

GUJARAT TECHNOLOGICAL UNIVERSITY

BIO MEDICAL ENGINEERING (31)

MEDICAL OPTICS

SUBJECT CODE: 2723111

SEMESTER: II

Type of course: Major Elective – II Subject

Prerequisite: NA

Rationale: NA

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		C	Theory Marks		Practical Marks			
			ESE (E)		PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
4	0	2#	5	70	30	20	10	10	10	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	BASICS OF LASER Absorption and Emission of Radiation by atoms, Ions and Molecules, Properties of laser –Mono-chromaticity, Coherence, Directionality, Brightness, Pumping mechanism- Optical pumping, Electrical pumping, Laser pumping, Resonators, Q-switching and its methods, Gain switching, Mode locking and its types, Cavity damping, Dosimeter-optical and thermal.	10	20
2	LASER FABRICATION Effect of wavelength, Effect of temperature, Effect of surface films, Effect of angle of incidence, Effect of Materials and Surface Roughness, Refraction, Scattering, Interference, Diffraction, LASER Beam Characteristics, Wavelength, Coherence, Mode and Beam Diameter, Polarization, Focusing with a single lens, Final spot size, Depth of focus, Optical components, Lens doublets, Depolarizers, collimators, Metal optics, Diffractive optical elements - Holographic lenses, Laser scanning system, Fiber delivery system.	10	20
3	TYPES OF LASER Solid state, Gas, Molecular gas, Semiconductor, Chemical, Free-electron type, X-ray.	8	20
4	MECHANISM OF LASER TISSUE INTERACTION Photochemical interaction- biostimulation, Thermal interaction- Heat generation, heat transport, heat effects, LASER induced interstitial thermotherapy (LITT)- Photoablation: Model, cytotoxicity of UV Radiation-Plasma induced ablation: Model, analysis of plasma parameters, photo distribution, plasma formation, shock wave generation, cavitation, and jet formation.	10	20
5	LASERS IN MEDICAL DIAGNOSTICS	10	20

	Photo Dynamic Therapy, LASER in Ophthalmology, Dermatology, Neurosurgery, Dentistry, Gynecology, Urology, Angioplasty and Cardiology, Orthopedics, Gastroenterology, Pulmonology- Other advanced applications of LASER		
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Reference Books:

1. Markolf H.Niemz, “Laser Tissue Interaction-Fundamentals and Applications”, Springer, Third edition, 2007.
2. Orazio Svelto, “Principles of Laser”, Springer, Fifth edition, 2010.
3. Ronald W.Waynant, “Lasers in Medicine”, CRC Press, Second edition,2002..
4. G. Reiser, “Optical fiber communications”, Tata McGraw Hill, Third Edition, 2000..
5. Greory T. Absten, “Lasers in Medicine: An Introductory Guide”, Kluwer Academic Publisher, Second edition, 1989.

Course Outcome:

1. To achieve fundamental competency with the use of LASERS in medicine.
 2. To understand the basics concepts of LASER physics.
 3. To learn about different types of Health Care LASER Systems and how they are categorized.
 4. Become familiar with the nature of the interaction of LASER radiation and biological tissue.
- To gain knowledge about the types of LASER used for different medical applications

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website