



**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**  
**Semester- VI**

**Course- B.Tech.(NIT Scheme)**

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.	BM206 11BM	Medical Image Processing	3	1	-	20	15	15	70	-	120	4
2	Biomedical Engg.	BM206 12BM	Management Science	3	1	-	20	15	15	70	-	120	4
3	Biomedical Engg.	BM206 13BM	Telemedicine	3	1	-	20	15	15	70	-	120	4
4	Biomedical Engg.	BM206 14BM	Basic Clinical Science-2	3	1	-	20	15	15	70	-	120	4
5	Biomedical Engg.	BM206 15BM	Bioelectricity	3	1	-	20	15	15	70	-	120	4
6	Biomedical Engg.	BM206 16BM	Bioinformatics	4	1	-	20	15	15	70	-	120	5
7	Biomedical Engg.	BM206 21BM	Bioinformatics Lab	-	-	3	30	-	-	-	20	50	2
8	Biomedical Engg.	BM206 22BM	Medical image Processing Lab	-	-	3	30	-	-	-	20	50	2
9	Biomedical Engg.	BM206 23BM	Telemedicine Lab	-	-	3	30	-	-	-	20	50	2
10	Humanities	EN2062 4BM	I. & E Skill	-	-	2	25	-	-	-	-	25	1
11			Discipline	-	-	-	25	-	-	-	-	25	1
			Total	19	6	11	260	90	90	420	60	920	33



## DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	Medical image processing	Subject code	BM20611BM
Semester	Sixth	Board of Studies	Biomedical Engg
Maximum Marks	120	Minimum Marks	
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	1	3	4

### Unit I: Introduction & fundamentals

Origin of DIP, examples of fields that use DIP, fundamentals of DIP, components of an DIP system, Digital image representation, Image characteristics & quality, Image viewing conditions, Elements of visual perception, light and the EM spectrum, a simple image formation model, image sampling and quantization, some basic relationships between pixels.

### Unit II: Image enhancement in spatial domain & frequency domain

Image Enhancement in Spatial Domain: Background, some basic gray level transformations, Histogram processing, enhancement using arithmetic and logic operations, basic of spatial filtering, smoothing spatial filters, sharpening spatial filters.

Image Enhancement in the Frequency Domain: Background, Introduction to FT and frequency domain, smoothing frequency domain filters, sharpening frequency domain filters, homomorphic filtering, additional properties of the 2-D FT, convolution and correlation theorems.

### Unit III: Image compression

Fundamentals, image compression models, elements of information theory, error free Compression, run length coding, loss less predictive coding, lossy predictive coding, image compression standards, JPEG, video compression standards.

### Unit IV: Image segmentation

Detection of discontinuities, point detection, line detection, edge detection, gradient operators, laplacian, edge linking and boundary detection, thresholding, region based segmentation.

### Unit V: Image representation, description & recognition

Representation, Boundary descriptors, Regional descriptors, Principal component analysis, Recognition based on decision theoretic & structural methods.

### TEXT BOOKS

1. Digital Image Processing by Rafael .C .Gonzalez and Richard. E.
2. Digital Image Processing – by William K. Pratt 3rd Edition John Wiley and Sons Inc.
3. P. Suetens, Fundamentals of image processing, Cambridge University Press, 2002.
4. R. C. Gonzalez, R. E. Woods, S. L. Eddins , Digital Image Processing Using MATLAB(R) ,Course Technology, 1 edition, 2004
5. A. K Jain, Fundamentals of image processing, prentice hall, Eagle cliffs, New Jersey, 1989
6. Chanda&Majumdar, Digital image processing and analysis, PHI, 2003



## DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	Management Science	Subject code	BM20612BM
Semester	Sixth	Board of Studies	Biomedical Engg.
Maximum Marks	120	Minimum Marks	
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	1		4

**Unit I: Nature of management:** Meaning of management; Characteristics of management: Management Vs. Administration; Importance of Management; Development of Management Thoughts; Principles of Management; The Management Functions; Inter-relationship of Managerial functions.  
Nature, Purpose and Objectives of Planning; Organizing: nature and Purpose; Authority and Responsibility; Controlling: System and Process of Controlling; Control Techniques.

**Unit II: Personnel management & Conflict Management:** Functions of personnel management; Manpower planning; Process of manpower planning; Recruitment; Selection; Promotion – Seniority vs. Merit; Training: objectives and types; Grievances; Motivation & its types; Models for Motivation; Reward and Punishment; Leaders: Kind of Leaders, leadership styles, Roles and Function of Leaders.  
Kinds and cause of Conflict; Settlement of Conflict; Group and Team Working; Organizational Design and Development.

**Unit III: Production management & Cooperate planning:** Definition, Objectives, Functions and Scope; Production Planning and Control; its significance; stages in production planning and control; Planning and Design of Production and Operation Systems: Facilities Planning, Location, Layout and Movement of Materials, Materials management Inventory Control, Maintenance Management. Cooperate planning: mission, objectives, programs, goals, environmental scanning: SWOT –strategy formation and implementation.

**Unit IV: Marketing management & decision making:** Definition of marketing, Marketing concept, objectives & functions of marketing, Marketing environment, Consumer markets and buyer behavior, Marketing mix; Marketing Research: Meaning, Definition, objectives, Importance, Limitations, Process; Advertising & Sales Promotion: meaning of advertising, objectives, functions, criticism; Channels of Distribution.  
decision making: Definition, types of decision, its importance and significance, decision making process, strategic and tactical decision, decision support system.

**Unit V: Financial management & network analysis to project management:** Financial management: Objectives of Financial Management, Functions and importance of Financial Management; Brief introduction to the concept of capital structure and various sources of finance; Book Keeping; Financial Statement Analysis; Financial Ratios; Capital Budgeting; Break Even Analysis. Network analysis to project management: PERT/CPM- Application of Network Techniques to engineering problems.

### TEXT BOOKS

1. Principles and Practice of Management – R. S Gupta, B. D. Sharma, N. S. Bhalla (Kalyani Publishers)
2. Organisation and Management – R. D. Aggarwal (Tata McGraw Hill)
3. Principles and Practices of Management – L. M. Prasad (Sultan Chand & Sons)
4. Management – Harold, Koontz and CyriloDonell (McGraw Hill)
5. Marketing Management – S.A. Sherlikar (Himalaya Publishing House, Bombay)
6. Financial Management – L.M. Pandey (Vikas Publishing House, New Delhi)



## DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	Telemedicine	Subject code	BM20613BM
Semester	Sixth	Board of Studies	Biomedical Engg
Maximum Marks	120	Minimum Marks	
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	1	3	4

### Unit I: Introduction of telemedicine

History of Telemedicine, Block diagram of telemedicine system, Definition of telemedicine, Tele health, Tele care, Origin & development of telemedicine, Scope, benefits and limitation of telemedicine.

### Unit II: Communication & networks

Types of information: Audio, Video, Still image, Text and Data, Fax.

Types of Communication & network: PSTN, POTS, ATN, ISDN, Internet and Wireless Communications: GSM, Satellite and Micro wave, Different modulation techniques, Types of antenna depending on requirement, Integration and Operational issue: System Integration, Store and Forward operation, Real Time telemedicine.

### Unit III: Data exchange

Network Configuration, Circuit and packet switching, H.320 series (Video phone based ISDN) T.120, H.324 (Video phone based PSTN), Video Conferencing.

### Unit IV: Data security and standards & ethical and legal aspects of telemedicine

Data security and standards: Encryption, Cryptography, Mechanism of Encryption, Phase of Encryption. Protocols: TCP/IP, ISO-OSI, Standard to follow DICOM, HL 7

Ethical and legal aspects of telemedicine: Confidentiality and law, Patient rights and consent, access to medical records, consent treatment, intellectual property rights, jurisdictional issue.

### Unit V: Tele communication based biomedical systems

Tele-radiology system, Tele-pathology, Tele-cardiology, Tele-oncology, Tele-surgery, Tele-education and Tele-Monitoring.

### TEXT BOOKS

1. A .C. Norris, Essentials of Telemedicine and Telecare, John Wiley & Sons, 2002
2. R. Wootton & Victor Patterson, Introduction to Telemedicine, RSM Press, 2006
3. Mohan Bansal, Medical Informatics-A Primer, Tata McGraw-Hill, 2003

### REFERENCE BOOKS

1. Olga Ferrer-Roca & M. Sosa Iudicissa, Handbook of Telemedicine, IOS Press 2002
2. A. Darkins & M. Cary, Telemedicine and Telehealth: Principles, Policies, Performance and Pitfalls, Springer Publishing Company; 1 edition, 2000
3. R. Latifi, Current Principles and Practices of Telemedicine and e-Health: Volume 131 Studies in Health Technology and Informatics, IOS Press; 1 edition, 2008



## DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	Basic Clinical Science II	Subject code	BM20614BM
Semester	Sixth	Board of Studies	Biomedical Engg
Maximum Marks	120	Minimum Marks	
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	1		4

### Unit I: Orthopedics & Fracture

Bioengineering aspects of fracture management. Structure of bone :gross, microscopic biochemical. Fracture-types mechanism of injury. Normal healing of fractures. Pieze electricity and electrical stimulation for bone healing. Treatment of fractures-general principles –closed methods. External fixation and internal fixation. Biomechanics of internal fixation and description of external fixators. Bioengineering principles of internal fixation. Intra medullary nails. Plates, screws. the concepts of load hearing and lode sharing and shielding by implants.

### Unit II: Joints

Bioengineering aspects of joint diseases. Structure of joints – fibrous, cartilaginous, synovial. Lubrication of joints and the function of articular cartilage. Degeneration of cartilage degenerative arthritis and rheumatoid arthritis. Joint replacement, hip, knee, shoulder, small joints.

### Unit III: Principal and management of paralytic problems

Gait analysis, orthotics, principles of tendon transports, bioengineering principles of amputation and prosthetics. Upper limb prosthesis, lower limit prosthesis.

### Unit IV: Muscle physiology

Classification of muscles ,structure of skeletal muscles, Properties of skeletal muscles ,changes during muscular contraction excitation and contraction of coupling mechanism, neuromuscular junction, smooth muscles, electromyogram and disorder of skeletal muscles, endurance of muscles.

### Unit V: Diagnosis techniques

Computerized axial tomography. Radioactive brain scanning, angiography ,pneumoencephalography, the motor recording methods, electro-diagnosis, neuromuscular stimulation, electromyography, clinical applications. Diseases of muscles, motorneuron disorders, the electrical study of reflexes. Disorders of neuromuscular transmission.

### TEXT BOOKS

1. Wilton bunch and robertd.keagy, principles of orthotics treatment.
2. John crawforadams and xchurchill living stone, outline of orthopaedics and outline of fractures”.
3. Owen, good fellow and bulloughg, scientific fiundation of orthopaedics and traumatology.
4. Frankel, lea, febgier and nordin, “basic biomechanics of the skeletal system “.
5. M.denagardiner, the principles of exercise therapy.
6. Pauline m.scott, clayton’s electrotherapy and actinotherapy
7. Adams & Victor- principles of Neurology.
8. Erodal – Neuroanatomy.
9. Lance & McLeod-Physiological approach to clinical Neurology



## DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	Bioelectricity	Subject code	BM20615BM
Semester	Sixth	Board of Studies	Biomedical Engg
Maximum Marks	120	Minimum Marks	
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
3	1		4

### Unit I: introduction to bioelectricity & excitable cells

Bioelectric Potentials and Currents: Ionic composition of excitable cells; Nernst-Planck equation; Membrane structure; Nernst potential; Parallel-conductance model, Membrane Channels: Channel structure; Biophysical methods for measuring channel properties; Macroscopic channel kinetics; Channel statistics; Introduction to the Hodgkin-Huxley membrane model

### Unit II: Action potentials & impulse propagation

action potentials: Observing action potentials; Nonlinear membrane behavior; Origin of action potential; Resting and peak voltages; Voltage and space clamp; Hodgkin-Huxley equations; Simulation of membrane action potential; Action potential characteristics; Active transport; Calcium channels and "other" membrane models, Impulse Propagation: Core-conductor model; Cable equations; Local circuit currents during propagation; Mathematics of propagating action potentials; Numerical solutions for propagating action potentials; Propagation velocity constraint for uniform fiber; Propagation in Myelinated nerve fibers

### Unit III: Electrical Stimulation of Excitable Tissue, Extracellular fields & Neural Electrophysiology

Electrical Stimulation of Excitable Tissue: Linear (sub threshold) response of a single spherical cells; Linear (sub threshold) response of a cylindrical fiber, Extra cellular Fields: Basic formulation; Lumped fiber source models, Neural Electrophysiology: Structure of nervous system; Sensory transducers and neurons; Neural synapses, excitation and inhibition; Neural coding and computation

### Unit IV: Cardiac Electrophysiology & Neuromuscular Junction

Cardiac Electrophysiology: Electrical nature of intercellular communication; Source models; ECG measurement and analysis, Neuromuscular Junction: Structure of neuromuscular junction; Evidence for the quantal nature of transmitter release; Poisson statistics for transmitter release; Expressions for the effect of  $Ca^{++}$  and  $Mg^{++}$  on transmitter release; Post-junctional response to transmitter

### Unit V: Skeletal Muscle & Functional Electrical Stimulation

Skeletal Muscle: Muscle structure; Muscle contraction; Structure of Myofibril; Sliding filament theory; Excitation-contraction Functional Electrical Stimulation; Electrodes and electrode-tissue behavior; Nerve excitation; Recruitment; Clinical applications

### TEXT BOOKS

1. Robert Plonsey and Roger Barr, Bioelectricity, McGraw Hill, 1986.

### REFERENCE BOOKS

1. Principles of Applied Biomedical Instrumentation by L. A Geddes, John Willy & Sons, 1989.
2. John Webster. Medical Instrumentation.- Application and Design. John Wiley and Sons. Inc., New York. Third edition 2003.
3. Plonsey Robert and Flemming David G. Bioelectrical phenomena, McGrawHill, 1969.



## DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

Name of the subject	Bioinformatics	Subject code	BM20616BM
Semester	Sixth	Board of Studies	Biomedical Engg
Maximum Marks	120	Minimum Marks	
Lecture Periods/Week	Tutorial Periods/Week	Practical Periods/Week	Credits
4	1	3	5

### Unit I: Introduction to Bioinformatics

Introduction to Bioinformatics: Data bank: Protein and Nucleic acid; data bank for different organisms. Use of databases in biology, sequence databases, structural databases.

### Unit II: Sequence Alignment

Sequence Alignment: Sequence analysis: protein and nucleic acids, Analysis tools for sequences DataBank; Pair wise and Multiple sequence alignment; secondary structure predictions; Fold recognition, FASTA-BLAST-Amino acid substitution matrices PAM and BLOSSUM.

### Unit III: Projects and databases

Projects and databases: Structural comparisons, genome projects, Biological Information-Database location and organization; access to database; software; database searching; locating specific entries; identity searches; similarity searches

### Unit IV: Information theory and biology

Information theory and biology: Entropy, Shannon's formula, divergences from equiprobability and independence, Markov chains, ergodic processes, redundancy, application to DNA and protein sequences

### Unit V: DNA Mapping and sequencing:

DNA Mapping and sequencing: Map alignment: Large scale sequencing and alignment, Shotgun-DNA sequencing, Sequence assembly, Gene predictions, Molecular predictions with DNA strings.

### TEXT BOOKS

1. Molecular databases for protein sequence and structure studies by Sillince, JA and Sillince M (1991) Springer Verlag.
2. Sequence Analysis primer by M. Gribskov, J. Devereux (1989) Stockton Press.
3. Computational Methods in Mol. Biol. / Now Comprehensive Biochemistry Vol. 32. S.L. Seizberg, DB Searls, S. Kasif Elsevier 1998.
4. Computer methods for macromolecular analysis. Methods in Enzymology. Vol. 266 by R.F. Doolittle. Academic Press 1996.
5. Information theory and living systems by L.I. Garfield, (1992) Columbia University Press.
6. Dan Gusfield, " Algorithms on Strings Trees and Sequences ", Cambridge University Press, 1997.
7. P. Baldi, S. Brunak, Bioinformatics; " A Machine Learning Approach ", MIT Press, 1998.



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**DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS**

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<b>Name of the subject</b>	<b>Bioinformatics Lab</b>	<b>Subject code</b>	<b>BM20621BM</b>
<b>Semester</b>	<b>Sixth</b>	<b>Board of Studies</b>	<b>Biomedical Engg</b>
<b>Maximum Marks</b>	<b>50</b>	<b>Minimum Marks</b>	
<b>Lecture Periods/Week</b>	<b>Tutorial Periods/Week</b>	<b>Practical Periods/Week</b>	<b>Credits</b>
		<b>3</b>	<b>2</b>

List of Experiments:

1. To determine the sequence of a specific protein/nucleotide using NCBI's official site.
2. To determine nucleotide composition using MATLAB.
3. To determine the trinucleotides (codons) code for an amino acid using MATLAB.
4. To undergo sequence alignment using FASTA algorithm approach.
5. To compare amino acid sequences using Global and Local Alignment functions to compare two amino acids.
6. To undergo sequence alignment using BLAST algorithm approach.
7. To convert a sequence from nucleotide to amino acids and identify open reading frames (ORF's).
8. To study about structure visualization tools (like Jmol, Cn3D, Rasmol) of proteins.

To undergo Multiple Sequence Alignment (MSA) using Clustal-X software.





## DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS

<b>Name of the subject</b>	<b>Medical image Processing Lab</b>	<b>Subject code</b>	<b>BM20622BM</b>
<b>Semester</b>	<b>Sixth</b>	<b>Board of Studies</b>	<b>Biomedical Engg</b>
<b>Maximum Marks</b>	<b>50</b>	<b>Minimum Marks</b>	
<b>Lecture Periods/Week</b>	<b>Tutorial Periods/Week</b>	<b>Practical Periods/Week</b>	<b>Credits</b>
		<b>3</b>	<b>2</b>

### List of Experiments:

1. Basic Operation of Image
2. Filtering of images
3. Histogram Equalization & Contrast Adjustment
4. Spatial Transformation
5. Basic Operation of Image
6. Edge Detection Techniques
7. Stastical Performance of Image
8. Region Based Processing
9. Color Based Image Processing



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**DEPARTMENT OF BIOMEDICAL ENGINEERING SYLLABUS**

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<b>Name of the subject</b>	<b>Telemedicine Lab</b>	<b>Subject code</b>	<b>BM20623BM</b>
<b>Semester</b>	<b>sixth</b>	<b>Board of Studies</b>	<b>Biomedical Engg</b>
<b>Maximum Marks</b>	<b>50</b>	<b>Minimum Marks</b>	
<b>Lecture Periods/Week</b>	<b>Tutorial Periods/Week</b>	<b>Practical Periods/Week</b>	<b>Credits</b>
		<b>3</b>	<b>2</b>

List of Experiments

1. To study about general architecture of MySQL
2. To interact with MySQL using the MySQL Query Browser
3. To study about database properties and study about data definition languages.
4. To study about MySQL TABLE and its properties.
5. To study about SQL SELECT COMMANDS.
6. To study about the methods and tools needed to utilize SQL expressions.
7. To study about Functions in SQL Expressions.
8. To study about SQL DML Commands.
9. To study about SQL Joins.