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- VII

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	BM20711BM	Biomaterials	3	1	-	20	15	15	70	-	120	4
2	Biomedical Engg	BM20712BM	Microcontroller	3	1	-	20	15	15	70	-	120	4
3	I.T	IT20713BM	Database management system	3	1	-	20	15	15	70	-	120	4
4	Biomedical Engg		(Elective -I)	4	1	-	20	15	15	70	-	120	5
5	Biomedical Engg	BM20721BM	Microcontroller Lab	-	-	3	30	-	-	-	20	50	2
6	I.T	IT20722BM	DBMS Lab	-	-	3	30	-	-	-	20	50	2
7			Pract. Training	-	-	-	50	-	-	-	-	50	2
8			Minor Project	-	-	12	100	-	-	-	50	150	6
9	Humanities	EN20723BM	Seminar & Report writing	-	-	2	50	-	-	-	-	50	1
			Total	13	4	20	340	60	60	280	90	830	30

Sub. Code	Elective -I
BM20731BM	Artificial Intelligence & Neural Networks
BM20732BM	Rehabilitation Engineering
BM20733BM	Drug Delivery System
BM20734BM	Project Planning, Management & Evaluation
IT20735BM	Software Technology

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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	Biomaterials	Subject code	BM20711BM
Semester	VII	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 - PROPERTIES OF MATERIALS

Bulk properties and Surface properties of Materials.

MATERIALS USED IN MEDICINE:

Metals; Polymers; Hydrogels; Bioresorbable and Biodegradable Materials

UNIT-II- MATERIALS USED IN MEDICINE:

Fabrics; Biologically Functional Materials; Ceramics; Natural materials; Composites, thin films, grafts and coatings; Pyrolytic Carbon for long-term medical Implants; Porous materials; Nano biomaterials.

UNIT-III- HOST REACTIONS TO BIOMATERIALS:

Inflammation; Wound healing and the Foreign body response; Systemic toxicity and Hypersensitivity; Blood coagulation and Blood-materials Interactions; Tumorigenesis.

DEGRADATION OF MATERIALS IN BIOLOGICAL ENVIRONMENT:

Degradation of Polymers, Metals and Ceramics.

UNIT-IV-APPLICATION OF BIOMATERIALS:

Cardiovascular Applications; Dental implants; Adhesives and Sealants; Opthalmologic Applications; Orthopedic Applications; Drug Delivery System; Sutures; Bioelectrodes; Biomedical Sensors and Biosensors.

UNIT-V- IMPLANTS AND DEVICES:

Sterilization of implants and Devices; Implants and Device failure; Implant retrieval and Evaluation.

PRODUCTS AND STANDARDS: Voluntary Consensus Standards; Product Development and Regulation.

TEXT BOOKS

1. **Biomaterials Science: An Introduction to Materials in Medicine** Buddy D. Ratner, Frederick J. Schoen, Allan S. Hoffman, Jack E. Lemons
2. Hench L L Ethridgc E.C. **Biomaterials, an interfacial approach**, Academic press 1982

REFERENCE BOOKS

1. Bronzino J D, **The biomedical engineering handbook** CRC Press

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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	Microcontroller	Subject code	BM20712BM
Semester	VII	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 TO MICRO CONTROLLER:

A brief History of 8051, 8052, 8031, 8751, AT89651, Pin configuration of 8051, 89C52RD2.

UNIT II -INSTRUCTION SET OF 8051:
Assembly language programming, Internal structure of 8051, Power resetting, Built up RAM & ROM, I/O programming and Addressing modes.

UNIT III- COUNTER & TIMER DETAILS:

Counter and timer programming using 8051, interrupt programming, Types of interrupt.

UNIT IV- ASYNCHRONOUS SERIAL COMMUNICATION:

Data programming, RS232 Standard, RS422 Standard, 1488 & 1489 Standard, GPIB, Max 232 Driver, Serial communication programming.

UNIT V- INTERFACING:
ADC & DAC interfacing, stepper motor interfacing, keyboard interfacing, Memory interfacing, embedded design concept, Embedded design card, 8096 Architecture.

REFERENCE BOOKS

1. Microprocessor: Architecture, Programming, Interfacing and System Design, Rajkamal, Pearson Education.
2. The 8085 Microcontroller and Embedded System using Assembly and C, Mazidi, Mazidi & McKinlay, 2nd Ed., PHI.
3. 8085 Programming , Interfacing and Application K.J. Ayala, Penram Pub.
4. 8 bit Microprocessor & Embedded System Manual.
5. Programming and Customizing the 8081 Microcontroller, Predko, TMH.
6. Handbook of Microcontroller, Myke Predko, TMH.

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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	Database Management System	Subject code	IT20713BM
Semester	VII	Board of Studies	INFORMATION TECHNOLOGY
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	1		4

UNIT-I: INTRODUCTION TO DATABASE SYSTEMS:

Patient Database: Patient Database strategies for HIS, data acquisition, patient admission, transfer, discharge, evaluation & management. Computer based patient record, clinical decision support systems.

Managing Data: File Systems versus a DBMS; Advantages of a DBMS, Describing and Storing Data in a DBMS, Queries in a DBMS, Transaction Management; Structure of a DBMS.

ENTITY – RELATIONSHIP MODEL:

Using High – Level Conceptual Data Models for Database Design; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; ER Design for the HOSPITAL Database; ER Diagrams, Naming Conventions and Design Issues.

UNIT-II: RELATIONAL MODEL AND RELATIONAL ALGEBRA:

Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations and Dealing with Constraints Violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER-to-Relational Mapping.

UNIT-III: SQL – THE RELATIONAL DATABASE STANDARD:

SQL Data Definition and Data Types, Specifying Basic Constraints in SQL, Schema Change Statements in SQL; Basic Queries in SQL; More Complex SQL Queries; Insert, Delete and Update Statements in SQL; Additional Features of SQL; Specifying General Constraints as Assertion; Views (Virtual Tables) in SQL; Database Programming: Issues and Techniques; Embedded SQL, Dynamic SQL.

UNIT-IV: DATABASE DESIGN:

Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form; Properties of Relational Decompositions; Algorithms for Relational Database Schema Design; Multivalued Dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form; Inclusion Dependencies; Other Dependencies and Normal Forms.

UNIT-V: HOSPITAL INFORMATION SYSTEM:

Information technology in Healthcare; Electronic Medical and Patient Record (EMR/EPR); DataWarehousing: Design through implementation for the Healthcare Professional; Functional Capabilities of a Computerized HIS; Need for Computerization in Hospitals; Security of Computer Records.

TEXT BOOKS

The Biomedical Engineering Handbook-Volume II (2nd Edition) - by Joseph D. Bronzino, CRC/IEEE Press, 2000.

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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	ELECTIVE-I ARTIFICIAL INTELLIGENCE & NEURAL NETWORKS	Subject code	BM20731BM
Semester	VII	Board of Studies	BIOMEDICAL ENGINEERING
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
4	1		5

UNIT-I

Introduction to Artificial Intelligence: Definition. A.I Applications, A I representation. Properties of internal Representation, General problem solving, production system, control strategies: forward and backward chaining.

UNIT-II

Heuristic search techniques. Depth First Search, Breadth First Search, Best first search, mean and end analysis, A* and AO* Algorithm.

UNIT-III

Knowledge representation using predicate logic: predicate calculus, Predicate and arguments, resolution and unification Semantic, Frame System, Scripts, conceptual Dependency.

UNIT-IV

Knowledge representation using non-monotonic logic: TMS (Truth maintenance system), statistical and probabilistic reasoning, fuzzy logic, structure knowledge representation.

UNIT-V

Introduction to Artificial Neural Network, supervised and unsupervised learning, pattern recognition problems, perception, Back propagation network, Application of neural network.

TEXT BOOKS

1. Eugene, Charniak, Drew Mcdermott: Introduction to artificial intelligence.
2. Elaine Rich and Kerin Knight: Artificial Intelligence.
3. Kishen Mehrotra, Sanjay Rawika, K Mohan; Artificial Neural Network.

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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	ELECTIVE-I REHABILITATION ENGINEERING	Subject code	BM20732BM
Semester	VII	Board of Studies	BIOMEDICAL ENGINEERING
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
4	1		5

UNIT-I: ENGINEERING CONCEPTS IN REHABILITATION ENGINEERING, ANTHROPOMETRY:
Methods for Static and dynamic Measurements: Area Measurements, Measurement of characteristics and movement, Measurement of Muscular Strength and capabilities. Measurement tools and processes in Rehabilitation engineering: fundamental principles, structure, function; performance and behavior. Subjective and objective measurement methods.

UNIT-II: ERGONOMIC ASPECTS IN DESIGNATING DEVICES:
Introduction to Models in Process Control, Design of Information Devices, Traditional Devices, V.D.U' s, Using color, Design of Controls

UNIT-III: ENGINEERING CONCEPTS IN SENSORY REHABILITATION ENGINEERING. SENSORY AUGMEN- TATION AND SUBSTITUTION:
Visual system: Visual augmentation, Tactual vision substitution, and Auditory vision substitution. Auditory system: Auditory augmentation, Audiometer, *Hearing aids*, cochlear implantation, visual auditory substitution, tactual auditory substitution, Tactual system: Tactual augmentation, Tactual substitution,

UNIT-IV: ORTHOPEDIC PROSTHETICS AND ORTHOTICS IN REHABILITATION:
Engineering concepts in motor rehabilitation, applications. Computer Aided Engineering in Customized Component Design. Intelligent prosthetic knee. A hierarchically controlled prosthetic hand. A self-aligning orthotic knee joint. externally powered and controlled Orthotics and Prosthetics. FES systems-Restoration of hand function, restoration of standing and walking, Hybrid Assistive Systems (HAS).

UNIT-V: COMPUTER APPLICATIONS IN REHABILITATION ENGINEERING:
Interfaces in compensation for visual perception. Improvement of orientation and mobility, Computer assisted lip reading, Brain computer interface.

TEXT BOOKS

1. Bronzino, Joseph; Handbook of biomedical engineering. 2nd edition,CRC Press, 2000.

REFERENCE BOOKS

1. Horia- Nocholai Teodorecu, L.C.Jain , intelligent systems and technologies in rehabilitation engineering; CRC; December 2000.
2. Robinson C.J Rehabilitation engineering. CRC press 1995
3. Etienne Grandjean, Harold Oldroyd, Fitting the task to the man, Taylor & Francis, 1988
4. Principles of deadlock – deadlock prevention, detection and avoidance dining philosophers problem – example Systems.

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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	ELECTIVE-I DRUG DELIVERY SYSTEM	Subject code	BM20733BM
Semester	VII	Board of Studies	BIOMEDICAL ENGINEERING
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
4	1		5

UNIT-I: PHYSICOCHEMICAL PROPERTIES OF DRUGS: Activity of drug solutions; Osmotic properties of drug solutions; ionization of drugs in solution.
DRUG STABILITY: Chemical decomposition of drug; kinetics of decomposition in solution; decomposition in the solid phase; factors affecting drug stability.

UNIT-II: DRUG SOLUBILITY: Factors affecting drug solubility; solubility products; partitioning.
SURFACE AND INTERFACIAL BEHAVIOR: Surfaces and surfactant; surface activity of drug; insoluble mono layer; adsorption isotherms; applications of adsorption in pharmaceutical science; micellisation; solubilisation using micelles.

UNIT-III: DRUG DISPERSE SYSTEMS: Drug emulsions; drug suspensions; applications of disperse systems in delivery of pharmaceuticals; pharmaceutical gels.
POLYMERS FOR DRUG DELIVERY: Types of polymer, pharmaceutical polymers, physicochemical properties of polymers and relationship with structure, properties, kinetics, mechanisms and applications, delivery systems for macromolecules.

UNIT-IV: FORMULATION METHODS: Principles, technology and manufacture of sustained drug delivery systems and applications to therapeutic delivery systems designed to release a specific quantity of drug at controlled rates; Diffusional system, Fick's law of diffusion, transdermal delivery, ocular delivery and intra-uterine system; modified-release by coating: enteric and other coated tablets, particles and other systems.

UNIT-V: CHEMICAL METHODS: Prodrugs - definition of the prodrug; concept; prodrugs of various functional groups; design strategies for modification of drug properties; modification of the physicochemical, Pharmacokinetics and pharmacodynamic properties of a drug through chemical transformation. Applications of the prodrug approach: transport theory, oral absorption, reduction of side effects, Bioavailability.

TEXT BOOKS

1. Pharmaceutical Biotechnology – S.P. Vyas, V.K. Dixit, CBS publication and Distributors.

REFERENCE BOOKS

1. Industrial microbiology – L.E. Casida JR, New age International (P) Limited Publication
2. Introduction to Biopharmaceutics and Pharmacokinetics, Dr. H.P.Tipnis, Dr. M.S.Nagarsenker, Nirali Prakasan Publications.

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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	ELECTIVE-I Project Planning, Management & Evaluation	Subject code	BM20734BM
Semester	VII	Board of Studies	BIOMEDICAL ENGINEERING
Maximum Marks	70	Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
4	1		5

UNIT-I: IDENTIFICATION OF PROJECTS:
Generation and screening of idea, monitoring corporate appraisal, preparing project profiles and project rating index.

UNIT-II: FEASIBILITY STUDIES:
Market and demand analysis, technical analysis, financial analysis and economic viability.

UNIT-III: PROJECT APPRAISAL:
Criteria, net present value, internal rate of return, payback period and accounting rate of return method

UNIT-IV: PROJECT MANAGEMENT AND IMPLEMENTATION:
Project planning, project control, prerequisites of Implementation. Network techniques of project management- Project evaluation and review technique (PERT) and critical path method (CPM)

UNIT-V: PROJECT REVIEW AND CONTROL:
Initial review, performance evaluation, abandonment analysis and its behavioral issues

TEXT BOOKS

1. Project planning, analysis, selection, implementation and review by Prasanna Chandra, TMH.

REFERENCE BOOKS

1. Project management, Dr. Harold Kerzner.
2. Total Project management, Dr. P K Macmillan.

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Name of the subject	ELECTIVE-I SOFTWARE TECHNOLOGY	Subject code	IT20735BM
Semester	VII	Board of Studies	INFORMATION TECHNOLOGY
Maximum Marks	70	Minimum Marks	2
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
4	1		5

UNIT-I:ASSEMBLY LANGUAGE PROGRAMMING:
Pentium Assembly languages-Registers, Memory Model, Addressing mode, 1source Link, Installation, Assembler Directives.

ASSEMBLER DESIGN:
Simple manual Assembler, Assembler Design Process, Load and Go Assembler, Object File Formats.

UNIT-II: LINKERS:
Linking -Combining Object Modules, Pass I, Pass II; Library Linking; Position Independent Code (PIC); Shared Library Linking.

LOADERS:
Binary Image; Types of Loaders.

UNIT-III: MACROPROCESSORS:
Macro in NASM- Local Labels in Macro Body, Nested Macros.; Design of Macroprocessors – Major Data Structures, Macroprocessing Technique, Simple macroprocessors without nesting, Nested calls & definitions

UNIT-IV: COMPILERS:
Lexical Analysis; Syntax Analysis; Intermediate Code Generation; Target Code Generation; Optimizing Transformation

UNIT-V: TEXT EDITORS:
Design of a Text Editor; Data Structures for Text Sequences; Text Document Design; Text View Design

DEBUGGER:
Features; Breakpoint mechanism; Hardware support; context of Debugger; Check pointing & reverse Execution

TEXT BOOKS

1. SYSTEM SOFTWARE by Santanu Chattopadhyay ; Prentice Hall of India
2. Software Engineering By Roger S Pressman ; Mc -Graw Hill

REFERENCE BOOKS

1. Foundations of Software Technology and Theoretical Computer Science, By V.(Venkatesh) Raman: Springer
2. Software Visualization by John Stasko; MIT press
3. Software Engineering By Rajib Mall : PHI

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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	MICROCONTROLLER LAB	Subject code	BM20721BM
Semester	VII	Board of Studies	BIOMEDICAL ENGINEERIMG
Maximum Marks		Minimum Marks	25
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
			2

1. Programs on Data Transfer Instructions
2. Programs on Arithmetic and Logical Instructions
3. Programs on Branch Instructions
4. Programs on Subroutines
5. Programs for Sorting of an Array
6. Programs on Conditional CALL & RETURN
7. Programs to generate delay, Programs using serial port and on-Chip timer/ counter.
8. Programs on Interrupts (Software and Hardware)
9. Programs on Data Transfer between two PCs using RS.232 C Serial Port
10. Programs for Stepper Motor Control
11. Programs for Keyboard Interface / LCD Interface
12. Programs for DAC Interface-Waveform generations
13. Programs on External ADC and Temperature control interface to 8051

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DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	DBMS LAB	Subject code	IT20722BM
Semester	VII	Board of Studies	BIOMEDICAL ENGINEERING
Maximum Marks		Minimum Marks	
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
			2

Lab Activity 1: Creation of base table by SQL command according to specification as per the instruction on lab class lab class

Lab Activity 2: Select operations Execution on base table created by lab activity 1 by SQL command according to specification as per the instruction.

a) Single select operations
b) Multiple select operations

Lab Activity 3: Update operations Execution on base table created by lab activity 1 by SQL command according to specification as per the instruction.

a) Single update operations
b) Multiple update operations

Lab Activity 4: Update operations Execution on base table created by lab activity 1 by SQL command according to specification as per the instruction.

a) Single insert operations
b) Multiple insert operations

Lab Activity 5: Update operations Execution on base table created by lab activity 1 by SQL command according to specification as per the instruction.

a) Single delete operations
b) Multiple delete operations

Lab Activity 6: Creation of view by SQL command from table created by lab activity 1 according to specification as per the instruction on lab class lab class.

Lab Activity 7: Statically function (i.e avg, sum, max, min) operations Execution on base table created by lab activity 1 by SQL command according to specification as per the instruction.