राष्ट्रीय प्रौद्योगिकी संस्थान रायपुर
NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
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COURSE OF STUDY AND SCHEME OF EXAMINATION OF B.TECH/B.ARCH/M.TECH/M.C.A. NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR

Branch- Biomedical Engineering **Course- B.Tech.(NIT Scheme)**
Semester- VIII

S. No.	Board of Studies	Sub. Code	Subject Name	Periods/Week			Examination Scheme					Total Mark	Credits L+(T+P)/2
				L	T	P	TA	FE	SE	ESE	Prac. ESE		
1	Biomedical Engg.	BM20811BM	Optical Fiber and Laser in Medicine	3	1	-	20	15	15	70	-	120	4
2	Biomedical Engg.	BM20812BM	Nuclear Medicine	3	1	-	20	15	15	70	-	120	4
3	Biomedical Engg.	BM20813BM	Tissue Engg.	3	1	-	20	15	15	70	-	120	4
4	Biomedical Engg.		(Elective- II)	4	1	-	20	15	15	70	-	120	5
5	Biomedical Engg.	BM20821BM	Tissue Engineering Lab	-	-	2	30	-	-	-	20	50	2
6	Biomedical Engg.	BM20822BM	Optical Fiber and Laser in Medicine Lab	-	-	2	30	-	-	-	20	50	2
7			Major Project	-	-	16	100	-	-	-	100	200	8
8			Discipline	-	-	-	50	-	-	-	-	50	2
			Total	13	4	20	290	60	60	280	140	830	31

Sub. Code	Elective -I
BM20831BM	Artificial Organs
BM20832BM	Bio Mems
BM20833BM	Robotics & Automation
BM20834BM	Embedded & Real Time System
BM20835BM	Nanotechnology
BM20836BM	Physiological System & Modelling

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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	OPTICAL FIBRE AND LASER IN MEDICINE	Subject code	BM20811BM
Semester	VIII	Board of Studies	BIOMEDICAL ENGINEERING
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	1		4

UNIT-I: INTRODUCTION:

Historical background .Medical Lasers: Introduction, Laser physics- fundamentals, principles, advances. Medical Laser system-fundamentals, principles. Laser safety-fundamentals.

APPLICATION OF LASERS IN DIAGNOSIS &THERAPY:

Introduction, Laser assisted diagnosis and therapy fundamentals.

UNIT-II: LASER-TISSUE INTERACTION:

Laser interaction with tissue-principles; laser assisted diagnostic –principles, application of lasers in diagnosis and imaging-advances, laser surgery and therapy –principles-photothermal & photomechanical mechanism, thermal interaction between laser and tissue-advances.

UNIT-III: SINGLE OPTICAL FIBER:

Introduction, historical background, optical fiber fundamentals. Light transmission in optical fibers-principles, optical properties of optical fibers-advances, fabrication of optical fibers- principles , optical fibers for UV, visible, IR light-principles, power transmission through optical fibers-principles.

UNIT-IV: OPTICAL FIBER BUNDLES:

Introduction, non ordered fiber optic bundles for light guides-fundamental & principles, ordered fiberoptic bundles for imaging devices-fundamentals & principles, fiberoscopes and endoscopes-fundamentals fiber optic imaging systems-advances.

ENDOSCOPY

Introduction endoscopic imaging systems-fundamental, principles, advances, endoscopic diagnostic –advances endiscopic therapy –fundamentals.

UNIT-V: CLINICAL APPLICATIONS OF FIBER OPTIC LASER SYSTEMS:

Introduction ,fiber optic laser system in cardiovascular disease, gastroenterology. Gynecology, neurosurgery, oncology, ophthalmology, orthopaedics, otolaryngology (ENT), urology, and flow diagram for laser angioplasty& photodynamic therapy.

TEXT BOOKS

1. 1. Laser and optical fibers in Medicine by Abraham Katzir, Academics Press,1998.

REFERENCE BOOKS

1. Therapeutic Lasers-Theory and Practice by G. David Baxter, Churchill Livingstone Publications.
2. Medical Lasers and their safe use DAVID H Shiney .Stephen and L Trokel, Springer, Springer. verlag publications.
3. Elements of fiber optics S.L.Wymer,Regents PHI
4. Biomedical Electronics and Instrumentation S.K.Venkata Ram Galgotia publications.

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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	NUCLEAR MEDICINE	Subject code	BM20812BM
Semester	VIII	Board of Studies	BIOMEDICAL ENGINEERING
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	1		4

UNIT-I: INTRODUCTION:
Basics of radioactivity: Atomic and Nuclear Structure, Radioactive radiations, Radioactive decay,Ineraction of radiation with matter:directly ionizing radiation, indirectly ionizing radiation (coherent scattering,photoelectric effect, Compton Effect,pair production);Radiopharmaceuticals: Diagnostic (*in vitro & in vivo*) & Therapeutic uses.

UNIT-II: RADIATION DETECTION & MEASUREMENT:
Radiation detector: Introduction,characteristics, modes of operation, detection mechanism, Types of Radiation. Detectors:Gas-filled (Ionisstion chamber,proportional counter,Geiger-Muller tubes), Scintillation Detectors (PMTs, solid & liquid detector),Semiconductor Detector.

UNIT-III: NUCLEAR MEDICINE IMAGING SYSTEM:
Components of imaging system:Collimators (Parallel Hole: High resolution, High & medium energy, Slant hole; Non parallel Hole:Converging & diverging, Pinhole, Fan-beam), Camera Head, Computers; Rectillinear Scanner; Single crystal scintillation camera;Multi crystal scintillation camera; Multicrystal scintillation camera; Positron Emission Tomography; Emission computed Tomography.

UNIT-IV: RADIATION THERAPY:
Biology of radiation therapy;Delivery of Radiotherapy: external beam, sealed source radiotherapy (branch therapy) & unsealed source radiotherapy; Radiation Modality (superficial, orthovoltagr, megavoltage); Megavoltage Radiotherapy: Cobolt-60 units & LINACs; Brachytherapy.

UNIT-V: RADIATION PROTECTION IN MEDICINE:
Principles of radiation protection; Biological effects of Radiation; Radiation Dosimetry; Dose Limits; Methods of Limiting Exposure; Radiation protection in diagnostic radiology & in Radiotherapy.

TEXT BOOKS

1. Essential Nuclear Medicine Physics, Rachel A. Powsener & Edward R. Powsener.
2. Medical Imaging Physics, William R. hendee & E. Russell Ritenour, Wiley.
3. Clinical Nuclear Medicine, Hans- Jurgen Biersack & Leonard M. Freeman, Springer.

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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	TISSUE ENGINEERING	Subject code	BM20813BM
Semester	VIII	Board of Studies	BIOMEDICAL ENGINEERIMG
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	1		4

UNIT-I: INTRODUCTION: Basic definition, Structural and organization of tissues: Epithelial, connective; vascularity and angiogenesis, basic wound healing, cell migration, current scope of development and use in therapeutic and in-vitro testing.

UNIT-II: CELL CULTURE: Different cell types, progenitor cells and cell differentiations, different kind of matrix, cell-cell interaction. Aspect of cell culture: cell expansion, cell transfer, cell storage and cell characterization, Bioreactors.

UNIT-III: MOLECULAR BIOLOGY ASPECTS: Cell signaling molecules, growth factors, hormone and growth factor signaling, growth factor delivery in tissue engineering, cell attachment: differential cell adhesion, receptor-ligand binding, and Cell surface markers.

UNIT-IV: SCAFFOLD AND TRANSPLANT: Engineering biomaterials for tissue engineering, Degradable materials (collagen, silk and polylactic acid), porosity, mechanical strength, 3-D architecture and cell incorporation. Engineering tissues for replacing bone, cartilage, tendons, ligaments, skin and liver. Basic transplant immunology, stems cells: introduction, hepatopoiesis.

UNIT-V: CASE STUDY AND REGULATORY ISSUES: Case study of multiple approaches: cell transplantation for liver, musculoskeletal, cardiovascular, neural, visceral tissue engineering. Ethical, FDA and regulatory issues of tissue engineering.

TEXT BOOKS:

1. Clemens van Blitterswijk, **Tissue Engineering**, Academic Press, 2008

REFERENCES:

1. **Principles of tissue engineering**, Robert. P.Lanza, Robert Langer & William L. Chick, Academic press.
2. **The Biomedical Engineering Handbook**, Joseph D. Bronzino, CRC press.
3. **Introduction to Biomedical** Engg. , Endarle, Blanchard & Bronzino, Academic press.
4. **Tissue Engineering**, B. Palsson, J.A. Hubbell, R.Plonsey & J.D. Bronzino, CRC- Taylor & Francis

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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	ARTIFICIAL ORGANS	Subject code	BM20831BM
Semester	VIII	Board of Studies	BIOMEDICAL ENGINEERIMG
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
4	1		5

UNIT-I: ARTIFICIAL HEART & CIRCULATORY ASSIST DEVICES:
Engineering Design of artificial Heart & Circulatory Assist Devices; Detailed Design to execute the plant; Heart Assist Technology; Blood Pumps; Prosthetic Heart Valves.

UNIT-II: ARTIFICIAL KIDNEY:
Structure & functions of Kidney; Hemodialysis: Principle, Dialysis membrane, membrane support structure, Dialyzer effectiveness; Hemofiltration; Plasmapheresis.

UNIT-III: ARTIFICIAL BLOOD:
Blood components & characteristics; Oxygen carrying plasma expanders; Blood substitutes; Crystalloid & colloidal solutions as volume expanders; Artificial oxygen carriers; Fluorocarbons ; Hemoglobin based artificial blood.

COCHLEAR IMPLANT:
Introduction; candidates for implant; the auditory system; the auditory periphery; theory of operation; evaluation of cochlear prosthesis; benefits & risks of implantation; the cost of implantation; the future of cochlear prosthesis.

UNIT-IV: ARTIFICIAL SKIN:
Structure & functions of skin; Characteristics & clinical use of skin substitutes; Two conceptual stages in the treatment of massive skin loss; Skin substitutes: characteristics & uses, types of skin substitutes.

UNIT-V: ARTIFICIAL PANCREAS:
Structure & function of Pancreas; Endocrine pancreas & insulin secretion; Diabetes; Insulin therapy; Insulin administration systems; Insulin production systems.

ARTIFICIAL LUNGS:
Gas exchange systems; Cardiopulmonary Bypass; Oxygen & CO_2 transport; Coupling of oxygen & CO_2 exchange; Shear-Induced Transport Augmentation and Devices for Improved Gas Transport.

TEXT BOOKS:
1. **The Biomedical Engineering Handbook**, Joseph D. Bronzino, CRC press.
2. **Artificial Organs**, Nadey S. Hakim, Springer.

REFERENCE BOOKS:
1. **Artificial Organs**, Gerald E. Miller, Morgan & Claypool Publishers.
2. **Biomaterials Science: An Introduction to Materials in Medicine** Buddy D. Ratner, Frederick J. Schoen, Allan, S. Hoffman, Jack E. Lemons

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Name of the subject	ARTIFICIAL ORGANS	Subject code	BM20831BM
Semester	VIII	Board of Studies	BIOMEDICAL ENGINEERIMG
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
4	1		5

UNIT-I: ARTIFICIAL HEART & CIRCULATORY ASSIST DEVICES:
Engineering Design of artificial Heart & Circulatory Assist Devices; Detailed Design to execute the plant; Heart Assist Technology; Blood Pumps; Prosthetic Heart Valves.

UNIT-II: ARTIFICIAL KIDNEY:
Structure & functions of Kidney; Hemodialysis: Principle, Dialysis membrane, membrane support structure, Dialyzer effectiveness; Hemofiltration; Plasmapheresis.

UNIT-III: ARTIFICIAL BLOOD:
Blood components & characteristics; Oxygen carrying plasma expanders; Blood substitutes; Crystalloid & colloidal solutions as volume expanders; Artificial oxygen carriers; Fluorocarbons ; Hemoglobin based artificial blood.

COCHLEAR IMPLANT:
Introduction; candidates for implant; the auditory system; the auditory periphery; theory of operation; evaluation of cochlear prosthesis; benefits & risks of implantation; the cost of implantation; the future of cochlear prosthesis.

UNIT-IV: ARTIFICIAL SKIN:
Structure & functions of skin; Characteristics & clinical use of skin substitutes; Two conceptual stages in the treatment of massive skin loss; Skin substitutes: characteristics & uses, types of skin substitutes.

UNIT-V: ARTIFICIAL PANCREAS:
Structure & function of Pancreas; Endocrine pancreas & insulin secretion; Diabetes; Insulin therapy; Insulin administration systems; Insulin production systems.

ARTIFICIAL LUNGS:
Gas exchange systems; Cardiopulmonary Bypass; Oxygen & CO_2 transport; Coupling of oxygen & CO_2 exchange; Shear-Induced Transport Augmentation and Devices for Improved Gas Transport.

TEXT BOOKS:
1. **The Biomedical Engineering Handbook**, Joseph D. Bronzino, CRC press.
2. **Artificial Organs**, Nadey S. Hakim, Springer.

REFERENCE BOOKS:
1. **Artificial Organs**, Gerald E. Miller, Morgan & Claypool Publishers.
2. **Biomaterials Science: An Introduction to Materials in Medicine** Buddy D. Ratner, Frederick J. Schoen, Allan, S. Hoffman, Jack E. Lemons

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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	BIO MEMS	Subject code	BM20832BM
Semester	VIII	Board of Studies	BIOMEDICAL ENGINEERIMG
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
4	1		5

UNIT-I: INTRODUCTION:

History of MEMS, market for MEMS, overview of MEMS processes properties of silicon, a sample MEMS process.

BASICS OF MICRO TECHNOLOGY:

Definitions and terminology, a sample process, lithography and etching.

MEMS BIOSENSORS:

Bio Flow Sensors, MEMS Images. Introduction to MEMS Prodesign software.

UNIT-II: MICROMACHINING:

Subtractive processes (wet and dry etching), additive processes (evaporation, sputtering, epitaxial growth).

FUNDAMENTAL DEVICES AND PROCESSES:

Basic mechanics and electrostatics for MEMS, parallel plate actuators, pull-in point, comb drives.

UNIT-II: FUNDAMENTAL DEVICES AND PROCESSES:

More electrostatic actuators; MEMS foundries, Cronos MUMPs (multi user MEMS process).

MUMPS MULTI USER MEMS PROCESS:

JDS Uniphase MUMPs processing sequence and design rules.

MUMPS AND SUMMIT:

Design rules; applications; micro hinges and deployment Actuators

UNIT-IV: CMOS MEMS:

CMOS foundry processes, integrated IC/MEMS, MEMS postprocessing, applications. Clean room lab techniques: clean rooms, gowning procedures; safety, fire, toxicity; acids and bases; photolithography.

UNIT-V: MEMS PACKAGING AND ASSEMBLY:

Microassembly: serial and parallel, deterministic and stochastic; microgrippers: HexSil process; packaging techniques.

FUTURE OF MEMS:

BioMEMS - neural implants, gene chips, diagnostic chips; MEMS in space; mechanical computers; invisible and ubiquitous computing.

TEXT BOOKS

1. HSU, TAI RAN, MEMS AND MICROSYSTEMS Design And Manufacture, Tata McGraw-Hill, 2002.
2. Rai-Choudhury, Prosenjit; Mems and Moems Technology and Applications SPIE 2000.

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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	ROBOTICS & AUTOMATION	Subject code	BM20833BM
Semester	VIII	Board of Studies	BIOMEDICAL ENGINEERIMG
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
4	1		5

UNIT-I: BASIC CONCEPTS:

Automation and Robotics, An overview of Robotics – present and future applications, Classification by coordinate system and control system, Dynamic stabilization of Robotics.

POWER SOURCES AND SENSORS:

Hydraulic, Pneumatic and electric drivers – Determination HP of motor and gearing ratio, variable speed arrangements, Path Determination - Machinery Vision – Ranging – Laser – Acoustic, Magnetic Fiber Optic and Tactile Sensor

UNIT-II: MANUPULATORS:

Construction of Manipulators, Manipulator Dynamic and Force Control, Electronic and Pneumatic manipulators.

ACTUATORS AND GRIPPERS:

Pneumatic, Hydraulic Actuators, Stepper Motor Control Circuits, End Effecter, Various types of Grippers, Design consideration.

UNIT-III:

Differential transformation and manipulators, Jacobians – problems .Dynamics: Lagrange – Euler and Newton – Euler formations – Problems.

UNIT-IV: KINEMATICS:

Forward and Inverse Kinematic Problems, Solutions of Inverse Kinematic problems, Multiple Solution, Jacobian Work Envelop – Hill Climbing Techniques.

UNIT-V: PATH PLANNING:

Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion – straight line motion – Robot programming, languages and software packages.

TEXT BOOKS

1. Industrial Robotics / Groover M P /Pearson Edu.
2. Robotics / Fu K S/ McGraw Hill.

REFERENCE BOOKS

1. Robotics, CSP Rao and V.V. Reddy, Pearson Publications (In press)
2. Robotics and Control / Mittal R K & Nagrath I J / TMH.
3. An Introduction to Robot Technology, / P. Coiffet and M. Chaironze / Kogam Page Ltd. 1983 London.
1. Robotic Engineering / Richard D. Klafter, Prentice Hall
2. Robot Analysis and Intelligence / Asada and Slow time / Wiley Inter-Science
3. Introduction to Robotics / John J Craig / Pearson Edu.
4. Robot Dynamics and Control by Mark W. Spong and M. Vidyasagar, John Wiley & Sons.

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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	EMBEDDED & REAL TIME SYSTEM	Subject code	BM20834BM
Semester	VIII	Board of Studies	BIOMEDICAL ENGINEERIMG
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
4	1		5

UNIT-I: EMBEDDED SYSTEMS:
Overview, design challenge, processor technology, IC technology, Design Technology, Trade-offs. Single purpose processors RT-level combinational logic, sequential logic (RT-level), custom single purpose processor design (RT-level), optimizing custom single purpose processors.

UNIT-II: GENERAL PURPOSE PROCESSORS:
Basic architecture, operation, Pipelining, Programmer's view, development environment, Application Specific Instruction-Set Processors (ASIPs) – Micro Controllers and Digital Signal Processors.

UNIT-III: STATE MACHINE AND CONCURRENT PROCESS MODELS:
Introduction, models Vs. languages, finite state machines with data path model (FSMD), using state machines, program state machine model (PSM), concurrent Process model, concurrent processes, communication among processes, synchronization among processes, implementation, data flow model, real-time systems.

COMMUNICATION INTERFACE:
Need for communication interfaces, RS232 / UART, RS422 / RS485, USB, Infrared, IEEE 1394 Firewire, Ethernet, IEEE 802.11, Bluetooth.

UNIT-IV: EMBEDDED / RTOS CONCEPTS – I:
Architecture of the Kernel, Tasks and Task scheduler, Interrupt service routines, Semaphores, Mutex.

EMBEDDED / RTOS CONCEPTS – II:
Timers, Memory Management, Priority inversion problem, Embedded operating systems Embedded Linux, Real-time operating systems, RT Linux, Handheld operating systems, Windows CE.

UNIT-V: DESIGN TECHNOLOGY:
Introduction, Automation, Synthesis, Parallel evolution of compilation and synthesis, Logic Synthesis, RT synthesis, Behavioral Synthesis, Systems Synthesis and Hardware/ Software Co-Design, Verification, Hardware/Software co-simulation, Reuse of intellectual property codes.

TEXT BOOKS

1. Embedded System Design – A Unified Hardware/Software Introduction – Frank Vahid, Tony D. Givargis, John Wiley, 2002.
2. Embedded / Real Time Systems – KVKK Prasad, Dreamtech Press, 2005.

REFERENCE BOOKS

1. Embedded Microcomputer Systems – Jonathan W. Valvano, Brooks / Cole, Thompson Learning.
2. An Embedded Software Primer – David E. Simon, Pearson Ed., 2005.
3. Introduction to Embedded Systems – Raj Kamal, TMS, 2002.

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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	NANOTECHNOLOGY	Subject code	BM20835BM
Semester	VIII	Board of Studies	BIOMEDICAL ENGINEERIMG
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
4	1		5

UNIT-I: INTRODUCTION TO NANOTECHNOLOGY:

Background, definition , basic ideas about atoms and molecules, physics of solid state, review of properties of matter and quantum mechanics

UNIT-II: PREPARATION OF NANOSTRUCTURED MATERIALS:

Lithography: nanoscale lithography, Ebeam lithography, dip pen lithography, nanosphere lithography. Sol gel technique Molecular synthesis, Self-assembly, Polymerization

UNIT-III: CHARACTERIZATION OF NANOSTRUCTURED MATERIALS:

Microscopy: TEM, SEM, SPM techniques, confocal scanning microscopy, Raman microscopy-Basic principles, applicability and practice to colloidal, macromolecular and thin film systems. Sample preparation and artifacts;

POLYMER FRACTIONATION TECHNIQUES:

SEC, FFF, Gel electrophoresis: Basic theory, principles and practice.

THERMAL ANALYSIS:

Basic principles, theory and practice. Micro DSC in the study of phase behavior and conformational change

MASS SPECTROMETRY OF POLYMERS:

MALDI TOF MS – Basic theory, principles and practice. Applicability to proteins, polyethers, controlled architecture systems

UNIT-IV: CROSS-CUTTING AREAS OF APPLICATION OF NANOTECHNOLOGY:

Energy storage, Production and Conversion. Agriculture productivity enhancement Water treatment and remediation. Disease diagnosis and screening. Drug delivery systems. Food processing and storage. Air pollution and remediation. Construction. Health Monitoring. Vector and pest detection, and control. Biomedical applications. Molecular electronics. Nanophotonics. Emerging trends in applications of nanotechnology

UNIT-V: INDUSTRIAL IMPLICATIONS OF NANOTECHNOLOGY:

Development of carbon nanotube based composites. Nanocrystalline silver Antistatic conductive coatings. Nanometric powders. Sintered ceramics. Nanoparticle ZnO and TiO_2 for sun barrier products. Quantum dots for biomarkers. Sensors. Molecular electronics. Other significant implications

TEXT BOOKS

1. Guozhong Cao, “Nanostructures and Nanomaterials”, Imperial College Press, London
2. Mark Ratner and Daniel Ratner, “A Gentle Introduction to Next Big Thing”, Pearson Education 2005

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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	PHYSIOLOGICAL SYSTEM & MODELLING	Subject code	BM20836BM
Semester	VIII	Board of Studies	BIOMEDICAL ENGINEERIMG
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
4	1		5

UNIT-I:
Feedback control system, Homeostasis, Regulatory system, servomechanism biological control systems, similarities and differences, components of living control systems. Mathematical approach, electrical analogues

UNIT-II:
Introduction to various process controls like cardiac rate, blood pressure, respiratory rate, blood glucose regulation, pharmaco-modeling & drug diffusion system.

UNIT-III:
Modeling of human thermal regulatory systems parameters involved, control system model etc. Biochemistry of digestion, type of heat loss from body, Models of heat transfer between subsystems of human body like skin and core etc and systems like within body environment etc.

UNIT-IV
Respiratory system modeling oxygen uptake by RBC and pulmonary capillaries mass balancing by lungs, gas transport mechanism of lungs and O_2 and CO_2 transport in blood and tissues

UNIT-V
Ultra filtration system, transport through cells and tubles passive diffusion, facilitated diffusion and action transport methods of waste removal. Counter current model of urine formations in enthrone, model of Henle's loop.

TEXT BOOKS

1. Medical Engineering –Rushmeer.
2. Bio-Medical Engineering principles, David Cooney Moral dekken INC. New York and Basel.
3. Advanced Biomedical Engg. David Cooney.
4. Regulation and Control in Physoological Systems Ibrall and Gution, Instruments Society, USA
5. The artificical kidney, Yukihito Nose, C.V. Moshy CO
6. Electronic Devices and Rehabilitation, Webster
7. Engineering in heat blood vessels, Mysers, Wiley International
8. Engineering in Physiology, Brown & Gann Vol 1 to 12

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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	TISSUE ENGINEERING LAB	Subject code	BM20813BM
Semester	VIII	Board of Studies	BIOMEDICAL ENGINEERIMG
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	1		4

List of Experiments

1. Synthesis of wound healing patch
2. Synthesis of drug loaded patch
3. Haemocompatability study of biomaterials
4. Synthesis of amino acid loaded patch
5. Synthesis of hydroxyapatite
6. Study of MTT assay
7. Synthesis of mucoadhesive patch
8. Study of tensile strength of polymer composite
9. Synthesis of hydrogel film
10. Determination of swelling index of hydrogels

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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	OPTICAL FIBRE AND LASER IN MEDICINE	Subject code	BM20811BM
Semester	VIII	Board of Studies	BIOMEDICAL ENGINEERING
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	1		4

Lab Exercise 1. Perform light guiding via making fiber optics cable

Lab Exercise 2. Perform fiber optics cable Transmission

Lab Exercise 3. To study the characteristics of connectors and splices

Lab Exercise 4. Comparison of the transmission characteristics of a fiber splice with and without

Index matching

Lab Exercise 5. Determining losses due to fiber end preparation

Lab Exercise 6. To determine light source upper frequency 3 dB bandwidth using a photodiode as the optical detector

Lab Exercise 7. To study fiber optics transmitters

Lab Exercise 8. Designing receiver amplifier for fiber optics communication system.