation, Virtual images, conjugate points and planes, Convention of signs, Graphical constructions(parallel ray method only), Magnification, Vergence and reduced vergence, Gaussian formula. Numerical.	06
4	Spherical mirrors – focal points, focal lengths, image formation, mirrors and vergence, reflection matrix, aspheric mirrors	02
5	Thin lenses :Lenses, Focal points and focal lengths,Image formation : graphical method(parallel ray and oblique ray	08

	methods) and derivation of lens formula, conjugate points and planes. Lateral magnification, Virtual images, Lens makers' formula, Power of a thin lens, Thin lenses in contact, without contact. Numerical.	
6	Thick lenses :Image formation : graphical method(both parallel ray and oblique ray methods), Focal points, principal points, nodal points and optical centre, thick lens formulas(no derivation). Numerical	08
7	Matrix methods in paraxial optics :Introduction, Translation matrix, Refraction matrix, Reflection matrix and Thick lens and thin lens matrices. Numerical.	06
8	Aberration theory :Spherical (coma, astigmatism, curvature of field and distortion) and chromatic aberrations and their minimization including GRIN systems(qualitative description only).	06
9	Optics of the Eye :Biological structure of the eye, Optical representation of the eye, Functions of the eye, Errors of refraction and their correction, Laser therapy for ocular defects. Depth of focus	06
10	Aperture and stops :Field stop and Aperture stop, Entrance and exit pupils, chief ray, Front stop, stop between two lenses, two lenses with no stop, field of view	08
11	Optical Instruments – The Camera, eye and its refractive anomalies, simple magnifier, compound microscope and telescopes.	08

RECOMMENDED BOOKS

1. Fundamentals of Optics – 4th edition – Francis.A.Jenskins and Harvey.E.White.
2. A textbook of Optics – N.Subrahmanyam and Brij Lal.
3. Introduction to optics – Frank.L.Pedrotti and Leno.S.Pedrotti
4. Optics and Refraction – A.K.Khurana

Sec (c) PRINCIPLES OF LIGHTING

SLNO	TOPIC	HOURS
1.	Visual tasks: factors affecting visual tasks	02
2.	Modern theory on light & colour: synthesis of light	02
3.	Additive & subtractive synthesis of colour	02
4.	Light sources: Modern light sources – spectral energy distribution – luminous efficiency – colour temperature – colour rendering]	02
5.	Illumination: Luminous flux, candela, solid angle, illumination, utilization factor, depreciation factors, illumination laws	02
6.	Lighting installation: glare, luminaries, lighting fixtures, types of lighting	02
7.	Photometry: measurement of illumination, photometers and filters	02
8.	Eye care and Lighting – special care with V D U .	02

RECOMMENDED BOOKS

1. Fundamentals of Optics – 4th edition – Francis.A.Jenskins and Harvey.E.White.
2. A textbook of Optics – N.Subrahmanyam and Brij Lal.
3. Introduction to optics – Frank.L.Pedrotti and Leno.S.Pedrotti.
4. Physics for scientists and Engineers with modern Physics, Vol 2, 6th Edition, Serway and Jewett
5. Introductory lighting (Illuminating engineering society of North America)
6. Environmental vision (Pitts)

Computer Basis Program

SLNO	TOPICS	HOURS
1	Introduction to computers	
2	Definition ✓ Input ✓ Output ✓ CPU	
3	Input output devices (types)	
4	Basis of computer system ✓ Switching computer on & off ✓ What is bias? ✓ Computer generations	
5	Keyboard practices	
6	Definitions of terms ✓ Desktop ✓ Software	
7	Computer systems: Hardware & software definitions	
8	Windows'98 ✓ Definition & Why ✓ Calculator - Word pad - Short cuts - Start menu - Media player - Note pad - Win amp – Paint - Control panel	
9	Microsoft word ✓ Opening, saving, deleting, typing, print , Page border, spelling, table,	

	grammar, margin, Clip art, BIU, word art, Colour text &background, Picture drawing using word	
10	Excel ✓ Formulas - Design charts- Format tables	
11	PowerPoint ✓ Designing a presentation - Inserting some animation with sound	
12	Internet &its applications ✓ Interconnection to HTML ✓ E- mailing – Browsing – Chatting	
	TOTAL	30