



MUTHAYAMMAL ENGINEERING COLLEGE
(An Autonomous Institution)



(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to
Anna University)

Rasipuram - 637 408, Namakkal Dist., Tamil Nadu

MUST KNOW CONCEPTS

MKC

BME & MDE

2021-2022

Subject		19BME08 & 19MDE07- MEDICAL OPTICS		
UNIT-1 OPTICAL PROPERTIES OF THE TISSUES				
S.No	Term	Notation (Symbol)	Concept/Definition/Meaning/Units/Equation/Expression	Units
1	Optics	-	Optics is the branch of physics that studies the behaviour and properties of light, including its interactions with matter and the construction of instruments that use or detect it.	-
2	Optical properties	-	Absorbance, Luminosity, Scattering, Transmittance, Diffraction, Refractive index, photosensitivity, interference	-
3	Specular reflection	-	Specular reflection is a type of surface reflectance often described as a mirror-like reflection of light from the surface.	-
4	Diffuse reflection	-	It is a reflection from rough surface.	-
5	Snell's law	-	Snell's law, in optics, a relationship between the path taken by a ray of light in crossing the boundary or surface of separation between two contacting substances and the refractive index of each. $n_1/n_2 = \sin \alpha_2/\sin \alpha_1$	-
6	Index of refraction	-	The index of refraction, n, is the ratio of the speed of light in a vacuum, c, to the speed of light in a medium, v $n=c/v$	-
7	Huygens principle	-	The Huygens–Fresnel principle is a method of analysis applied to problems of wave propagation both in the far-field limit and in near-field diffraction and also reflection	-
8	Total internal reflection	-	Total Internal Reflection (TIR) is a phenomenon in optics, by which light experiences complete reflection at an	-

			interface between two media.	
9	Fiber optic	-	Fiber optics is the technology used to transmit information as pulses of light through strands of fiber made of glass or plastic over long distances	-
10	Tissue properties	-	Refractive index, absorption, Scattering	-
11	Population inversion	-	Generally electron tends to (ground state) what would happen if a substantial percentage of atoms could somehow be excited into an upper state having the lower state all empty. This is known as population inversion.	-
12	Pumping source	-	Optical pumping, Element pumping, chemical reaction.	-
13	Types of laser	-	Solid, liquid, gas lasers	-
14	Uses of laser technology	-	Science, Machining, communication, security, medicine.	-
15	Photocoagulation can be done	-	1.xenon lamp 2. Laser	-
16	Benefit of laser dentistry	-	Faster healing, Reduced risk of infection, less bleeding, less port.	-
17	Measurements scheme	-	--CW (continuous wave) measurements --Time resolved measurements --Specifically-resolved measurements	-
18	Laser -tissue interaction	-	Photo chemical, photo thermal, photo mechanical	-
19	Photo chemical interactions	-	Photo dynamic therapy, hyperthermia, Photocoagulation	-
20	Photo thermal interactions	-	Desiccation, Thermal injury	-
21	Photo mechanical interactions	-	Transient stress waves, Quasi-state stress	-
22	Speckles	-	The term speckle refers to a random granular pattern which can be observed.	-
23	Types of speckle	-	1.Subjective speckle 2.Objective speckle	-
24	Fiber	-	A fibre is a thin thread of a natural or artificial substance, especially one that is used to make cloth or rope.	-
25	Types of fiber	-	1.Mode of propagation 2.Refer -index	-

UNIT -2 INSTRUMENTATION IN PHOTONICS

26	Instrumentation	-	The use of tools, appliances, or apparatus in the treatment of a patient	-
27	Photonics	-	Photonics is the physical science of light waves. It deals with the science behind the generation, detection and manipulation of light.	-
28	Instrumentation for absorption	-	Instrumentation used to carry out atomic absorption spectrophotometry requires a source of light that matches the narrow bands of light that a particular atom absorbs	-
29	Scattering measurements	-	By measuring the intensity of the scattered light as a function of the scattering angle θ ($= 0^\circ$ for unscattered light and $= 180^\circ$ for light scattered directly back into the laser)	-
30	Emission measurements	-	Emissions measurement is the process of measuring the amount of pollutants, in a gaseous or particulate form, being emitted to the air from a specific source, such as an industrial process.	-
31	Excitation light source	-	High pressure arc lamp, LED, Laser.	-
32	High pressure arc lamp	-	A xenon arc lamp is a highly specialized type of gas discharge lamp, an electric light	-
33	LED	-	Made popular by their efficiency, range of color, and long lifespan, LED lights are ideal for numerous applications including night lighting, art lighting, and outdoor lighting.	-
34	Laser	-	A laser is a device that emits light through a process of optical amplification based on the stimulated emission of electromagnetic radiation.	-
35	Optical filters	-	Prism Monochromators Polarizer's	-
36	Prism	-	A polyhedron with two polygonal faces lying in parallel planes and with the other faces parallelograms	-
37	Monochromators	-	A monochromator produces a beam of light with an extremely narrow bandwidth, or light of a single color	-
38	Polarizer's	-	Polariser is an optical filter that lets light waves of a specific polarization pass through while blocking light waves of other polarizations.	-
39	Optical detectors	-	An optical detector is a device that converts light signals into electrical signals, which can then be amplified and processed.	-

40	Optical detectors types	-	Single Channel and Multichannel detectors, Time resolved and phase resolved detection methods,	-
41	Single channel detectors	-	Single-channel detectors have one active sensing element that acts as single transducer.	-
42	Multichannel detectors	-	Multichannel Analyzers (MCAs) are workhorse instruments in many scientific measurements. An MCA analyzes a stream of voltage pulses and sorts them into a histogram, or “spectrum” of number of events, versus pulse-height, which may often relate to energy or time of arrival.	-
43	Phase resolved detection	-	Phase-resolved OCT systems measure both the amplitude and phase of the light reflected from the sample as a function of depth.	-
44	Optical fibers	-	-Total internal reflection -.Optical fibers are about the diameter of a strand of human hair	-
45	Uses of optical detectors	-	They are absolutely necessary for various scientific implementations like fiber optic communication systems, process control, environmental sensing, safety and security, and also in defense-related applications.	-
46	Application of optical fibers	-	Medical. Used as light guides, imaging tools and also as lasers for surgeries	-
47	Uses of single channel & Multichannel detectors	-	The benefits of simultaneous multichannel detection over single-channel scanning detection are well established in analytical chemistry.	-
48	Application of scattering	-	The applications of light scattering are discussed, including critical phenomena, molecular weight determination, air	-
49	Importance of emissions measurements	-	Measurements of emissions can be used to understand the relative importance of a given source compared to other sources	-
50		-		-
UNIT -3 SURGICAL THERAPEUTIC APPLICATIONS OF LASERS				
51	Medical applications of lasers	-	Lasers are commonly employed in many medical disciplines; dermatology, dentistry, cardiology, neurosurgery and eye surgery	-
52	Ophthalmology	-	Ophthalmology is a branch of medicine dealing with the diagnosis, treatment and prevention of diseases of the eye and visual system.	-
53	Lasers in Ophthalmology	-	There are numerous other LASERS in use in ophthalmology. They include 1.The excimer LASER used in corneal	-

			refractive surgeries such as LASIK, PRK and variants of this technology. 2.The femtosecond LASER used sometimes in corneal and cataract surgery. The cyclodiode LASER for advanced glaucoma.	
54	Dermatology	-	Dermatology is the branch of medicine dealing with the skin. It is a speciality with both medical and surgical aspects. A dermatologist is a specialist medical doctor who manages diseases related to skin, hair, nails, and some cosmetic problems.	-
55	Laser therapy used in dermatology	-	In dermatology, LLLT has beneficial effects on wrinkles, acne scars, hypertrophic scars, and healing of burns. LLLT can reduce UV damage both as a treatment and as a prophylaxis	-
56	Lasers work in dermatology	-	Lasers use light energy to resurface the skin.This light energy is very precise, and targets damaged skin cells while preserving healthy skin cells Along with protecting the healthy skin cells, laser skin procedures also stimulate collagen growth	-
57	Lasers used by dermatologists	-	Lasers that have been used to treat these conditions include argon, APTD, KTP, krypton, copper vapour, copper bromide, pulsed dye lasers and Nd:YAG. Argon (CW) causes a high degree of non-specific thermal injury and scarring and is now largely replaced by yellow-light quasi-CW and pulsed laser therapies	-
58	Dentistry	-	Dentistry is the diagnosis, treatment, and prevention of conditions, disorders, and diseases of the teeth, gums, mouth, and jaw	-
59	Types of lasers used in dentistry	-	<ul style="list-style-type: none"> ● The lasers that are most commonly used in dentistry are diode lasers, argon lasers, Nd-YAG lasers, carbondioxide lasers, the Erbium lasers and more. ● The carbon dioxide lasers produce laser waves that are very well absorbed by water and are mostly used to treat soft tissues. 	-
60	Lasers in dentistry	-	The laser instruments used by dentists create a narrow and focused beam of light designed to react to specific tissue. Each	-

			laser instrument produces different wavelengths in order to target specific tissue.	
61	Laser device used in dentistry	-	Mostly diode lasers are being extensively used in the field of dentistry.	-
62	Benefits of laser dentistry	-	A faster healing time Less post-surgical bleeding Less pain Anesthesia may not be necessary	-
63	Urology	-	Urology, also known as genitourinary surgery, is the branch of medicine that focuses on surgical and medical diseases of the male and female urinary-tract system and the male reproductive organs.	-
64	Types of lasers used in urology	-	KTP:YAG (Potassium titanyl phosphate), LBO:YAG (lithium borate), diode lasers, Holmium (Ho):YAG and Thulium (Tm):YAG lasers.	-
65	Laser uses in surgery	-	With proper use, lasers allow the surgeon to accomplish more complex tasks, reduce blood loss, decrease postoperative discomfort, reduce the chance of wound infection, and achieve better wound healing. As with any type of surgery, laser surgery has potential risks.	-
66	Otolaryngology	-	Otolaryngology is a medical specialty which is focused on the ears, nose, and throat. An otolaryngologist is often called an ear, nose, and throat doctor, or an ENT for short.	-
67	Lasers in otolaryngology	-	Pulsed dye lasers are being more broadly adopted for treatment of a wide range of true vocal fold and laryngeal disorders. Lasers are used to treat ear disease and cranial base disorders as well Lasers are also used to reduce or eradicate vascular lesions and neoplasms in infants, children, and adults that obstruct the airway.	-
68	Laser in nasal surgery	-	CO2 laser are mostly used in ENT, particularly appreciated for the high degree of precision in cutting combined with an excellent coagulation effect.	-
69	Tissue welding	-	Tissue welding is a relatively new procedure that aims to seal wounds and openings in a surgery using laser.	-

70	Lasers in tissue welding	-	The function of lasers in welding is to bring about efficient delivery of heat to the tissues in the junction. The main molecules that absorb heat are water, hemoglobin, and melanin. Water has strong absorption in the NIR region. This makes the use of solid-state and CO ₂ lasers ideal for water based heating.	-
71	Benefits of laser tissue welding	-	The advantages of the welding procedure with respect to standard suturing and stapling are reduced operation times, lesser inflammation, faster healing and increased ability to induce tissue regeneration.	-
72	Limitation of laser tissue welding	-	The welding plants are expensive, depending upon the equipment,relatively expensive. The disadvantage is counteracted by the low amount used compared to the welding time and also that there are few post welding operations.	-
73	Laser tissue soldering(LTS)	-	LTS is various substances are applied on the approximated edges of the tissue, before the lasing process.This localizes the heat generated by the laser light to the region of the protein glue, protecting the underlying tissue from excessive heat.	-
74	Photothermal - effects of laser tissue soldering	-	<ul style="list-style-type: none"> Increasing the laser irradiance and thus surface temperature resulted in an increased severity of histological injury. Thermal denaturation of tissue collagen and necrosis of the intimal layer smooth muscle cells increased laterally and in depth with higher temperatures. 	-
75	Optical parameters of laser tissue soldering	-	Variations in laser irradiance, exposure time, solder composition, chromophore type and concentration.To determine the parameters ,an in vitro study was performed using an 808-nm diode laser in conjunction with an indocyanine green (ICG)- doped albumin protein solder to weld bovine aorta specimens.	-
UNIT-4 NON THERMAL DIAGNOSTIC APPLICATIONS				
76	Optical coherence tomography	-	Optical coherence tomography or OCT is a non-contact , non-invasive imaging technique used to obtain high resolution cross sectional images of the retina and anterior segment.	-
77	Principle of OCT	-	OCT images obtained by measuring, <ul style="list-style-type: none"> Echo time 	-

			<ul style="list-style-type: none"> Intensity of reflected light. Source of light : <ul style="list-style-type: none"> 830 nm diode laser 1310 nm AS-OCT 	
78	Types of OCT	-	<ul style="list-style-type: none"> Time domain – OCT Spectral domain – OCT 	-
79	Advantages of OCT	-	<ul style="list-style-type: none"> ❖ Non - invasive ❖ Non - contact ❖ Minimal cooperation needed ❖ Pick up earliest sign of disease ❖ Quantitatively monitor disease / staging 	-
80	Disadvantages of OCT	-	<ul style="list-style-type: none"> ➤ Best for optically transparent tissues ➤ Diminished penetration through ➤ Retinal / sub-retinal haemorrhage ➤ Requires pupil diameter >4 mm 	-
81	Elastography	-	Non-invasive imaging technique used to depict relative tissue stiffness or displacement(strain) in response to imparted force	-
82	Aim of elastography	-	<ul style="list-style-type: none"> Excitation – transmission of stress in a tissue Acquisition – recording the signal induced by the tissue deformation due to the stress Analysis / post treatment – analysis of tissue strain induced by the propagation of the stress 	-
83	Techniques of elastography	-	Based on type of force applied- Quasi – static elastography <ul style="list-style-type: none"> strain elastography Dynamic- elastography <ul style="list-style-type: none"> Acoustic radiation Forced impulse imaging Transient elastography Shearwaveelastography 	-
84	Advantages of elastography	-	<ul style="list-style-type: none"> First elastography technique developed; most widely used and validated. Doesn't require a complex software. 	-
85	ARFI Advantages	-	<ul style="list-style-type: none"> Less user – dependent Better resolution than SE Better transfer of shear modulus contrast to image contrast 	-
86	Advantages of transient elastography	-	<ul style="list-style-type: none"> Easy to use Quantification of tissue elasticity Rapid, painless 	-

			<ul style="list-style-type: none"> • Good reproducibility 	
87	Advantages of shearwave elastography	-	<ul style="list-style-type: none"> • Displayed in real time, like a conventional ultrasound image. • Good reproducibility. • Quantitative value of stiffness • Very short acquisition time (~30ms). 	-
88	Clinical application of elastography	-	<ul style="list-style-type: none"> • Breast imaging • Prostate imaging • Thyroid imaging • Liver imaging • Cardiac elastography 	-
89	Laser induced fluorescence	-	Laser induced fluorescence (LIF) is the optical emission from molecules that have been excited to higher energy levels by absorption of electromagnetic radiation.	-
90	Advantages of LIF	-	<ol style="list-style-type: none"> To get two and three – dimensional images since fluorescence takes place in all directions. Signal to noise ratio of the fluorescence signal is very high. Good sensitivity. 	-
91	Lasers used in LIF	-	<ol style="list-style-type: none"> Excimer lasers XeF(351 nm), XeCl(308 nm) etc are usually used Spectral width – 0.3 nm Pulse width 10 ns 	-
92	Various techniques in Raman spectroscopy	-	<ul style="list-style-type: none"> ➤ Absorption spectroscopy ➤ Reflectance spectroscopy ➤ Fluorescence spectroscopy ➤ Raman spectroscopy 	-
93	Advantages of silicon detectors method	-	<ul style="list-style-type: none"> ➤ Fluorescence emission is reduced ➤ Spectra with acceptable SNRS ratios can be achieved with relatively short integration time on the order of a few seconds 	-
94	Clinical application of Raman spectroscopy	-	<p>Raman spectroscopy has been studied extensively for tissue diagnosis in four main organ sites:</p> <ol style="list-style-type: none"> Breast(breast cancer) Esophagus Cervix(Cervical intraepithelial neoplasia) Skin (Melanoma & Non-melanoma skin cancers) Brain Eye Biological fluids 	-
95	Other	-	<ol style="list-style-type: none"> Raman spectroscopy has also been 	-

	applications of Raman spectroscopy		to determine various analytes such as those in the blood (eg. determination of glucose concentration in diabetes patients) ii. The transdermal measurement of blood glucose using the tissue modulation for extraction.	
96	Holographic techniques in medicine	-	1. Ophthalmology 2. Dentistry 3. Urology 4. Otology 5. Pathology 6. Orthopaedics	-
97	Endoscopic holography	-	<ul style="list-style-type: none"> ○ Endoscopic holography has potential of providing a powerful tool for non-contact high resolution 3D imaging and non-destructive measurements inside natural cavities of human body or in any difficult to access environment. ○ It combines the features of holography and endoscopy. 	-
98	Laser speckle contrast imaging (LSCI)	-	<ul style="list-style-type: none"> ➤ LSCI is a technique based on the dynamic change in this back scattered light as a result of interaction with RBC. ➤ It can be used to visualize perfusion in various tissues. 	-
99	Clinical applications of laser speckle	-	1. Rheumatology 2. Burns 3. Dermatology 4. Ophthalmology 5. Neurology 6. Gastro-intestinal tract surgery	-
100	Advantage of speckle lasers imaging	-	<ul style="list-style-type: none"> ○ It's a cheap ○ Non-contact and ○ Reliable imaging modality that can measure blood perfusion at any time during a clinical examination. 	-
UNIT-5 DIAGNOSTIC AND THERAPEUTIC TECHNIQUES				
101	Imaging	-	"Medical imaging" - The process of making a visual representation of something by scanning it with a detector or electromagnetic beam.	-
102	Field imaging	-	Any microscope technique where the entire sample is exposed to light is known as 'widefield' imaging.	-
103	Biological structures	-	An arrangement or organization of parts to form an organ, system, or living thing	-

104	Vitro	-	When something is performed in vitro, it happens outside of a living organism.	-
105	Diagnostic	-	concerned with the diagnosis of illness or other problems.	-
106	Clinical diagnostic	-	The process of identifying a disease, condition, or injury based on the signs and symptoms a patient is having and the patient's health history and physical exam. Further testing, such as blood tests, imaging tests, and biopsies, may be done after a clinical diagnosis is made.	-
107	Phototherapy	-	The use of light in the treatment of physical or mental illness.	-
108	Types of Phototherapy	-	Single light phototherapy Double and triple light phototherapy	-
109	Advantages	-	No need for eye shielding Simple deployment for home phototherapy Low risk of over heating the infant	-
110	Disadvantages	-	May include noise from the fan in the light source. Decrease of delivered energy with aging and/or breakage of optical fibres. Some new fibrotics units now incorporate photodiodes as a light source.	-
111	Photodynamic therapy(PDT)	-	Photodynamic therapy (PDT) is a treatment that uses a photosensitizer (PS), or photosensitizing agent, and a light of appropriate wavelength, which in the presence of oxygen, will lead to the generation of cytotoxic species and consequently to cell death and tissue destruction.	-
112	Three steps in PDT	-	1) Application of photosensitizer drugs- Light sensitizing liquid, cream, intravenous drug (photosensitizer) is applied or administered. 2) Incubation - There is an incubation period of minutes to days. 3) Light activation- Finally target tissue is then exposed to specific wavelength of light that then activates the photosensitizing medication.	-
113	Mechanism of PDT	-	Type I Reaction <ul style="list-style-type: none"> • Direct reaction with substrate (cell membrane or molecule) • Transfer of H atom to form radicals. Type II Reaction <ul style="list-style-type: none"> • Transfer of oxygen to form singlet oxygen. 	-
114	Assay	-	An assay is an investigative (analytic) procedure for qualitatively assessing or	-

			quantitatively measuring the presence, amount, or functional activity of a target entity (the analyte).	
115	Photosensitizer	-	Photosensitizers are molecules that can be activated by light in order to generate ROS that can damage cell structures from microorganisms or from diseased mammalian cells leading to cell death	-
116	Advantages of PDT	-	<ul style="list-style-type: none"> • killing acne-causing bacteria on the skin. • affecting only targeted cells, helping to maintain skin integrity. • reducing the size and activity of sebaceous glands. • helping fade old acne scars. 	-
117	Disadvantages of PDT	-	It can only treat areas where light can reach. That means it can only be used to treat cancer on or just under the skin, or in the linings of some organs. Also, it cannot be used in people with certain blood diseases.	-
118	Oncological application	-	<p>Palliative treatment of obstructing esophageal cancer;</p> <ul style="list-style-type: none"> • palliative treatment of obstructing endobronchial lesions; • treatment of early stage non-small-cell lung cancer in patients who are ineligible for surgery and radiotherapy; • treatment of high-grade dysplasia in Barrett's esophagus; 	-
119	Non-Oncological application	-	Non-Oncology Indication means any Indication in humans other than an Oncology Indication. For clarity, treatment of separate stages or forms of the same Non-oncology Indication would not be separate Non-oncology Indications.	-
120	Bio stimulation effect	-	Biostimulation refers to the addition of rate limiting nutrients like phosphorus, nitrogen, oxygen, electron donors to severely polluted sites to stimulate the existing bacteria to degrade the hazardous and toxic contaminants	-
121	LASER	-	Non-ionizing radiation monochromatic	-
122	Sources of laser hazard	-	<p>Misaligned laser beam</p> <p>Equipment Malfunction</p> <p>Use of unfamiliar equipment</p> <p>Accidental eye exposure during alignment</p>	-
123	Safety measures	-	<p>Signage, Eyewear, Laser key, Blast shields,</p> <p>Evolve laser Blast shield, Helium laser Blast shield</p>	-

124	Urological laser Procedures	-	Bladder Biopsies, Lithotripsy, Fulguration of Bladder tumors, Strictures	-
125	Procedural Practices	-	Laser foot Pedal Laser used correctly <ul style="list-style-type: none"> Laser in “standby” when not in direct use Smoke evacuator used whe lasing produces particulates.	-
PLACEMENT QUESTION AND ANSWERS				
126	Acronym - MASER	-	Microwave Amplification by Stimulated Emission of Radiation	-
127	One way to describe a Photon	-	A wave packet	-
128	What determines the color of light?	-	Wavelength	-
129	Scientist first came up with the idea of stimulated emission	-	Albert Einstein	-
130	Which laser is considered “eye safe”?	-	Laser bar-code scanners	-
131	In Stimulated Absorption, what is the lifetime of atoms ground state? a) 1 second b) 1 minute c) 1 hour d) Infinity	-	Answer: d - Infinity Explanation: At the ground state, the atoms are perfectly stable. They are under no excessive force that might lead to become unstable. All the forces are balanced. Thus, as the atom is stable in ground state, its lifetime is infinity.	-
132	Where is ND: YAG most commonly used? a) Cosmetic Surgery b) Welding c) Photography d) Optical Communications	-	Answer: a - Cosmetic Surgery Explanation: ND: YAG is most commonly used for cosmetic energy because it has the property of maximum energy absorption by the target (hair or lesion) with minimum absorption by the surrounding skin structures.	-
133	The information carrying capacity of laser is enormous due its large _____ a) Coherence b) Bandwidth c) Directionality	-	Answer: b - Bandwidth Explanation: Laser has a large bandwidth. The rate at which the information can be transmitted is proportional to bandwidth and the bandwidth is proportional to carrier frequency. Because of these properties, Laser is widely used as optical carrier signal.	-

	d) Intensity			
134	Which characteristic of LASER allows it to be used in holography? a) Coherency b) Directionality c) Intensity d) Monochromaticity	-	Answer: a - Coherency Explanation: The production of an image in a hologram takes place via a process called reconstruction. In this process, the image is “reconstructed” in the form of a hologram. This reconstruction if possible, via LASER as they are highly coherent.	-
135	type of laser is used in CD and DVD players?	-	Semiconductor Lasers	-
136	Why lasers are used in “Laser Printers” ?	-	They can be focused down to very small spot sizes for high resolution	-
137	Which color of light has the shortest wavelength ? a) Yellow b) Blue c) Red d) Green	-	Answer : Blue	-
138	The Eximer laser produces light with what wavelength? a) Visible b) Ultraviolet c) Infrared	-	Answer : b) Ultraviolet	-
139	Laser energy is used to break up kidney or gallstones in process called? a) Trbecularplasty b) Lithotripsy c) Viscocanalostomy	-	Answer : b) Lithotripsy	-
140	Chemical lasers use_____ to produce their beams. a) Excessive amounts of electrical power b) Small amounts of electrical power c) No	-	Answer : c) No electrical power	-

	electrical power			
141	What type of laser could cause skin cancer if not used properly? a) Red semiconductor laser b) Blue semiconductor c) Eximer laser d) YAG laser	-	Answer: c) Eximer Laser	-
142	What is the region enclosed by the optical cavity called? a) Optical Region b) Optical System c) Optical box d) Optical Resonator	-	Answer:d Explanation: The optical cavity resembles an oscillator as it provides feedback of the photons by reflection, at the mirrors. Therefore, the area enclosed inside the optical cavity is called optical resonator.	-
143	As wavelength gets longer, the laser light can be focused to... a) Larger spot sizes b) Smaller spot sizes	-	Answer : b) Smaller spot sizes	-
144	Which of the following is not a characteristic of LASERS? a) Monochromatic b) Coherent c) Divergent d) Intense	-	Answer:c Explanation: The lasers are highly directional having almost no divergence. The output beam of laser has a well-defined wave front due to which it can be focused on a point. Lasers are highly intense compared to ordinary light. They are monochromatic and coherent.	-
145	Laser is used in LIDAR for what purpose? a) High-Speed Photography b) Range finder c) Optical Carrier signal d) Drilling	-	Answer: b - Range finder Explanation: LIDAR stand for Light Detection and Ranging. Laser is used in LIDAR as range finder. The transit time of transmitted and reflected pulse of laser light is recorded and the distance of the reflecting object is estimated.	-
146	Epilepsy	-	(Neurological) disorder in which brain activity becomes abnormal.	-

147	In the sampler, the range of the sample size is from _____ a) 0.1 to 8.5 ml b) 1 to 8.5 ml c) 0.85 to 0.1 ml d) 8.5 to 10 ml	-	Answer: a Explanation: With this sampler, the sample size may range from 0.1 to 8.5 ml. It utilizes cups of sizes 0.5, 2, 3 and 10 ml. The sample plate is kept covered to prevent evaporation, which may sometimes lead to errors up to 5%.	-
148	The blood pressure within the glomerular capillaries is _____ of mercury. a) 80 mm b) 70-80 mm c) 90 mm d) 70-90 mm	-	Answer: d-70-90 mm Explanation: The renal arteries carry blood at very high pressure from the aorta into the glomerular capillary tuft. The blood pressure within the glomerular capillaries is 70–90 mm of mercury. The blood flow through the capillary tuft is controlled by the state of contraction of the muscle of the arteriole leading to the tuft.	-
149	Optical fiber sensors are immune to electromagnetic disturbances. a) True b) False	-	Answer: a - True Explanation: It is True. Optical fiber sensors are electrically passive and consequently immune to electromagnetic disturbances. They can be miniaturized and are most suitable for telemetry applications. They are geometrically flexible and corrosion resistant.	-
150	Neutrophils are bigger than the red cells. a) True b) False	-	Answer: a - True Explanation: It is True. Neutrophils are nearly twice as big as the red cells. Lymphocytes are of the same size as the red cells but contain a large density staining nucleus and no granules. Neutrophils contain both a nucleus divided into several lobes and granules in their protoplasm.	-
Faculty Prepared	Mrs. M.Gayathri Devi, Assistant Professor, Department of BME.	Signature		

HOD