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## **(BM-100) - Introduction to Biology For Pre-Engineering**

### **Course Outline:**

#### **Theory:**

- 1. Cell Structure and Function**
  1. Techniques used in Cell Biology
  2. Cell Wall and Plasma Membrane – The Boundary Wall
  3. Cytoplasm and Organelles
  4. Prokaryotic and Eukaryotic Cells
- 2. Biological Molecules**
  1. Biological Molecules in Protoplasm
  2. Importance of Water (Importance in Protoplasm and in Environment)
  3. Carbohydrates
  4. Proteins
  5. Lipids
  6. Nucleic Acids
  7. Conjugated Molecules (Glycolipids, Glycoproteins, Lipoproteins and Nucleoproteins)
- 3. Enzymes**
  1. Structure of Enzymes
  2. Mechanism of Enzyme Action
  3. Factors affecting the Rate of Enzymatic Action (Temperature, pH, Enzyme Concentration and Substrate Concentration)
  4. Enzyme Inhibition (Competitive and Noncompetitive Inhibitors)
  5. Classification of Enzymes
- 4. Bioenergetics**
  1. Aerobic and Anaerobic respiration
  2. Mechanism of Respiration
  3. Synthesis of ATP – Chemiosmosis and Substrate-level Phosphorylation
- 5. Biodiversity**
  1. Acellular life
  2. Prokaryotes
  3. Diversity among animals
  4. Digestion
  5. Circulation
  6. Immunity
  7. Respiration
  8. Homeostasis
  9. Support and movement
  10. Nervous coordination
  11. Chemical coordination
- 6. Continuity in Life**
  1. Reproduction

2. Development and aging
3. Inheritance
4. Chromosome and DNA
5. Evolution
7. **Application of Biology**
  1. Gene Cloning (Recombinant DNA Technology and Polymerase Chain Reaction)
  2. DNA Sequencing
  3. DNA Analysis
  4. Genome Maps
  5. Tissue culture
  6. Transgenic bacteria, plants and animals
  7. Biotechnology and healthcare
  8. Scope and importance of biotechnology
  9. Vaccination and integrated disease management
  10. Animal husbandry
  11. Latest techniques applied to enhance crop and fruit yields
  12. Home gardening
  13. Role of microbes in human welfare

### **Suggested Teaching Methodology:**

- Lecturing
- Written Assignments Report Writing

### **Suggested Assessment:**

#### **Theory (100%)**

- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

### **Recommended and Text Books:**

1. AS/A level Biology, Mary Jones, Contributors: Richard Fosbery, Jennifer Gregory, Dennis Taylor  
Edition 2, Cambridge University Press, 2007, ISBN 0521703069, 9780521703062
  2. National Curriculum 2006, HEC Pakistan
  3. AQA A-Level Biology, Pauline Lowrie, Mark Smith
-

# **(BM-101) - Introduction to Biomedical Engineering**

## **Course Outline:**

### **Theory:**

- 1. Biomedical Engineering**
  1. What is biomedical engineering
  2. Branches of biomedical engineering
  3. Role of biomedical engineer
- 2. Devices used in Biomedical Engineering**
  1. Biomedical instrumentation fundamental
  2. Critical care devices used in biomedical engineering
  3. Radiological instrumentation.
  4. Diagnostic biomedical devices
  5. Therapeutic Biomedical devices
- 3. Applications of Biomedical Engineering**
  1. Rehabilitation Engineering
  2. Physiological modelling and simulation
  3. Biomedical signal processing
  4. Clinical Engineering
  5. Biomaterials
  6. Biomechanics
  7. Tissue Engineering and regenerative medicine
  8. Neural engineering
  9. Medical Image Processing

## **Suggested Teaching Methodology:**

- Lecturing
- Written Assignments Guest Speaker
- Report Writing

## **Suggested Assessment:**

### **Theory (100%)**

- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

## **Text and Reference books::**

1. Introduction to Biomedical Engineering, 4th Edition, John Enderle
  2. Biomedical Engineering Handbook Volume I & II, J. D. Bronzino
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# **(BM-108) - Computer Aided Engineering Drawing**

## **Course Outline:**

### **Theory:**

#### **1. Introduction**

1. Introduction to Engineering Drawing
2. Use of drawing instruments and materials.
3. Basic Tools- classification and brief description
4. Lines, Types of lines, configuration of lines and their application, Selection of line thickness

#### **2. Engineering Geometry**

1. Geometric construction
2. Coordinate systems
3. Basic entities
4. Drawing simple geometric objects
5. Introduction to different types of scales.

#### **3. Modelling Fundamentals**

1. Introduction to solid modelling

#### **4. Multiviews and Visualization**

1. Projection theory
2. Projection of principal views from 3D models
3. Orthographic projections
4. Isometric drawings
5. Section views

#### **5. Dimensioning and plotting**

1. Dimensioning
2. Plotting and printing

## **Suggested Teaching Methodology:**

- Lecturing
- Lab tasks
- Report Writing

## **Suggested Assessment:**

### **Theory (100%)**

- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

### **Laboratory (100%)**

- Labs
- Open-Ended Labs

## **Text and Reference Books:**

1. A Textbook of Engineering Drawing: Along with an Introduction to AutoCAD (2015) by Roop Lal, Ramakant Rana
2. Mastering Autodesk Inventor 2015 and Autodesk Inventor LT 2015: Autodesk Official Press, Curtis Waguespack, ISBN: 978-1-118-86213-1

3. Engineering Drawing and Graphic Technology-International Edition, Thomas E. French, Charles J. Vierck, Robert J. Foster, McGraw-Hill, Inc.1993 ISBN 0-07-022347-5
  4. Engineering Drawing and Design-Sixth Edition, C. Jensen, J.D. Helsel, D.R. Short, McGraw-Hill, 2002, ISBN 0-07-821343-6 (T 353 J47 2002)
  5. Technical Drawing-Fourteenth Edition, F. E. Giesecke, A. Mitchell, H. C. Spencer, I.L. Hill, J.T. Dygdon, J.E., Novak, Prentice-Hall, Inc., 2012, ISBN 0-13-178446-3 (T 353 T43 2003)
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# **(BM-113) - Engineering Mechanics**

## **Course Outline:**

### **Theory:**

#### **1. Introduction:**

1. General principles;
2. units of measurement;
3. Force Vectors:
4. Addition of vectors;
5. Cartesian vectors;
6. Free vector;
7. Position vectors;
8. Force directed along a line.

#### **2. Equilibrium of a Particle:**

1. Conditions for the equilibrium;
2. Free body diagram; 3D force systems;
3. Force system resultants;
4. Moment of force;
5. Virognon's theorem; cross product;
6. Moment of a couple;
7. Equivalent systems.

#### **3. Equilibrium of a Rigid Body:**

1. Equilibrium in 2D and 3D;
2. Constrains for a rigid body;
3. Redundant and improper constraints.

#### **4. Friction:**

1. Types of friction;
2. Angle of repose;
3. Application of friction.

#### **5. Kinematics of a Particle:**

1. Rectilinear motion;
2. Curvilinear motion;
3. Motion of projectile;
4. Absolute dependent motion of two particles.

#### **6. Kinetics of a Particle:**

1. Equation of motion for a system of particle;
2. Equation of motion in rectangular, cylindrical, normal and tangential coordinates;
3. Principles of work and energy for a system of particles;
4. Linear momentum;
5. Conservation of momentum;
6. Impact;
7. Angular momentum;
8. Kinematics of a rigid body;
9. Translation;
10. Rotation.

## **Suggested Teaching Methodology:**

- Lecturing
- Written Assignments Report Writing

## **Suggested Assessment:**

### **Theory (100%)**

- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

### **Laboratory (100%)**

### **Text and Reference books:**

Engineering Mechanics Statics; R. C. Hibbeler, 12th ed. 2007, Pearson Prentice Hall. Engineering Mechanics Dynamics; R. C. Hibbeler, 12th ed. 2007, Pearson Prentice Hall.

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# **(BM-114) - Anatomy**

## **Course Outline:**

### **Theory:**

- 1. Introduction**
  1. Anatomy and its branches
  2. Anatomical positions
  3. Planes
  4. Topography
- 2. Cell Anatomy**
  1. Overview of Cellular Anatomy.
- 3. Extremities (Upper and lower)**
  1. Bones
  2. Muscles
  3. Ligaments
  4. Tendons
  5. Bursae
  6. Reticulae
  7. Capsules
  8. Arteries
  9. Veins
  10. Lymphatic system
- 4. Vertebral Anatomy**
  1. Vertebrae
  2. Pelvic girdle
  3. Spinal cord
  4. Nervous system
- 5. Thorax-Thoracic Viscera**
  1. Surface anatomy
  2. Bones surface musculature
  3. Lungs
  4. Heart
- 6. Abdomen**
  1. Organs location
  2. Structures
  3. Relations and function
- 7. Head & Neck**
  1. Bones
  2. Muscles
  3. Cranial nerves

### **List of Practicals:**

1. Demonstration of Human Skeleton in general.
2. Demonstration of basic structures in Human Anatomy (Skin, Muscles & Other Structures).
3. Demonstration of Anatomical planes & positions.
4. Demonstration of Movements & Motinal Terms.
5. Demonstration & Study of Scapula & Clavicle.
6. Demonstration & Study of Humerus bone.
7. Demonstration of Ulna and Radius.
8. Demonstration of wrist & hand bones.
9. Demonstration of Pelvic bone.
10. Study and demonstration of Femur bone.

11. Study and demonstration of Tibia & Fibula.
12. Demonstration of Foot bones.
13. Demonstration of skull.
14. Demonstration & study of different parts of Vertebral column.
15. Study and Demonstration of different Models.
16. Audio & Visual Demonstration of Human Anatomy.

### **Suggested Teaching Methodology:**

- Lecturing
- Written Assignments Report Writing

### **Suggested Assessment:**

#### **Theory (100%)**

- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

#### **Laboratory (100%)**

#### **Text and Reference books:**

1. Medical Terminology: A Living Language (6th Edition) [Bonnie F. Fremgen and Suzanne S. Frucht], ISBN: 978-0134070254
  2. New Biology for Engineers and Computer Scientists [Aydin Tozeren and Stephen W. Byers], ISBN: 978-0130664631
  3. Gerard J. Tortora, Principles Of Human Anatomy, 13th Edition, ISBN: 9781118344996
  4. B. D. Chaurasia, BD Chaurasia's Human Anatomy: Vol. 1, 6th Edition, ISBN: 9788123923307
  5. Frederic H. Martini, Human Anatomy, 8th Edition, ISBN: 9780321883322
  6. Elaine N. Marieb, Human Anatomy, 8th Edition, ISBN: 9780134243818
  7. Michael McKinley and Valerie O'Loughlin, Human Anatomy, 4th Edition, ISBN: 9780073525730
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# **(BM-115) - Physiology-I**

## **Course Outline:**

### **Theory:**

#### **1. Introduction**

1. The Cell and General Physiology
2. Functional organization of human body and control of the internal environment
3. Cell and its function, protein synthesis and cell reproduction
4. Metabolism of carbohydrates and formation of ATP
5. Lipid and Protein Metabolism, transport through Cell membrane

#### **2. Human physiology from a system's view point**

1. Quantitative issues at the organ and whole body levels of Cardiovascular
2. Respiratory
3. Renal
4. Digestive systems

#### **3. Nerve and Muscle**

1. Membrane potential
2. Action potential
3. Excitation and Rhythmicity
4. Contraction of Skeletal and cardiac muscles, sliding filament Mechanism, Heart as a pump

#### **4. Sensory Systems**

1. Sensory Receptors
2. Classification and basic mechanism of action

#### **5. Somatic Sensations**

1. Mechanoreceptive sensations, pain, thermal and visceral pain, headache

#### **6. Special Senses**

1. Eye, receptor function of the retina, Neurophysiology of Vision, the Chemical Sense-taste and smell

## **List of Practicals:**

1. Use of stethoscope & measurement of human arterial blood pressure & pulse
2. Determination of Red Blood Cells per cmm of human Blood
3. Determination of White Cells per cmm of human blood
4. Determination of haemoglobin percentage in human blood
5. Physiochemical & microscope analysis of human urine sample (Renal System)
6.
  1. Demonstration of the use of ECG,
  2. Test of hearing
7. Determination of visual acuity of a human subject by using snellen's eye chart
8. Determination of bleeding time in human body
9. Determination of the coagulation time in human body
10.
  1. To record normal respiration & effect of System exercise on it using spirometer.
  2. To record normal respiration & effect of exercise on it using power lab.
11. Introduction the organization & classification of neurons using neurolab
12. To demonstrate the differential count of leukocytes in human blood Sample
13. To observe the shape of RBC in normal saline stem

14. To identify various parts of digestive tract & to observe gut mobility in exposed abdomen of dissected rabbit
15. To determine the group of blood sample

### **Suggested Teaching Methodology:**

- Lecturing
- Written Assignments Report Writing

### **Suggested Assessment:**

#### **Theory (100%)**

- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

#### **Laboratory (100%)**

### **Text and Reference Books:**

1. Physiology for Engineers: Applying Engineering Methods to Physiological Systems (Biosystems & Biorobotics) [Michael Chappell and Stephen Payne], ISBN:978-3319261959
  2. Quantitative Human Physiology: An Introduction [Joseph J Feher], ISBN:978-0123821638
  3. John E. Hall, Guyton and Hall Textbook of Medical Physiology, 13th Edition, ISBN: 9781455770052
  4. Elaine N. Marieb, Essentials of Human Anatomy & Physiology, 11th Edition, ISBN: 9780321919007
  5. Arthur B. Ritter, Physiology for Engineers: A Systems Approach, 2017, ISBN: 9781498734561
-

# (BM-116) - Physiology-II

## Course Outline:

### Theory:

#### 1. Nervous System

1. Organization of Nervous System
2. Basic functions of synapses
3. Neuronal Mechanism and circuits for processing information

#### 2. Motor Functions

1. Spinal cord and the cord reflexes
2. The cerebral cortex and intellectual functions of the Brain
3. Motor function of the Brain stem
4. Vestibular control of postural reflexes
5. Cerebrum and basal ganglia
6. Reticular

#### 3. Somatic Sensations

1. Mechanoreceptive sensations
2. Pain
3. Thermal and visceral pain
4. Headache

#### 4. Behavioral functions of the Brain

1. Limbic System
2. Role of the Hypothalamus
3. Control of the vegetative functions of the body
4. The Autonomic nervous system
5. The Adrenal Medulla
6. Electrical Activity from Brain

#### 5. Endocrinology and Reproduction

1. Introduction to Endocrinology and the pituitary Hormones;
2. Hormonal functions in male and female ## **List of Practicals:**

6. Study of kymograph
7. Recording of simple muscle twitch in Gastrocnemius sciatic nerve preparation
8. Recording of the effect of two successive stimuli on the nerve muscle preparation
9. Recording of the effect of continuous stimuli (fatigue) in a nerve muscle preparation
10. To demonstrate phenomenon of tetanisation
11. Effect of temperature on the simple muscle twitch
12. Demonstrate the superficial reflexes on a given subject
13. Demonstrate the deep reflexes on a given subject
14. To observe the receptor adaptation associated with Paccinian Corpuscle and other receptors in a computer simulated program
15. To illustrate the principle of phase locking in auditory fibers by using the computer simulated program
16. Determination of visual field in human subject.

17. Observe and study the spectrum and waveforms of different vowels sound and their relationship with the configuration of the vocal tract
18. Study the movement in basilar membrane during the passage of sound waves of different frequencies, on a simulated mode
19. a) To calculate nerve conduction velocity from twitch records obtained by using a nerve-muscle preparation using Kymograph. (b) To calculate nerve conduction velocity from twitch records obtained by using a nerve-muscle preparation using powerlab.
20. To locate the gustoreceptors in the human
21. (a) To calculate nerve conduction velocity from twitch records obtained by using a nerve-muscle preparation using Kymograph. (b) To calculate nerve conduction velocity from twitch records obtained by using a nerve-muscle preparation using powerlab. To locate the gustoreceptors in the human
22. Demonstration of the recording of an (extracellular) action potential from frog sciatic nerve (monophasic & biphasic) on oscillograph / oscilloscope
23. Study of reflex movements in spine of frog; Effect of acid treatment, Effect Effects of electric shock & Effect of Strychnine ## **Suggested Teaching Methodology:**

- Lecturing
- Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**
- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

#### **Laboratory (100%)**

#### **Text and Reference Books:**

1. Text book of Medical Physiology by Guyton and Hall (13th Edition).
  2. Essential of Medical Physiology by Jaypee (6th Edition).
  3. William F, "Review of Medical Physiology".
-



# (BM-203) - Cellular and Molecular Biology

## Course Outline:

### Theory:

1. Basic properties of cells
2. Prokaryotic and eukaryotic cells
3. Viruses
4. Biological molecules: carbohydrates, lipids, proteins, and nucleic acids, Techniques used in cell and molecular biology
5. Enzymes
6. Metabolism
7. Mitochondrion structure and function
8. Chloroplast structure and function
9. Plasma membrane composition, structure, and function
10. The movement of substances across cell membranes
11. The endomembrane system
12. The extracellular matrix
13. The structure and function of the nucleus
14. Genes and chromosomes
15. DNA replication
16. Transcription, Translation
17. Cytoskeleton and cell motility
18. Cellular reproduction
19. Cell signalling

### Suggested Teaching Methodology:

- Lecturing
- Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**
- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

### Reference Text Book:

1. H. Lodish et al. 2012. Molecular Cell Biology, 7th Ed. W.H Freeman and Company, and Turning
  2. Molecular Biology of the Cell (MBC) 5th Edition, 2008 Alberts, Johnson, Lewis, Raff, Roberts, Walter.
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# (BM-208) - Biomedical Electronics

## Course Outline:

### Theory:

1. **Operational Amplifiers**
  1. Analysis of OP-AMP action
  2. OP-AMP specifications
  3. Interpreting OP-AMP data sheet
  4. Offset voltage and current
  5. Temperature rating
  6. Output swing
  7. Gain, CMRR
2. **Basic OP-AMP Configuration Circuits**
  1. Inverting amplifiers
  2. non-inverting amplifiers
  3. Voltage follower
  4. Summing amplifiers
  5. Integrator and differentiator
3. **Instrumentational Amplifier**
  1. Sensing and Measuring with the instrumentation amplifier
  2. Instrumentation amplifier as a signal conditioning circuit
4. **Active Filters Design**
  1. Basic Low Pass filters
  2. Introduction to Butterworth filters
  3. High pass and Bandpass Butterworth filters
  4. Notch filters
5. **A/D and D/A converters**
6. **Selected Applications of OP-AMPs in Biomedical Engineering**
7. **Signal Acquisition and Conditioning of ECG using OP-AMPs**

### List of Practicals:

1. Design and Analyze OP-AMP Based Inverting Amplifier
2. Design and Analyze OP-AMP Based Non-Inverting Amplifier
3. Design and Analyze the characteristics of Summing Amplifier
4. To study Characteristics of Differential Amplifier
5. To determine common mode rejection ratio (CMMR)
6. Design and Analyze OP-AMP Based Integrator
7. Design and Analyze OP-AMP Based Differentiator
8. Design and Analyze Instrumentation Amplifier
9. Designing an ECG Amplifier.
10. To Analyze Analog to Digital Converter
11. To Analyze Digital to Analog Converter
12. Designing and analyzing frequency response of Active Low Pass Filter
13. Designing and analyzing frequency response of Active High Pass Filter
14. Designing and analyzing frequency response of Active Band Pass Filter
15. Designing and analyzing frequency response of Active Band Stop Filter/
16. Project : ECG/EMG/ EOG/PPG Amplifier and filters ## **Suggested Teaching Methodology:**
  - Lecturing
  - Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**
  - Sessional (20%)

- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

**Laboratory (100%)**

**Text and Reference Books:**

1. Electronics Design by Floyd 9th Edition
  2. Operational amplifier and linear integrated circuits by Robert Coughlin
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# (BM-209) - Basic Electronics

## Course Outline:

### Theory:

1. **Semiconductor Theory**
  1. Introduction,
  2. Intrinsic and Extrinsic Semiconductors,
  3. Doping and energy levels.
2. **Diodes**
  1. PN junction/ Biased PN junction,
  2. V-I Characteristics,
  3. Load Line and dynamic resistance.
  4. Diode models, Reverse recovery time and temperature effects,
3. **Diode Applications**
  1. Half wave and Full wave rectifiers,
  2. Clippers and Clampers, Logic gates.
4. **Bipolar Junction Transistors**
  1. Construction, operation and characteristics,
  2. Amplifying action and variation in current gain,
  3. Common Emitter, Common Collector and Common Base Configurations. Power Ratings.
5. **BJT Biasing Circuits**
  1. Fixed Bias, Voltage Divider Bias and Emitter feedback Bias Circuits,
  2. DC load line and operating point,
  3. Biasing circuit design and stabilization, Transistor as a switch
6. **BJT Small Signal Analysis**
  1. Common Emitter Amplifier, Common Base Amplifier, Common Collector Amplifier, Amplifier Design and Loading effects,
7. **Field Effect Transistors**
  1. JFET Construction and Operation,
  2. Transfer characteristics and parameters,
  3. FET Biasing Circuits, Fixed Bias,
  4. Self-Bias and Voltage divider Bias
8. **Design of a bias circuit**
  1. FET Small Signal Analysis,
  2. JFET/Depletion MOSFET small-signal model,
  3. Common source, common drain and common gate amplifiers,
  4. Loading effects and design of amplifier circuits.
9. **Differential Amplifiers**
  1. Darlington transistor circuit, properties of differential amplifier stage,
  2. Circuits of differential amplifiers using BJTs and FETs.
10. **Oscillators:**
  1. Hartley oscillators,
  2. Colpitt oscillators,
  3. RC phase shift oscillators,
  4. Wein-Bridge oscillators,
  5. Crystal oscillators based on BJT and FET. ## **List of Practicals:**
11. To observe the working of diode with forward and reverse bias.
12. Plot the diode characteristic curve.
13. Calculate the bulk resistance of the diode and observe its effect in the diode approximations.
14. To observe the working of half wave rectifier.
15. To observe the working of full wave rectifier
16. To observe the working of Bridge wave rectifier.
17. To observe the working of Zener Diode

18. To analyze the working of Clamper Circuit.
19. To analyze the wrking of Clipper Circuit.
20. To determine the output voltage for half wave voltage doubler.
21. To determine the output voltage for full wave voltage doubler.
22. To determine the output voltage for Zener limiting circuit
23. Checking and Troubleshooting the NPN and PNP Transistor using Multimeter.
24. To use the transistor in switching mode.
25. Demonstrate the operation and determine the biasing parameter of Base Bias Circuit.
26. Demonstrate the operation and determine the biasing parameter of Voltage Divider Bias Circuit. ##  
**Suggested Teaching Methodology:** Lecturing

Written Assignments Report Writing ## **Suggested Assessment:** ### **Theory (100%)**

- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

**Laboratory (100%)**

**Text Book:**

1. Electronic Devices and Circuit Theory By H. Boylestad and L. Nashelsky
  2. Electronic Devices and Circuits By Theodore F. Bogart, Jr.
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# (BM-210) - Biochemistry

## Course Outline:

### Theory:

#### 1. Introduction to Biochemistry

1. Colloidal state, buffer, pH, significance of pH Henderson equation, surface tension, viscosity, osmosis, diffusion, Biological Membrane, active Transport, Chemi-osmotic theory-passive transport concept of chromatographic techniques (TLC, paper chromatography, GLC column chromatography etc.) carbohydrates, amino acids, nucleic acids, proteins, vitamins, enzymes, hormones & signaling agents.

#### 2. Metabolism of Carbohydrates, Lipids and Proteins

1. Carbohydrate Amino acids: structure, and properties. Proteins: primary and secondary structure of proteins. *Enzymes*: Nomenclature, properties, Working, Factors affecting Reaction, Equation and diseases Globular proteins: heme-proteins, hormones & signaling agents.

#### 3. Conformational analysis and forces

1. Conformational analysis and forces that determine protein and nucleic acid structure. Molecular Modeling of protein, nucleic Tertiary and quaternary structure of protein, protein mis- folding.

#### 4. Carbohydrates

1. Introduction, classification and structure. Digestion of carbohydrates. Metabolism of carbohydrates: glycolysis, regulation of metabolism, Overview and reactions of glycolysis, hormonal regulation of glycolysis, Tricarboxylic acid cycle, reactions of TCA, energy and regulation of TCA cycle.

#### 5. Bioenergetics

1. *Bioenergetics*: Thermodynamic principles in human body. Thermodynamics of phosphate compounds (phosphate transfer reactions) and role of ATP for biological energy transfer, thermodynamics of life

#### 6. Metabolism of Lipids

1. Digestion, absorption and secretion. Utilization of dietary lipids

#### 7. Vitamins

1. folic acid, VitaminB12, Vitamin C, Vitamin D, Vitamin B1, Vitamin A, Vitamin E. ## **List of Practicals:**

8. How to prepare the Solution in Lab
9. Determination of pH by pH meter and Litmus paper
10. Demonstration the action of buffer
11. To determine the principle application of Hander son- Haselbash's equation
12. Tests for proteins
13. Examination of Egg white
14. Color reactions for proteins
15. Isolation of Casein from milk
16. Tests on carbohydrates
17. Measurement of Blood Glucose level with help of spectrophotometer
18. Oral Glucose Tolerance Test (OGTT)
19. Tests of Lipid profile by chemical analyzer
20. Separation of Amino Acids by chromatographic methods.
21. Open ended lab I
22. Open ended lab II
23. Open ended lab III ## **Suggested Teaching Methodology:**

- Lecturing
- Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**
- Sessional (20%)
- Quiz (12%)

- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

**Laboratory (100%)**

**Text and Reference Books:**

1. Lippincott, Bio-Chemistry 5th Ed,2010 Donald Voet, Judith, G. Voel and Charlotte, W. Prats,
  2. Fundamentals of Biochemistry, 2006, John Wiley & Sons. Rodney Boyer,
  3. Modern Experimental Biochemistry, Pearsons Education, Delhi, India. Tsai. C. Stan,
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# (BM-306) - Bio-Instrumentation and Measurements - I

## Course Outline:

### Theory:

1. **Introduction to measurements**
  1. Precision
  2. Resolution
  3. Sensitivity
  4. Accuracy
  5. Uncertainty
2. **Bio-potentials, biosensors and transducers**
  1. Biomedical signals of the human body,
  2. Sensors and transducers for bio-potential measurements
  3. Problems encountered in measuring biopotentials of the human body
  4. Invasive and noninvasive measurement techniques and related equipment.
  5. Functional Building blocks of a Biomedical Instrumentation System
3. **Cardiovascular System Devices**
  1. Diagnostic: Electrocardiography, Measurement of Blood pressure, Blood flow
  2. Therapeutic: Cardiac output. Defibrillator, pacemaker
4. **Pulmonary System Devices**
  1. Diagnostic: Pulmonary Function Analyzer, Spirometry, Ventilation Monitors, Respiration: Pulse oximetry, Capnography,
  2. Therapeutic: Ventilators, Heart lung machine, nebulizer
5. **Musculoskeletal & Nervous System Devices**
  1. EMG
  2. EEG
6. **Critical Care Devices**
  1. Patient Monitoring: Patient Monitors, central monitoring system, telemetry system
  2. Surgical/Operation Theatre Devices Equipment: Electrosurgical unit
7. **Genito-urinary System Devices**
  1. Hemodialysis Machine
8. **Quality Assurance and Quality Control**
  1. Common defects in medical equipment
  2. Performance measurement
  3. Calibration
  4. Maintenance and repair ## **List of Practicals:**
9. To study the principle of various Biomedical Transducer
10. To understand methods and instruments for body temperature measurement and compare temperature sensor for selection on the basis of their properties
11. To study the working of photo detectors/photo sensors and their application in biomedical
12. To study the techniques of measuring blood pressure and measure the systolic and diastolic pressure.
13. To become familiar with the electrocardiograph as a primary tool for evaluating electrical events within the heart and observe rate and rhythm changes in the ECG associated with body position and breathing.
14. To record maximum clench strength for right and left hands and correlate motor unit recruitment with increase skeletal force.
15. To record EMG response to increased weights lifted by dominant and non-dominant arms and to record EMG when fatigue is induced.
16. To observe respiratory cycle and record breath per minute and respiratory rate in different conditions eupnoea, hyperventilation and apnea Vera.
17. To record an EEG from an awake, resting subject with eyes open and eyes closed. Identify and examine alpha, beta, delta, and theta components of the EEG complex.
18. To record EOG on the horizontal plane and compare eye movements under the following conditions:



- pendulum tracking & pendulum simulation.
19. To observe respiratory cycle and record breath per minute and respiratory rate in different conditions eupnea, hyperventilation and apnea Vera.
  20. To observe real time monitoring through multipara monitor/bedside monitor.
  21. To Study the construction and working of x-ray equipment and to practice the safety aspect using standard procedure.
  22. To practice the safety aspect of ultrasound machine using standard procedure
  23. To observe the principle and working of ventilator.
  24. Open ended lab 1 ## **Suggested Teaching Methodology:**

- Lecturing
- Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**
- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

#### **Laboratory (100%)**

#### **Recommended Text and Reference Books:**

1. Biomedical Instrumentation & Measures 2nd edition by Leslie Cromwell.1980. ISBN: 978-81-203-0653-0.
  2. Bioinstrumentation by John G. Webster.2004.ISBN: 978-81-265-1369-7
  3. Medical Instrumentation: Application and Design by John G. Webster.4th ed, 2010. ISBN: 978-0-471-67600-3
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# (BM-307) - Bioinformatics

## Course Outline:

### Theory:

1. **History and evolution of bioinformatics**
    1. Introduction to databases (Database types, Database formats, DNA databases, European Molecular Biology Laboratory (EMBL))
    2. Genomics
    3. Transcriptomics
    4. Computational proteomics
  2. **Pairwise Sequence Alignment**
    1. Evolutionary Basis
    2. Sequence Homology versus Sequence Similarity
    3. Sequence Similarity versus Sequence Identity
  3. **Database Similarity Searching**
    1. Unique Requirements of Database Searching
    2. Heuristic Database Searching
    3. Basic Local Alignment Search Tool (BLAST)
    4. FASTA
    5. Comparison of FASTA and BLAST
  4. **GenBank and DNA Data base of Japan (DDBJ)**
    1. Protein information Resource (PIR) formats
    2. Protein Sequence (databases, SwissProt, UniProt, UniProtKB/TrEMBL)
    3. Structural databases (Protein Databank (PDB), Structural Classification of Proteins (SCOP) database, Class, Architecture, Topology, Homology (CATH) database)
  5. **Introduction to Biomolecules**
    1. Computational Biology : Introduction to Bioinformatics
    2. Protein folding and misfolding
    3. Protein Architecture: Sequence of amino acids
    4. protein interaction.
  6. **Structures**
    1. Secondary structure of proteins
    2. Tertiary structure of proteins
    3. Nucleic Acid Structure.
  7. **DNAs and RNAs**
    1. Interactions and conformations of DNAs.
    2. Interactions and conformations of RNA.
  8. **Computer Simulations of biomolecules**
    1. Classical versus quantum descriptions
    2. Statistical mechanics of biomolecules (e.g., canonical ensemble, ergodicity)
    3. Modeling interaction in protein (Bond-length and bond-angle potentials)
    4. Molecular Dynamics Simulations
- ## Suggested Teaching Methodology:**
- Lecturing
  - Written Assignments Report Writing **## Suggested Assessment: ### Theory (100%)**
  - Sessional (20%)
  - Quiz (12%)
  - Assignment (8%)
  - Midterm (30%)
  - Final Term (50%)

## **Practical Exercises (100%)**

- Open-Ended Labs ## **Text and Reference Books:**

1. Introduction to Bioinformatics, Arthur M. Lesk, 4th Edition, Oxford University Press, 2014, ISBN 0198724675, 9780198724674
2. Bioinformatics and Functional Genomics, Jonathan Pevsner, 2nd Edition, Wiley, 2009, ISBN 0470085851, 9780470085851.
3. D. Frankel and B. Smit “Understanding Molecular Simulations: From Algorithms to Applications”
4. T. E. Creighton “Proteins” (2nd edition, W.H. Freeman, and Co., New York) \_\_\_\_\_

## # (BM-310) - Control Systems for Biomedical Engineers

### Course Outline:

1. **Introduction**
  1. Introduction to control systems
  2. Open loop and close loop control systems.
  3. Examples of control systems in Biomedical Engineering.
2. **Modeling in the Frequency Domain**
  1. Electrical/Electronic/Mechanical systems transfer function
  2. Electric circuits analog
3. **Modeling in the Time Domain**
  1. General State-Space Representation and Analysis
  2. Converting a Transfer Function to State Space & vice versa.
4. **Time Response**
  1. Poles, Zeros, and System Response
  2. Transient and steady state response of first and second order systems
5. **Reduction of Multiple Subsystems**
  1. Block Diagrams and reduction techniques
  2. Signal-Flow Graphs and Mason's Rule.
6. **Control System Stability**
  1. Routh-Hurwitz Criterion and Special Cases
7. **Root Locus Techniques**
  1. Root Locus and its Properties
  2. Sketching the Root Locus plots.
8. **Frequency Response Techniques**
  1. Bode and Polar Plots
  2. Stability via the Nyquist Diagram
  3. Gain Margin and Phase Margin
9. To be familiar with the Matlab programming and control system toolbox.
10. Find the closed-loop transfer function of the system.
11. To find the impulse and step responses of the control system.
12. To compute the transient response parameters of control systems.
13. To find the partial fraction residues and poles of the system.
14. To find the Eigen values of the system.
15. Transfer function to state space conversion.
16. To find the closed-loop pole locations to check the stability of the system.
17. To obtain the root locus of the system.
18. To obtain the Bode plot of the system.
19. To plot the Nyquist diagram of the system.
20. To find the gain and phase margins of the system
21. Open ended lab 1
22. Open ended lab 2
23. Open ended lab 3
24. Open ended lab 4

### Suggested Teaching Methodology:

- Lecturing
- Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**
- Sessional (20%)
- Quiz (12%)

- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

**Laboratory (100%)**

- Labs
- Open-Ended Labs

**Recommended Text and Reference Books:**

1. Control Systems Engineering, by: Norman S. Nise, 7th Edition.
  2. Modern Control Engineering, by: Katsuhiko Ogata, 5th Edition.
  3. Biomedical Applications of Control Engineering, by Selim S. Hacısalihzade
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# (BM-311) - Bio-Instrumentation and Measurements - II

## Course Outline:

1. **Centrifugation techniques**
2. **Electrochemical methods of analysis**
  1. Electrophoresis
  2. Blood banking and transfusion
  3. Chromatography, Liquid chromatography
  4. Gas chromatography
  5. High performance liquid chromatography
  6. Clinical chemistry analyser
  7. Automated cell counter
3. **Spectroscopy**
  1. Spectrophotometry
  2. Flame photometry
  3. Mass spectrometry
  4. Infrared spectrometry
  5. Nuclear Magnetic Resonance Spectroscopy
4. **Microscopy**
  1. Electron microscopy
  2. Atomic force microscopy
  3. Confocal microscopy ## **List of Practicals:**
5. Demonstration and Troubleshooting of centrifuge
6. Separation of Blood components using Centrifuge
7. Hemoglobin separation using Electrophoresis.
8. Design and Development of Virtual Instruments in Lab View.
9. Introduction to Virtual Instrument Designing in Lab View
10. Building Applications using For loops in Lab View
11. Signal Processing using Lab View
12. Analysis of Cefixime Trihydrate using UV Spectrophotometer.
13. Determination of absorption coefficient using UV-spectrophotometer.
14. Wavelength analysis of different light sources using Atomic Spectrometer.
15. Demonstration and working of High Performance Liquid Chromatography (HPLC)
16. Demonstration and working of Hematology Analyzer.
17. Demonstration and working of Chemistry Analyzer
18. Troubleshooting and repair of Medical Equipment
19. Comprehension of documentation and hospital set-up
20. Open Ended Lab 1 ## **Suggested Teaching Methodology:**
  - Lecturing
  - Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**
  - Sessional (20%)
  - Quiz (12%)
  - Assignment (8%)
  - Midterm (30%)
  - Final Term (50%)

## Laboratory (100%)

- Labs
- Open-Ended Labs

## Recommended Text and Reference Books:

1. Mary C. Haven (Editor), et al, Laboratory Instrumentation, 4th ed, 1995. ISBN: 978-81-265-2857-8
2. Cromwell, Bio-Medical Instrumentation & Measures 2. 2nd ed,1980. ISBN: 978-81-203-0653-
3. John G. Webster (Editor), Medical Instrumentation 2. 2nd ed. 2010. ISBN: 978-0-471-67600-3

## Medical Devices Regulatory Affairs

### Course Outline:

1. **Introduction to regulatory affairs**
  1. The role of RA
  2. Introduction to major global reference regulations and harmonizations
  3. Overview of regulatory environment in major Asian reference countries
  4. Future trends in regulatory development
2. **Pre-market requirements**
  1. Background
  2. Classifications
  3. GMP
  4. Conformity assessment
3. **Advanced products**
  1. Combination products
4. **Medical Device Errors**
  1. Human Factors
  2. Electronic Health Records.
5. **Investigational Device Exemptions**
  1. HDEs
  2. Medical Device 510(k)
  3. Pre-Market Approval (PMA) submissions
  4. **de novo** review and Product Development Protocol
6. **FDA Enforcement**
  1. FDA Postmarket Transformation
  2. Medicare Reimbursement
  3. FDA and the Food and Drug laws. #####
7. **Medical Product Regulatory Affairs: Pharmaceuticals, Diagnostics, Medical Devices** by John J. Tobin, Gary Walsh, ISBN: 978-3-527-31877-3
8. **Handbook of Medical Device Regulatory Affairs in Asia** by Jack Wong, Raymond Tong Kaiyu

# (BM-312) - Biostatistics

## Course Outline:

1. **Descriptive Biostatistics**
  1. Introduction to Biostatistics,
  2. Measures of Central Tendency,
  3. Measures of Dispersion,
  4. Frequency Distribution,
  5. Graphical Methods (scatter plot, histogram, bar chart, stem-leaf plot etc.)
2. **Introduction to Probability**
  1. Multiplication and Addition Laws of Probability,
  2. Conditional Probability,
  3. Bayes' Rule and Screening Tests, Bayesian Inference
3. **Discrete Probability Distributions**
  1. Expected value and Variance of a Discrete Random Variable,
  2. Cumulative-Distribution Function of a Discrete Random Variable, Permutations and Combinations,
  3. Binomial Distribution,
  4. Poisson Distribution
4. **Continuous Probability Distributions**
  1. Normal Distribution,
  2. Properties of the Standard Normal Distribution,
  3. Normal Distribution Applications,
  4. Estimation of the Mean and Variance of a Distribution
5. **Sampling Distributions**
  1. Central Limit Theorem
6. **Hypothesis Testing**
  1. Hypothesis Testing (z-test t-test (one and two sample),
  2. chi-squared test),
  3. Analysis of Variance (ANOVA)(one-way & two-way),
  4. Regression analysis
7. **Statistical Software**
  1. Make appropriate use of statistical software (STATA, SPSS, MS- EXCEL etc.).

## Suggested Teaching Methodology:

- Lecturing
- Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**
- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

## Laboratory (100%)

- Labs
  - Open-Ended Labs
1. Bernard Rosner, "Fundamentals of Biostatistics", 7th Edition, Brooks/Cole Cengage Learning.



2. Wayne W. Daniel, "Biostatistics: A Foundation for Analysis in the Health Sciences", 10th Edition, John Wiley & Sons, Inc
  3. SPSS survival manual a step by step guide to data analysis using SPSS 4th edition by Julie Pallant.
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# (BM-313) - Biomaterials

## Course Outline:

### Theory

1. **Course Overview and Introduction**
  1. Introduction to biomaterials science
  2. Brief history of biomaterials (generations of biomaterials)
  3. Today's biomaterials applications: overview of types of implantable biomaterials and devices
2. **Properties of Biomaterials: General Concepts**
  1. Bonding, interatomic, intermolecular, surface interactions
  2. Introduction to bulk properties: microstructure, strength, deformation, thermal and optical properties
  3. Techniques: Introduction to surface Characterization of Biomaterials
  4. Electron spectroscopy for chemical analysis
  5. Attenuated total internal reflectance Fourier transform-infrared spectroscopy.
  6. Composite biomaterials
  7. 3D structure of biomaterials by bio X-ray diffraction, application of chitosan and other biopolymers in biomedical
3. **Classes of Materials Used in Medicine**
  1. Polymeric biomaterials (chitosan, collagen, elastin, proteoglycan and glycoprotein)
  2. basic principles: molecular and chemical structure, molecular weight and polydispersity
  3. physical behavior
  4. synthesis: addition, free-radical, condensation polymerization
  5. Hydrogels: structure and synthesis
  6. examples of biomedical hydrogels: acrylic, PVA, PEG, degradable, smart hydrogels
  7. Biological materials: structure and properties, hard tissues: tooth and bone, soft tissues: skin, blood vessel, tendon.
4. **Introduction to Mechanical Properties of Biomaterials**
  1. Review of static and dynamic properties: tensile, compressive, flexural, torsional, viscoelasticity, creep, dynamic modulus
  2. Deformation and fracture of engineering materials
  3. Biomechanics of arthroplasty
  4. Introduction to finite element analysis.
5. **Biomaterials Degradation in the Biological Environment**
  1. Review of clinical cases of implant failure
6. Mechanisms of metallic corrosion
7. Fatigue failure
8. Wear
9. Polymer degradation
10. Ceramic degradation
11. **Biocompatibility**
  1. Biological responses to biomaterials
  2. Toxicity and hypersensitivity
  3. Blood-material interactions
  4. Tumours associated with biomaterials and implants
  5. Biofilms
12. **Special Considerations for Implants, Devices and Biomaterials**
  1. Sterility and patient safety
  2. Device Failure Mode Analysis/Risk Analysis
  3. Voluntary consensus standards and regulatory compliance
  4. Legal aspects of biomaterials, clinical trials and case studies in regulations
13. **Tissue Engineering, gene therapy using viral vector materials for scaffolding.**
14. **Biomaterial implantation and Acute inflammation**

15. **Wound healing and the presence of biomaterials**
16. **Immune response to biomaterials**
17. **Biomaterials and thrombosis**
18. **Infection, tumorogenesis and calcification of biomaterials**

### **List of Practicals:**

1. To build molecular model of a biopolymer from basic repeating peptide units
2. Molecular graphics of basic repeating units of biopolymer
3. Interpretation of bio X-ray diffraction of a biomaterial expected diffraction pattern
4. Calculate R-value for structural analysis of biopolymers
5. To build model of CHITOSAN (bio-materials) from basic repeating units.
6. Molecular graphics of basic repeating units of CHITOSAN.
7. Demonstration of features of dental chair & dental operatory.
8. Demonstration of bio-materials (bioceramics, porcelain & metals) its composition & properties
9. Demonstration of the process of sterilization, autoclave & X-ray unit (dental).
10. Separation of bio-material (protein) by electrophoresis method involved in various diseases.
11. Demonstration of different types of sutures.
12. Fabricate a biomaterial for bone tissue
13. Fabricate a biomaterial for dental tissues
14. Tension and compression analysis for fabricated biomaterials.
15. Open ended lab 1
16. Open ended lab 2

### **Suggested Teaching Methodology:**

- Lecturing
- Written Assignments Report Writing

### **Suggested Assessment:**

#### **Theory (100%)**

- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

#### **Laboratory (100%)**

### **Recommended Texts and Reference Books:**

1. Buddy D. Ratner, et al, Biomaterials Science, Second Edition: An Introduction to Materials in Medicine
2. Handbook of Biomaterial Properties (*Second Edition*) edited by William Murphy, Jonathan Black, Garth Hastings.
3. Michael N. Helmus (Editor), Biomaterials in the Design and Reliability of Medical Devices
4. David Hill, Design Engineering of Biomaterials for Medical Devices
5. Jos Vander Sloten (Editor), Computer Technology in Biomaterials Science and Engineering (Biomaterials Science & Engineering)
6. Kay C. Dee, et al, An Introduction to Tissue-Biomaterial Interactions
7. Joon B. Park, Joseph D. Bronzino, Biomaterials Principles and Application
8. Xian, Wujing, A laboratory course in biomaterials, 2009.
9. Mahapatro, Anil, Polymers for biomedical applications, 2008.

10. Temenoff, J. S, Biomaterials: The intersection of biology & materials science, 2008.
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# (BM-401) - Numerical Methods for Biomedical Engineers

## Course Outline:

### Theory:

1. **Error analysis**
  1. Floating points
  2. Errors and types of errors
2. **Solution of non-linear equation**
  1. Bisection,
  2. Regula-Falsi,
  3. Fixed-point iterative and Newton-Raphson's methods.
  4. Solution of linear algebraic equations.
3. **Direct methods**
  1. Crout's and Cholesky methods;
4. **Iterative methods**
  1. Jaccobi's and Guass-Seidal methods.
5. **Eigen values and eigen vectors**
  1. Characteristics equation and Power methods.
6. **Interpolations and extrapolations**
  1. Forward, backward, central difference operators and their relations.
  2. Newtons Forward, Backward and Divided Difference Interpolation Formulae.
  3. Lagrange's and Stirling's Interpolation Formulae.
7. **Numerical differentiation**
  1. Newton's-Forward and Backward differentiation Formulae.
8. **Numerical quadrature**
  1. Trapezoidal, Simpson's one-third, Simpson's three-eight and Weddle's rules and Gaussian quadrature.
9. **Solution of OD Eqns**
  1. Taylor Series, Euler's and its modified,
  2. Runge-Kutta, Milne's,
  3. Adam-Moltan (Predictor-Corrector) methods.
10. **Solution of Higher Order Differential Equations**
  1. Runge-Kutta methods.
  2. Solution of Partial Differential Equations by Finite Differences Methods (Explicit, Implicit and Crank-Nicolson techniques) and ADI Method.

## Suggested Teaching Methodology:

- Lecturing
- Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**
- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

## Recommended Text and Reference Books:

1. Dunn, Stanley M, Alkis Conastantinides, Numerical Methods in Biomedical Engineering 2006
2. Canal and Chapra "Numerical Methods for Engineers".

3. Curits F. Gerald “Applied Numerical Analysis”.
  4. Erwin Kreyszig “Advanced Engineering Mathematics”.
  5. Chung Yau Lam “Applied Numerical Methods for the Solution of Partial Differential Equations”
  6. Dr Saeed Akhtar Bhatti “A First Course in Numerical Analysis”.
  7. John L. Van Iwaarden “Ordinary Differential Equations with Numerical Techniques”.
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# (BM-404) - Biomechanics

## Course Outline:

### Theory:

1. **Introduction**
  1. Definition and perspective
  2. Review of statics
  3. Review of Dynamics
  4. Review of deformable body mechanics
  5. Viscoelasticity, material properties
2. **Anthropometry**
  1. Density, mass and inertial properties
  2. Direct measurement of anthropometric parameters
  3. Muscle anthropometry
  4. Mechanical advantage of muscle
  5. Multipoint muscles,
3. **Kinematics of Human Movement**
  1. Forms of motion
  2. Standard reference systems and joint movement terminology
  3. Spatial reference systems
  4. qualitative vs. quantitative analysis of human movement
  5. limb-segment angles, joint angle, linear and angular velocities and acceleration
  6. tools for direct/indirect measurement of kinematic quantities
4. **The biomechanics of Human Bone Growth and Development**
  1. Composition and Structure of Bone Tissue
  2. Material Constituents
  3. Structural Organization
  4. Types of Bones
  5. Bone Growth and Development
  6. Longitudinal Growth
  7. Circumferential Growth
  8. Adult Bone Development
  9. Bone Response to Stress
  10. Bone Modeling and Remodeling
  11. Bone Hypertrophy
  12. Bone Atrophy
  13. Osteoporosis
5. **Kinetics of Human Movement**
  1. Link segment models
  2. Joint reaction forces
  3. Direct Force measurements
6. **Biomechanics of upper & lower extremity**
  1. Loading and injuries to the shoulder, elbow, wrist joints.
  2. Loading and injuries to the Hip, knee and ankle joints
7. **Gait Biomechanics**
  1. Methods of gait analysis
  2. Gait cycle
  3. Temporal-spatial parameters
  4. Hip, knee and ankle joint kinematics and kinetics
  5. Interpretation of gait data ## **List of Practicals:**
8. To determine the coordinates of the centre of gravity (COG) of a body using segmentation method.
9. To determine the centre of Gravity Measurement using Reaction Board
10. Volumetric analysis of irregular shaped body segments

11. To determine the muscle force required by the biceps while holding a known weight in hand for a range of elbow joint angles using the mechanical arm model
12. To determine the muscle force using an analytical model comprising two muscles at the elbow joint and compare the results with the previous one.
13. Design and develop a goniometer for upper limb.
14. Design and develop a goniometer for lower limb.
15. Design and develop a dynamometer for wrist.
16. Gait analysis among healthy individuals.
17. Dynamometry of human foot by virtue of body weight
18. Volumetric analysis of irregular shaped body segments
19. Analysis of human motion using Movement Velocity counter
20. Development of static human model using Visual 3D
21. Study of blood flow using blood vessel models
22. To design the human limbs on Solid works.
23. To analyse the human limbs on ANSYS. ## **Suggested Teaching Methodology:**

- Lecturing
- Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**
- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

#### **Laboratory (100%)**

- Labs
- Open-Ended Labs

#### **Recommended Text and Reference Books:**

1. Susan J. Hall, Basic Bio-Mechanics, 6th Ed, 2011.
  2. Margareta Nordin, Victor H. Frankel, Basic Biomechanics of the Musculoskeletal System
  3. NihatÖzkaya, et al, Fundamentals of Biomechanics: Equilibrium, Motion, and Deformation
  4. David A. Winter, Biomechanics and Motor Control of Human Movement
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## (BM-408) - Biomedical Imaging

### Course Outline:

#### Theory:

1. **Digital Image Fundamental**
  1. Image file formats
  2. Elements of Visual Perception
  3. Image Sampling and Quantization
  4. An Introduction to the Mathematical Tools Used in Digital Image Processing
2. **Intensity Transformations and Spatial Filtering**
  1. Basic Intensity Transformation Functions
  2. Histogram Processing
  3. Fundamentals of Spatial Filtering
  4. Smoothing Spatial Filters
  5. Sharpening Spatial Filters
3. **Filtering in the Frequency Domain**
  1. Review of Concept about Fourier in 1D
  2. Fourier Functions of Two Variable
  3. The Basics of Filtering in the Frequency Domain
  4. Image Smoothing Using Frequency Domain Filters
  5. Image Sharpening Using Frequency Domain Filters
4. **Image Restoration and Reconstruction**
  1. Noise Models
  2. Restoration in the Presence of Noise Only-Spatial Filtering
  3. Periodic Noise Reduction by Frequency Domain Filtering
  4. Inverse Filtering, Least Squares Filtering, GM filtering
  5. Image Reconstruction from Projections
5. **Image Segmentation**
  1. Point, Line, and Edge Detection
  2. Thresholding
  3. Region-Based Segmentation
  4. Segmentation Using Morphological Watersheds
  5. The Use of Motion in Segmentation
6. **Image Compression**
  1. Compression Standards
  2. Some Basic Compression Methods (Huffman Coding, Golomb Coding)
7. **X-ray Imaging**
  1. Physics of X-ray
  2. Imaging with X-ray
  3. Radiation dose
  4. Attenuation based X-ray Imaging
  5. X-ray Detection
  6. X-ray Image Quality
  7. Diagnostic Applications of X-ray Imaging
  8. Demonstration of X-rays Equipment
8. **Principles of Computed Tomography**
  1. Introduction to Computed Tomography and Scanners
9. Attenuation Tomography
10. Time of Flight Tomography
11. Reflection Tomography
12. Diffraction Tomography
13. Formulation of Attenuation Computed Tomography
14. Fourier Slice theorem

1. **Magnetic Resonance Imaging**
    1. Physical and physiological principle of Magnetic Resonance Imaging
    2. MR Imaging
    3. Formulation of MRI reconstruction
    4. Functional MRI, BOLD MRI,
    5. Applications of MRI and fMRI
  2. **Ultrasound Imaging**
    1. Generation and detection of ultrasound waves
    2. Physical and physiological principles of Ultrasound
    3. Resolution of Ultrasound imaging
    4. Ultrasound Imaging Modalities
    5. Doppler Ultrasound Imaging
    6. Modes of ultrasound image representation
    7. Ultrasound Image Artifacts
  3. **Positron Emission Tomography**
    1. Physical and physiological principles of PET
    2. PET Signal Acquisition
    3. PET Image formation
    4. Significance of PET
    5. Applications of PET
- ## List of Practicals:**
15. MATLAB: Introduction to MATLAB and image processing toolbox
  16. Digital Image Fundamentals: Sampling and quantization, bits per pixel & shades, spatial resolution & image size, Zooming & shrinking images
  17. Basic Gray Level transformations: Image Negative, Log transform.
  18. Application Of Gamma Correction to enhance image
  19. Contrast stretching and thresholding
  20. Introduction to image Histogram , Histogram sliding
  21. Histogram equalization
  22. Enhancement using arithmetic/logic operations
  23. Smoothing spatial filters (Mean and Median filters)
  24. Sharpening spatial filters (Laplace and Sobel)
  25. Un-sharp masking and high-boost filtering Combining Spatial Enhancement methods
  26. Review of Fourier transform and convolution theorem, 2D-FT, FT and frequency components of an image
  27. Lowpass and Highpass Filters: Ideal filters, Butterworth filters, Gaussian filters. Filters comparison, Unsharp Masking
  28. Dilation and erosion
  29. Detection of discontinuities, Edge linking and boundary detection, Segmentation by thresholding
  30. Object recognition, classification and image compression
- ## Suggested Teaching Methodology:**
- Lecturing
  - Written Assignments Report Writing
- ## Suggested Assessment: ### Theory (100%)**
- Sessional (20%)
  - Quiz (12%)
  - Assignment (8%)
  - Midterm (30%)
  - Final Term (50%)

#### **Laboratory (100%)**

- Labs
- Open-Ended Labs

### **Recommended Text and Reference Books:**

1. Bushberg J.T., The Essential Physics of Medical Imaging 3rd Ed.
  2. Z. H. Cho, Foundations of Medical Imaging
  3. Biomedical Imaging (Principles & Application Engg: Series).
  4. Digital Image Processing for Medical Applications, Geoff Dougherty, Cambridge University Press 978-0-521-86085-7
  5. Digital Image Processing for Medical Applications by Geoff Dougherty, Cambridge University Press.
  6. Digital Image Processing by Gonzales, R. C., Prentice Hall, New Jersey.
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## (BM-413) - Biomedical Engineering Project

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## **(BM-423) - Introduction to Robotics**

### **Course Outline:**

#### **1. Fundamentals**

1. What is a Robot?
2. Classification of Robots.
3. What is Robotics?
4. History of Robotics.
5. Advantages and Disadvantages of Robots.
6. Robot Components.
7. Robot Degrees of Freedom.
8. Robot Joints.
9. Robot Coordinates.
10. Robot Reference Frames.
11. Programming Modes.
12. Robot Characteristics.
13. Robot Workspace.
14. Robot Languages.
15. Robot Applications.
16. Other Robots and Applications.
17. Social Issues.

#### **2. Robot Kinematics**

1. Position Analysis.
2. Robots as Mechanisms.
3. Matrix Representation.
4. Homogeneous Transformation Matrices.
5. Representation of Transformations.
6. Inverse of Transformation Matrices.
7. Forward and Inverse Kinematics of Robots.
8. Denavit-Hartenberg Representation of Forward Kinematic Equations of Robots.
9. The Inverse Kinematic Solution of Robots.
10. Inverse Kinematic Programming of Robots.
11. Degeneracy and Dexterity.
12. The Fundamental Problem with the Denavit- Hartenberg Representation.
13. Differential Motions and Velocities.

#### **3. Differential Relationships**

1. Jacobian.
2. Differential Motions of a Frame.
3. Interpretation of the Differential Change.
4. Differential Changes between Frames.
5. Differential Motions of a Robot and Its Hand Frame.
6. Calculation of the Jacobian.
7. How to Relate the Jacobian and the Differential Operator.
8. Inverse Jacobian.
9. Design Project.
10. Dynamic Analysis and Forces.

#### **4. Lagrangian Mechanics**

1. A Short Overview.
2. Effective Moments of Inertia.
3. Dynamic Equations for Multiple-Degree-of-Freedom Robots.
4. Static Force Analysis of Robots.
5. Transformation of Forces and Moments between Coordinate Frames.
6. Design Project.

## 5. Trajectory Planning

1. Path vs. Trajectory
2. Joint Space vs. Cartesian-Space.
3. Basics of Trajectory Planning.
4. Joint space trajectory planning,
5. Cartesian space trajectories.

## 6. Application of Robotic in BME

1. Introduction to medical robotics
2. Mechanisms for medical robots
3. Sensing for medical robots
4. Actuators for medical robots
5. Controls for medical robots
6. Interfaces for medical robots ##### **List of Practicals:**

7. Introduction to the Rhino
  8. The Tower of Hanoi
  9. Forward Kinematics
  10. Inverse Kinematics
  11. Image Processing
  12. Camera Calibration
  13. Object Centroids
  14. Camera Calibration
  15. Pick and Place 10 Grading
- 11 Tactile and force sensing 12 Proximity sensing

13. Medical robotics
14. Open ended lab 1
15. Open ended lab 2
16. Open ended lab 3 ### **Suggested Teaching Methodology:** Lecturing

Written Assignments ### **Suggested Assessment: Theory (100%)**

Sessional (20%)

Quiz (12%)

Assignment (8%)

Midterm (30%)

Final Term (50%)

**Laboratory (100%)**

### **Text and Reference Books:**

1. Robotics: Everything You Need to Know About Robotics from Beginner to Expert, Peter Mckin-non(Paperback– January 28, 2016)
  2. Robotics, Vision and Control: Fundamental Algorithms in MATLAB, 2011
  3. Springer Handbook of Robotics, Siciliano, Bruno, Khatib, Oussama, 2008
  4. Robotics Modelling, Planning and Control, Siciliano, B.,Sciavicco, L., Villani, L., Oriolo, 2009.
  5. Medical Robotics: Minimally Invasive Surgery, Paula Gomes, ISBN:9780857097392, 2012
  6. Medical Robotics, Schweikard, Achim, Ernst, Floris, 2015
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## **(BM-425) - Telemedicine**

### **Course Outline:**

- 1. Origins and Development of Telemedicine**
  1. Overview of e-Health, Telehealth and Telemedicine
  2. Technological & non-technological drivers
  3. Benefits and limitations of telemedicine
  4. Telemedicine in developed & underdeveloped nations
- 2. Technologies of Telemedicine Systems**
  1. Types of information & transmission
  2. Tele-Consultation and Telemonitoring
  3. Types of Wireless Networks
  4. Communication Protocols, shared variables and network streaming
- 3. Telemedicine Applications**
  1. Tele-Radiology
  2. Tele-Dermatology
  3. Tele-Pathology
  4. Tele-cardiology
  5. Tele-Ophthalmology
  6. Tele-Surgery
  7. Tele-psychiatry
  8. Tele-dentistry
  9. Disaster Management
- 4. Development and Delivery of Telemedicine Services**
  1. The Strategic Context of Service Development: USA, Australia, the UK and Malaysia
  2. The Evaluation of Pilot Studies
- 5. Ethical and Legal Aspects of Telemedicine**
  1. Confidentiality, Patient Rights and Consent
  2. Data Protection and Security
  3. Telemedical Malpractice
  4. Intellectual Property Rights
- 6. Future Trends in Healthcare Technology**
  1. Prognostics in Telemedicine
  2. The Aging Population: Home Care for the Elderly
  3. Smart Home Assistive Technologies
  4. Clothing Technology and Healthcare
  5. Haptic Sensing for Practitioners
- 7. Introduction to Information Systems**
  1. Basics of Information Systems
  2. Rudiments of Healthcare Information Management System
  3. HIS, Now and future
- 8. Data standards, Handling and Processing**
  1. Data representation
  2. Storage Tiers
  3. Data Structure
  4. Flow Charts and Work Process Flow Diagrams
  5. Electronic Health Records (HERs)
  6. Pros & Cons of Paper medical records
  7. Functions and Benefits of EHRs
- 9. Subsystems of HIS**
  1. Health Information Systems in Clinical Settings
  2. Laboratory Information Systems
  3. Radiology Information Systems

4. Clinical Decision Support Systems (CDSS)
  5. Healthcare Financial Management.
10. **Network and Communication**
1. Medical device networking
  2. DICOM
  3. HL7 standards
  4. HIMSS ## **Suggested Teaching Methodology:**
- Lecturing
  - Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**
  - Sessional (20%)
  - Quiz (12%)
  - Assignment (8%)
  - Midterm (30%)
  - Final Term (50%)

### **Recommended Text and Reference Books:**

1. Strategic Information Management in Hospitals: An Introduction to Hospital by Reinhold Haux  
ISBN:0-378-40356-6
  2. Medical Data Management: A Practical Guide ISBN 978-0-387-21773-4
  3. Bernard Fong, ACM Fong, CK Li “Telemedicine Technology: Information Technologies in Medicine and Telehealth” 2011 ISBN: 978-0-470-74569-4
  4. Norris A. C, “Essentials of Telemedicine & Telecare”, 2001 ISBN: 0-471- 53151-0
  5. Marlene Maheu, Ace Allen, Pamela Whitten, “E-Health, Telehealth & Telemedicine”: A guide to startup and success. ISBN: 0787944203
  6. B.S Chowdhry & Faisal Abro, “Telemedicine Modernization & Expansion of Healthcare System”. ISBN: 969-86-80-00-4
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## **(BM-432) - Neuroscience and Neural Networks**

### **Course Outline:**

- 1. Introduction to neuroscience**
  1. Nervous system
  2. Sympathetic
  3. Parasympathetic and motor nervous system and their functions
  4. Brain and its functions
  5. Neurons and glia, structure of a neuronal cell, types of glia.
  6. Blood brain barriers.
- 2. Neuronal Circuits**
  1. Neuronal circuit in emotional control
  2. Neuronal circuit in reward and addiction
  3. Neuronal regulation of stress
- 3. Receptors**
  1. Ionotropic and metabotropic receptors
  2. signal transduction pathways
  3. G-proteins
  4. protein phosphorylation
  5. Signaling to the nucleus
  6. regulation of gene expression
- 4. Neurotransmitters**
  1. Excitatory and inhibitory amino acid neurotransmitters
  2. Functions in the brain
  3. Pain pathways in brain
  4. Role of excitatory neurotransmitter in learning and memory
  5. Diseases associated with the malfunctioning of these neurotransmitters
  6. Neuronal degeneration
- 5. Catecholamines**
  1. Functions in the brain
  2. Diseases associated with the malfunctioning.
- 6. Neural basis of behavioral plasticity**
  1. Human and animal memory
  2. Cellular mechanisms of neural plasticity
- 7. Neuroendocrine and motivational systems**
  1. Endocrine systems
  2. Feeding behavior
  3. Stress
- 8. Diseases of the nervous system**
  1. Addiction
  2. Depression
  3. Schizophrenia
  4. Epilepsy
  5. Alzheimer
  6. Parkinson
  7. Prion
  8. Motor Neuron Disease
- 9. Introduction to Artificial Intelligence**
  1. Foundations of AI
  2. Agents and Environments.
10. Structure of Agents.
11. Problem Solving Agents.
  1. **Problem Solving by Searching**

1. Searching for Solutions.
2. Uninformed Search Strategies
3. Informed Search Strategies
12. Informed (Heuristic) Search Strategies:
13. Greedy Best-first Search.
14. A\* Search.
15. Heuristic Functions.
  1. **Reasoning and Knowledge Representation**
    1. Introduction to Reasoning and Knowledge Representation.
    2. Propositional Logic.
    3. First order Logic.
    4. Reasoning with Uncertainty & Probabilistic Reasoning
    5. Acting Under Uncertainty.
    6. Bayes' Rule.
  2. **Learning**
    1. Decision Trees
    2. ID3 Algorithm
    3. Statistical Learning.

### List of Practicals:

1. To study basics of Artificial Neural Network.
2. To study how a self-organizing map neural network can cluster iris flowers into classes topologically, providing insight into the types of flowers and a useful tool for further analysis.
3. Classification of wine vintage (using GUI) and crabs (through coding) using pattern recognition and classification network in Matlab.
4. Identification and prediction of relationship between independent and dependent variables using regression analysis.
5. Implementation of basic logic operations of ANN
6. To Work on the Command Line of Matlab to build fuzzy logic based application.
7. Study various methods to improve cognitive skills.
8. Study different methods to check memory skills
9. To understand the working of EEGLAB software for the analysis of EEG signals.
10. To study different processing tools available in EEGLAB software for the processing of EEG data.
11. To study about importing channels locations for EEG data using EEGLAB software.
12. To understand the working of SLORETA software for EEG analysis of the deep cortical structures.

#### ## Suggested Teaching Methodology:

- Lecturing
- Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**
- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

### Laboratory (100%)

- Labs
- Open-Ended Labs

### **Recommended Text and Reference Books:**

1. Russell S.; Norvig P.; “Artificial intelligence – A Modern Approach”, Latest Edition, Prentice Hall.
  2. Luger G.F.; Artificial Intelligence – Structures and Strategies for Complex Problem Solving”, Latest Edition, Pearson Higher Education.
  3. Progress in Neuroscience, Readings from Scientific American, John Wiley.
  4. Philip, G. Srauge, Brain Biochemistry and Brain Disorders, Oxford Press.
  5. George, J. Siegal, B. W. Agranoff, S. K. fisher , M. D. Uhler, Basic Neurochemistry: Molecular, Cellular and Medical Aspects, Lippincott D. Uhler.
  6. Darakhshan Haleem, Neurochemistry, Neuropharmacology and Behavior, 2010.
  7. Mark F. Bear, Barry W. Connors & Michael A. Paradiso, Neuroscience: Exploring the brain, 2006
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# (BM-451) - Bio-Signal Processing

## Course Outline:

### Theory:

1. **Introduction to Digital Signal Processing**
  1. Analog-to-Digital& Digital-to-Analog Conversion
  2. Digital Signals, Systems, and Difference Equations
  3. Realizations of Digital Systems
2. **Time domain Analysis**
  1. Digital Convolution
  2. Auto and Cross Correlation
3. **Discrete System Stability**
  1. The z-Transforms
  2. Transfer function, pole zero plot, and System Stability
4. **Discrete Time Fourier Transform**
  1. Frequency response of discrete system
  2. Frequency spectra of discrete signals
  3. Discrete Fourier Analysis and Periodic Signal Spectrum
  4. Fast Fourier transform (FFT),
5. **Finite Impulse Response Filter Design**
  1. FIR filter design using window method.
6. **Infinite Impulse Response Filter Design**
  1. IIR filter design using Bilinear Transformation Method
  2. IIR filter design using Pole-Zero placement, and Impulse Invariance methods.
7. **Biomedical Applications**
  1. Detection of Events: ECG rhythm analysis, Maternal Interference in Fetal ECG
  2. EEG wave-shape and wave-complexity: Analysis of event related potentials, coherence analysis, detection of EEG rhythms
  3. PPG wave analysis
  4. Sound wave analysis
  5. EMG Processing ## **List of Practicals:**
8. Impulse and Step Responses
9. Convolution and Correlation
10. Z-transform, Pole-Zero Plot, Stability
11. Frequency response analysis
12. Frequency spectra analysis
13. FIR filter design
14. IIR Filter Design
15. Analysis of Filter behavior
16. Filter simulation
17. PPG Signal Analysis. Signal Peaks. Peak widths. Heart rate. SpO2
18. ECG Waveform Analysis.
19. EEG Processing
20. Feature Extraction from EEG Signals.
21. Sound Processing. Detecting cardiac condition from digital stethoscope
22. Open ended lab 1
23. Open ended lab 2

## Suggested Teaching Methodology:

- Lecturing
- Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**

- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

#### **Laboratory (100%)**

- Labs
- Open-Ended Labs

#### **Recommended Text and Reference Books:**

1. Biomedical Signal Analysis, 2nd Ed, Ranagaraj M. Rangayyan, ISBN: 978- 0-470-91139-6, Willey-IEEE Press.
  2. Biomedical Signal Analysis: Contemporary methods and Applications, Fabian J, Theis and Anke Meyer, The MIT Press Cambridge, Massachusetts.
  3. Biomedical Signal Processing: Principles and Techniques. D. C. Reddy.
  4. Fundamentals of Digital Signal Processing. by: Joyce Van de Vegte.
  5. Digital Signal Processing: Fundamentals and Applications. by: Li Tan, 2nd Edition.
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# (BM-452) - Modelling and Simulation for Biomedical Engineers

## Course Outline:

### 1. Introduction

1. What is modeling and simulation
2. Application of Modeling and Simulation in Biomedical Engineering
3. Types of Models e.g. graphical model, Quantitative models,

### Multiscale Models

1. Hybrid models and its application in Biomedical Engineering
2. Conceptual modeling, why, when, where to use the conceptual model.
3. Conceptual model of cardiorespiratory system Subdivision of Physiology models and combining of basic elements of Conceptual models.
4. Things necessary before building a model.
5. One block model and its examples e.g. Heart, muscles, eye etc.
6. Hierarchical and integrated Model.

### 7. Mathematical Models

1. Mathematical Models and their importance in biomedical engineering
2. Mathematical models of Mechanical and Electrical systems.
3. Electrical and fluidic modeling of the blood flow through the artery.
4. Elementary Vascular Model and Its Electrical Analog
5. Electrical modeling of physiological System
6. Electrode electrolyte interface model

### 8. Application of Modeling and Simulation in Physiological System

1. Modeling of physiological systems
2. Examples of Physiological models
3. Medical imaging and its importance in modeling and Simulation
4. Importance of modeling and simulation according to new trends and technique
5. Modeling of human organs using 3D printing
6. Thermal modeling using Bio heat equations
7. Factors effecting thermal models
8. Application of thermal models on physiological System

### 9. Software Implementations

1. Implementation of Biomedical models using software. ##### **List of Practicals:**

10. Introduction to modeling using software
11. Design of conceptual model
12. Modeling of cardiovascular system
13. Simulation of Bio heat equation
14. Modeling and simulation of blood flow
15. Modeling and simulation arterial plaque
16. Modeling heat transfer through skin
17. Modeling of electrical stimulation
18. Modeling of human organs
19. Heat simulation using RF coil and high intensity focused ultrasound
20. Modeling through medical images
21. Simulation of light propagation in the eye
22. Glucose and insulin regulation model.
23. Renal clearance modeling using compartmental model
24. Skin Absorption Model using Ficks's Law
25. Open ended lab 1

### **Suggested Teaching Methodology:**

- Lecturing
- Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**
- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

### **Laboratory (100%)**

- Labs
- Open-Ended Labs

### **Recommended Text and Reference Books:**

1. Modeling and simulation in biomedical engineering, Willem Van Meurs.
  2. Physiological Modeling: An Introductory Course for Biomedical Engineers , John Enderle
  3. Advances in Numerical Heat Transfer, Volume 3, W. J. Minkowycz.
  4. Introduction to Modeling in Physiology and Medicine, Claudio Cobelli and Ewart Carson
  5. Modeling and Simulation in Medicine, Frank C. Hoppensteadt, Charles S. Peskin,
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# (CS-107) - Introduction to Computing

## Course Outline:

### Theory:

#### 1. Introduction

1. Applications of Computers
2. Classification of Computers
3. Advantages and Disadvantages of Computers.
4. Basic Components of a Computing Machine.
5. Input and Output Devices
6. Mass Storage Devices
7. Ports, Buses and Expansion slots.
8. Computer Networking Environment

#### 2. Data Storage

1. Data organization.
2. Data representation in Computers.
3. Physical and Logical Storage.
4. Magnetic Storage Devices viz. RAM, ROM, Secondary Storage, Cache.
5. Optical Storage Devices.

#### 3. Data Processing

1. Data Structures.
2. Flow Charts.
3. Process Flow Diagrams

#### 4. System and Application Programming

1. Basics of Operating Systems.
2. Desktop and Network Operating Systems, Application softwares.

#### 5. Computer Programming

1. Introduction to High Level and Low Level Programming Languages.
2. Process of Compilation and Interpretation.
3. Data Types and Declaration.
4. Header file and Linkage.
5. Preprocessor Directives.
6. Variables and Constants.
7. Basic library functions.
8. Input and Output Statements.
9. Termination, Remarks.
10. Control structures
11. Repetition and loops.
12. Arrays and String Operations
13. Data Filling
14. Using Graphics Libraries in Python/C++.

#### 6. Defining an Engineering Problem

1. Transforming Data in to Information.
2. Using Computers to Solve an Engineering Problem.

#### 7. Object Oriented Programming Basics

1. Understanding core concepts
2. Classes, Implementation of class and Objects.
3. Objects as physical objects.
4. Encapsulation.
5. Directives
6. Functions and Overloaded Functions
7. Reference arguments
8. Abstraction



9. Polymorphism
10. Object as data types constructor
11. Object as function arguments.
8. **User defined data types, Arrays and String Arrays fundamentals**
  1. User defined data types.
  2. Arrays of objects.
  3. Arrays as class Member Data
  4. Strings and String arrays.
9. **Inheritance**
  1. Concept of inheritance.
  2. Derived classes and Base classes.
  3. Derived Class Constructors.
  4. Member Functions
  5. Class hierarchies.
  6. Public and Private inheritance.
10. **Errors and Exceptions**
  1. A systematic, object-oriented approach to handling errors generated by python classes.
  2. Dealing example errors at runtime using Exceptions.
  3. Understanding Exceptional circumstance of Running out of memory
  4. Understanding Exceptional circumstance of Problems opening a file.
11. **Semester Project- Group Activity**

#### **Practical:**

1. Working with Windows 8/10 and DOS.
2. Basic Computer Hardware Awareness and Troubleshooting
3. To begin Programming in Python/C++.
4. Preparing your PC for Python/C++.
5. Understanding Shell and IDLE in Python and/or C++ IDE.
6. Making small programs, do compilation, execution and debugging of programs.
7. Implementation of simple control structures.
8. Using Loops
9. Implementation of functions
10. Using user input and presenting output.
11. Arrays, multidimensional arrays
12. Working with strings, string functions.
13. Data Filling in Python/C++.
14. Using Graphics Libraries in Python/C++.
15. Open Ended Lab I
16. Open Ended Lab II

#### **Teaching Methodology:**

- Lecturing, Student Engagement
- Quizzes and Assignments, uploading suggested resources on course website.
- Semester Project
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#### **Suggested Assessment:**

##### **Theory (100%)**

- Sessional (20%)

- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

**Laboratory (100%)**

**Text and Reference Books:**

1. Brian Williams and Stacey Sawyer, Using Information Technology, Latest Edition, McGraw-Hill, ISBN: 0072260718
  2. William Stallings, Computer Organization and Architecture: Designing for Performance, Latest Edition , Prentice Hall, ISBN: 0131856448, ISBN-13: 9780131856448
  3. Allen Downey; Think Python: How to Think Like a Computer Scientist; Green Tea Press Needham, Massachusetts.
  4. David Beazley and Brian K. Jones, “PYTHON Cookbook”; O’Reilly Atlas.
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# (CS-430) - Microprocessor Programming and Interfacing

## Course Outline:

### Theory:

1. **Introduction to Microprocessor and Microcontroller**
  1. Microprocessor and its Architecture
  2. Simplified CPU / Memory Organization
  3. Addressing modes / Instruction Set Summary
  4. I/O port, pin diagram and functions
  5. Data Bus, Address Bus and Control Bus
2. **Using Assembly Language with C/C++**
  1. Introduction to Assembly programming
  2. I/O Programming
  3. Arithmetic and Logical Operations
  4. Program Looping and Subroutine
  5. Serial Port Programming
  6. Interrupts Programming
3. **Data Acquisition Systems**
  1. Analog to digital converters and performance Parameters
  2. Designing of a Data Acquisition Systems
  3. Serial Communication
  4. Synchronous and Asynchronous Communication
4. **Interfacing Microprocessor/Microcontroller**
  1. Memory / Basic I/O interface
  2. RAM / ROM interfacing
  3. Keypad, Seven Segment / LED and LCD display
  4. Serial and Parallel ADC
  5. Sensor Interfacing
  6. Relays and Opto-isolators interfacing
  7. Stepper Motor Interfacing
  8. DC motor interfacing and PWM
5. **Defining an Engineering Problem**
  1. Introduction to embedded system chip board designing
  2. Component selection
  3. Troubleshooting and problem fixing ##### **List of Practicals:**
6. To demonstrate the hardware of microcontrollers and microprocessor
7. To use Proteus and Multisim simulating software for simulation
8. To use Keilmicro vision software for assembly and c programming
9. To generate List and Hex files
10. To interface and simulate ports of microcontroller (General)
11. To interface and simulate LEDs
12. To interface and simulate seven segments
13. To interface and simulate monochrome LCD
14. To program and perform ADC
15. To program and perform DAC
16. To connect external memory elements with microcontroller
17. To program and perform DC motor interfacing and PWM
18. To program and perform serial communication (RS232)
19. To program and perform parallel communication (RS232) ## **Suggested Teaching Methodology:**
  - Lecturing
  - Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**

- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

#### **Laboratory (100%)**

- Labs
- Open-Ended Labs

#### **Recommended Text and Reference Books:**

1. Barry B. Brey, The Intel Microprocessor, 8th ed. 2009, ISBN-10: 0135026458
  2. Roger L. Tokheim, Schaum's Outline of Theory and Problems of Microprocessor Fundamentals, Graw Hill Co., 1983, ISBN: 9780070649583
  3. Douglas. V. Hall, Microprocessor and Interfacing, Programming and Hardware, Mc. Graw Hill Co., 1986
  4. Scott Mackenzie, "The 8051 Microcontroller", Prentice Hall, ISBN: 0-13- 780008-8
  5. Muhammad Ali Mazidi, PIC Microcontroller and Embedded Systems, Pearson's Prentice Hall, 2008
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## (CY-106) - Chemistry

### Course Outline:

#### Theory:

##### 1. Introduction:

1. Wave properties of electrons and matter.
2. Quantum theory of matter at atomic level, atomic structure.
3. Energy levels, orbital, hydrogen spectrum, bond energy, molecular structure and its rotational and vibration energy.

##### 2. Chemical Bonding:

1. Types of Bonds, Hybridization and Theories of Bonding.
2. Valence Shell Electron Pair Repulsion Theory and Molecular Orbital Theory.
3. Physical state of matter.
4. Gas laws, properties of liquid, surface tension, viscosity, optical activity, dielectric constant, polarization, dipole moment.
5. Crystal structure.

##### 3. Chemical Kinetics:

1. Rate of reaction.
2. order of reaction.
3. First, Second and third order reaction.
4. factors affecting rate of reaction like Pressure, Temperature, Concentration, Catalyst, Surface Area and Volume.

##### 4. Electrochemistry:

1. oxidation and reduction reactions.
2. Balancing of redox reaction in acidic and basic medium.
3. Construction of galvanic cell.

##### 5. Organic chemistry:

1. Introduction and classification of organic compounds.
2. Saturated and unsaturated hydrocarbons.
3. Chemistry of Alkanes, Alkynes, Alkenes and Aromatics.
4. Nucleophilic and Electrophilic substitution Reactions.

### Lab Outline:

1. Order of reaction.
2. factors affecting rate of reaction.
3. acid-base titrations.
4. Redox's titrations.
5. preparation of Acidic and Basic buffer solutions and mixture analysis. **## Suggested Assessment: ### Theory (100%)**
  - Sessional (20%)
  - Quiz (12%)
  - Assignment (8%)
  - Midterm (30%)
  - Final Term (50%)

### Laboratory (100%)

### Text and Reference Books:

1. Silberberg Chemistry: The Molecular Nature of Matter and Change. McGraw Hill.
2. John, R. Holum: Elements of General, Organic and Biological Chemistry. John Wiley & Sons

# (EE-214) - *Circuit Theory*

**# (EE-493) - Digital Signal Processing ### Course Outline:**

- 3. Signal and System Characteristics and Models**
  1. Concept of Continuous-Time and Discrete-Time Signals and Systems
  2. Basic Operations on Signals
  3. Signal and system classifications
- 4. Time-Domain Representation of Continuous-Time Signals**
  1. Sinusoidal and Complex Exponential Signals
  2. Singularity Function Signals
  3. Signal Energy and Power
- 5. Time-Domain Analysis of Continuous-Time Systems**
  1. System Impulse Response
  2. Continuous-Convolution Evaluation and Properties
- 6. Frequency-Domain Representation of Continuous& Discrete-Time Signals**
  1. Spectra and Bandwidths of Continuous-& Discrete Time Signals
  2. Fourier Series Representation of Signals
  3. Amplitude and Phase Spectra of Periodic Signals
  4. The Fourier Transform and Spectra of Aperiodic Signals
  5. Properties of Fourier transform
- 7. Frequency-Domain Analysis of Continuous-Discrete Time Systems**
  1. System Frequency Response
  2. Amplitude and Phase Responses
- 8. Analysis of Continuous-Time Systems Using the Laplace Transform**
  1. Laplace Transform Evaluations and Theorems
  2. Evaluation of Inverse Laplace Transforms
  3. System Transfer Function and stability
- 9. Continuous-Time Filters**
  1. Distortion-less Transmission
  2. Ideal Filters
  3. Approximation of Ideal Filters
  4. Butterworth and Chebyshev Filter Design

**List of Practicals:**

1. To be familiarize with the MATLAB and SIMULINK.
2. To plot the sinusoidal, exponential and singularity functions
3. To perform the time-shift, time-scaling and time-reversal operations on the signals
4. To compute and plot the impulse response of the system
5. To compute the convolution of LTI Systems
6. To find the Laplace-Transform and inverse Laplace transform of the system
7. To find the transfer function and system stability
8. To plot the signals spectra using Fourier transform
9. To plot the frequency response of the system
10. To design filter using Butterworth & Chebyshev techniques
11. Open ended lab 1
12. Open ended lab 2
13. Open ended lab 3
14. Open ended lab 4
15. Open ended lab 5
16. Open ended lab 6

**Suggested Teaching Methodology:**

- Lecturing
- Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**

- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

**Laboratory (100%)**

- Labs
- Open-Ended Labs

**Recommended Text and Reference Books:**

1. Gordon E. Carlson. Signal and Linear System Analysis. John Wiley & Sons, Inc. 2nd Edition. 1992.
  2. Oppenheim, Alan V., and A. S. Willsky. Signals and Systems. Prentice Hall, 1982. ISBN: 9780138097318.
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# (EF-305) - Engineering Economic and Management

## Course Outline

### Theory

1. **Introduction to Engineering Management**
  1. Role of Engineer in Management;8
  2. Functions of Management
  3. Planning and Techniques of Management
2. **Organizational Management Engineering**
  1. Organizing Engineering and Structure
  2. Establishment of working relationship
  3. Market for engineering products
  4. Types of Markets
3. **Managerial Decision Making and Management of Operations**
  1. Efficient Managerial Decision in Healthcare setting
  2. Simulation Modeling of Healthcare delivery
  3. Simulation Applications in Healthcare setting
  4. Modeling clinical engineering activities to support healthcare technology management
4. **Management and Supervision**
  1. Principles of Hospital management
  2. Legal, Professional and Ethical Aspects
  3. Resources, duties and functions of medical and paramedical staff
  4. Planning, Knowledge of various Hospital services
5. **Cost and Quality Management**
  1. New Cost Accounting Model
  2. New Indicators for Hospital Management Based on Personnel Cost
  3. Total Quality Management ## **Suggested Teaching Methodology:**
  - Lecturing
  - Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**
  - Sessional (20%)
  - Quiz (12%)
  - Assignment (8%)
  - Midterm (30%)
  - Final Term (50%)

### Recommended Text and Reference Books:

1. Buchbinder Sharon, Introduction to Healthcare Management Latest ed.
  2. Alexander Kolker, Management Engineering for Effective Healthcare Delivery: Principles and Applications, 2012
  3. Kaluzny, Warner, Warren, Zelman, Management of Health Services
  4. Sakharkar Sharon B, Principles of Hospital Administration & Planning, 2009
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# (FE-119) - Fundamentals of Electrical Engineering

## Course Outline:

### Theory:

1. **Review**
  1. Structure of Matter, Conductors, Insulators and Semiconductors
  2. Electric Current, Electromotive Force (Voltage), Resistance, Conductance
2. Conventional Current, DC and AC, Real and ideal Sources
3. Ohm's Law
4. Work, Energy and Power, Efficiency
5. **Resistive Network**
  1. Kirchhoff's voltage and current Laws
  2. Voltage and Current Source Conversion
  3. The Voltage-Divider Rule
  4. The Current-Divider Rule
  5. Series and Parallel Connected Sources
  6. Y-Delta Transformations
  7. Balanced Bridges
6. **Network Theorems**
  1. The Superposition Theorem
  2. Maximum Power Transfer Theorem
7. **Capacitance and Capacitors**
  1. The Nature of Capacitance
  2. Capacitor Dimensions and Dielectrics
  3. Capacitor Types
  4. Energy Stored in a Capacitor
  5. Transients in RC Networks
8. **Inductance and Inductors**
  1. Electromagnetic Induction
  2. Lenz's Law, Faraday's Transformer Action, Self-Inductance, Inductor
  3. Energy Stored in an Inductor
  4. Transients in RL Circuits
9. **Poly Phase Systems**
  1. Three phase circuits and balanced loads.
10. **Transformers and AC Machines**
  1. General principle working, fundamental equations, types, efficiency and losses.

### Practical:

1. To get familiar with the usage of dual power supply and multimeter.
2. To study the resistor color code and measure the value

of given resistors by the resistor color code chart and also study about the potentiometer.

1. To study the properties of series circuit and also find the calculated value and measured values of the given resistors.
2. To study the properties of parallel circuit and also find the calculated value and measured values of the given resistors.
3. To solve the given combination (series-parallel) circuit and find the values given in the observation table.
4. To study the properties of combination (series-parallel) circuit and also solving the given circuits.
5. To study the properties of combination (series-parallel) circuit and also solving the given circuits.
6. To analyze the given circuit using superposition theorem and find out the value of voltage and current across Resistor.

7. To solve the given circuit using superposition theorem and find out the voltage and current.
8. To determine by analysis the values  $V_{TH}$  and  $R_{TH}$  in a DC circuit containing a single voltage source.
9. To verify Norton's Theorem and the theory of source Transformation.
10. To study the different switching method.
11. To study the characteristics of the transformer.
12. To perform open circuit and short circuit testing of a transformer
13. To study the characteristics and working principle of DC motor.
14. To study the different Relay switches.

### **Suggested Teaching Methodology:**

- Lecturing
- Written Assignments Report Writing

### **Suggested Assessment:**

#### **Theory (100%)**

- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

#### **Laboratory (100%)**

- Labs

### **Text Book:**

1. Basic Engineering Circuit Analysis, 8th Edition 2004 David Irwin ISBN-978- 81-265-
-

### **Course Outline:** 1. **The RLC Circuits** 1. Source Free Series & Parallel RLC Circuits, 1. over-damped, under-damped, critically damped RLC Circuits, 1. complete response of RLC Circuits, Lossless LC Circuits, 1. Power Factor Calculations 1. **The Sinusoidal Steady Response** 1. Nodal, Mesh & loop analysis, Comparison between Nodal and Mesh Analysis 1. AC source Transformation, Thevenin's, Norton's, 1. Reciprocity & Compensation theorems. Maximum Power Transfer Theorem. 1. First Order Circuits (RL and RC): Transient Response, Steady State Response, Unit Step Response 1. **Complex Frequency** 1. Introduction to complex frequency damped sinusoidal forcing function,  $Z(s)$  &  $Y(s)$ , frequency response as a function of  $s$ , Complex frequency plane, natural response & the  $S$ -Plane. 1. Voltage ratio synthesizing, Scaling & Bode Diagrams. 1. General Two Port Networks: Introduction, admittance parameters, some equivalent networks, impedance parameters, hybrid parameters, transmission parameters. ##### **List of Practicals:** 1. To determine the voltage of series circuit 1. To determine the voltage of parallel circuit. 1. To determine the current through mesh analysis 1. To determine the voltage across nodes through nodal analysis of the circuit 1. To determine the voltage across nodes through nodal analysis of the circuit 1. To determine the voltage across Resistor in the circuit. 1. To study the filter circuit and response 1. To study the response of an RC circuit when applied with a sudden dc voltage source. 1. To study the response of a Driven RC circuit when applied with a sudden dc voltage source. 1. To Study the response of Parallel Resonant Circuit 1. To study the response of Series Resonant Circuit 1. To study source free RLC circuit and determine its response mathematically and graphically 1. To determine the transient analysis and plot transient analysis of RL circuit using PSpice 1. To determine the transient analysis and plot transient analysis of RLC circuit using PSpice. 1. Determine Natural Response of an RLC circuit. 1. To study source free RL circuit and determine its response mathematically and graphically ### **Suggested Teaching Methodology:** Lecturing

Written Assignments Report Writing ### **Suggested Assessment: Theory (100%)**

Sessional (20%)

Quiz (12%)

Assignment (8%)

Midterm (30%)

Final Term (50%)

**Laboratory (100%)**

**Text book & Reference Books:**

1. Engineering Circuit Analysis by William Hayt, 7th Edition, 2006. ISBN: 978- 0073263182
2. Fundamentals of Electric Circuits by Charles K.Alexander, Matthew N. O. Sadiku. 4th Edition, 2008.ISBN 978-0077263195

## (HS-104) - Functional English

**Course Outline:**

1. **Presentation skills**
  1. Essay writing (Descriptive, narrative, discursive, argumentative)
2. **Academic writing**
3. **How to write a proposal for research paper/term paper**
4. **How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency)**
5. **Technical Report writing**
6. **Progress report writing ##### List of Practicals: N.A ### Suggested Teaching Methodology:** Lecturing

Written Assignments Report Writing ### **Suggested Assessment: Theory (100%)**

Sessional (20%)

Quiz (12%)

Assignment (8%)

Midterm (30%)

Final Term (50%) ##### **Text and Reference Books:** 1. Patterns of College Writing (4th Edition) by Laurie G. Kirsznar and Stephen

R. Mandell. St. Martin's Press

1. The Mercury Reader. A Custom Publication. Compiled by Northern Illinois University. General Editors: Janice Neulib; Kathleen Shine Cain; Stephen Ruffus and Maurice Scharton.
2. Writing. Advanced by Ron White. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 435407 3 (particularly suitable for discursive, descriptive, argumentative and report writing).
3. College Writing Skills by John Langan. McGraw-Hill Higher Education. 2004.

## **Professional Practices and Ethics**

### **Course Outline:**

#### **1. Professional Practices**

1. Overview of professional practices in Biomedical Engineering.
2. Engineering management in biomedical engineering
3. Relationship between Professional biomedical engineering Practice and Engineering Management

#### **2. Engineering Project Lifecycle**

1. Definition of project
2. Difference between engineering project and business process
3. Skills set for a project manager

#### **3. Management**

1. Need of managing engineering projects
2. Scope of Management
3. Resource and Cost Management
4. Quality Management
5. Risk Management

#### **4. Quality**

1. Definition of Quality
2. Quality Vs. Grade
3. Quality Management Process
4. Defining SLAs for an engineering project
5. Performance Reporting

#### **5. Planning**

1. Engineering Projects Planning
2. Monitoring and Controlling
3. Cost Estimates and Budget Constraints

#### **6. Professional Ethics**

1. Ethical responsibilities of Biomedical Engineers and Moral Complexities.
2. Health-Ethics
3. WHO's Health Policies
4. Codes of law of renowned societies for engineers
5. Code of law of Biomedical engineering society
6. Biomedical Engineers Pakistan code of ethics
7. Ethical challenges for Biomedical Profession. ### **Suggested Teaching Methodology:** Lecturing

Written Assignments Report Writing ### **Suggested Assessment: Theory (100%)**

Sessional (20%)

Quiz (12%)

Assignment (8%)

Midterm (30%)

Final Term (50%) ##### **Recommended Text and Reference Books:** 1. Evans, J.R. & Lindsay, W.M., The Management and Control of Quality, 2011, 8th Edition, West Publishing, ISBN9780538452601. 1. White, M.A. and Bruton, G.D., The Management of Technology, 2006, Thomson South Western, ISBN: 0-234-3565-0 1. Meredith & Mantel, Project Management - A Managerial Approach, 2014, 9th Ed, Prentice Hall, ISBN: 978-1-118-94583-4.

### **Functional English**

**Objectives:** To enhance language skills and develop critical thinking ##### **Course Contents:** Basics of Grammar

Parts of speech and use of articles

Sentence structure, Active and passive voice Practice in unified sentence

Analysis of phrase, clause and sentence structure Transitive and intransitive verbs

Punctuation and spelling ##### **Comprehension** Answers to questions on a given text ##### **Discussion** General topics and every day conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students) ##### **Listening** To be improved by showing documentaries/films carefully selected by subject teachers) ##### **Translation skills** Urdu to English ##### **Paragraph writing** Topics to be chosen at the discretion of the teacher ##### **Presentation skills** Introduction ##### **Note: Extensive reading is required for vocabulary building Recommended books:**

#### **1. Functional English**

##### 1) Grammar

1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492 PAGE 199

1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506

##### 1) Writing

1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41.

2)

#### **Reading/Comprehension**

1. Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.

3)

#### **Speaking**

#### **Communication Skills**

**Objectives:** To enable the students to meet their real life communication needs ##### **Course Contents:** Paragraph writing

Practice in writing a good, unified and coherent paragraph ##### **Essay writing** Introduction #####  
**CV and job application Translation skills**

Urdu to English ##### **Study skills** Skimming and scanning, intensive and extensive, and speed reading, summary and précis writing and comprehension ##### **Academic skills** Letter / memo writing and minutes of the meeting, use of library and internet resources ##### **Presentation skills** Personality development (emphasis on content, style and pronunciation) ##### **Note: documentaries to be shown for discussion and review Recommended books:**

### **Communication Skills**

#### 1) Grammar

1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.

#### 2) Writing

1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 45-53 (note taking).
2. Writing. Upper-Intermediate by Rob Nolasco. Oxford Supplementary Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).

#### 3)

### **Reading**

1. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0.
2. Reading and Study Skills by John Langan
3. Study Skills by Richard Yorky.

**Technical Writing and Presentation Skills Objectives:** To enhance language skills and develop critical thinking **Course Contents: ##### Presentation skills Essay writing**

Descriptive, narrative, discursive, argumentative

### **Academic writing**

How to write a proposal for research paper/term paper

How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency) ##### **Technical Report writing Progress report writing ##### Note: Extensive reading is required for vocabulary building Recommended books:**

### **Technical Writing and Presentation Skills**

#### 1) Essay Writing and Academic Writing

1. Writing. Advanced by Ron White. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 435407 3 (particularly suitable for discursive, descriptive, argumentative and report writing).
1. College Writing Skills by John Langan. McGraw-Hill Higher Education. 2004.
2. Patterns of College Writing (4th edition) by Laurie G.

Kirsznar and Stephen R. Mandell. St. Martin's Press.

#### 1) Presentation Skills

#### 2) Reading

The Mercury Reader. A Custom Publication. Compiled by Northern Illinois University. General Editors: Janice Neulib; Kathleen Shine Cain; Stephen Ruffus and Maurice Scharton. (A reader which will give students exposure to the best of twentieth century literature, without taxing the taste of engineering students).

**Technical Writing and Presentation Skills Objectives:** To enhance language skills and develop critical thinking **Course Contents: ##### Presentation skills Essay writing**

Descriptive, narrative, discursive, argumentative

### **Academic writing**

How to write a proposal for research paper/term paper

How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency)

### **Technical Report writing Progress report writing**

**Note: Extensive reading is required for vocabulary building**

### **Recommended books:**

#### **Technical Writing and Presentation Skills**

##### 1) Essay Writing and Academic Writing

1. Writing. Advanced by Ron White. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 435407 3 (particularly suitable for discursive, descriptive, argumentative and report writing).

4. College Writing Skills by John Langan. McGraw-Hill Higher Education. 2004.

5. Patterns of College Writing (4th edition) by Laurie G.

Kirsznar and Stephen R. Mandell. St. Martin's Press.

##### 4) Presentation Skills

##### 5) Reading

The Mercury Reader. A Custom Publication. Compiled by Northern Illinois University. General Editors: Janice Neulib; Kathleen Shine Cain; Stephen Ruffus and Maurice Scharton. (A reader which will give students exposure to the best of twentieth century literature, without taxing the taste of engineering students).

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# (HS-105) - Pakistan Studies

## Course Outline:

### 1. Historical Perspective

1. Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah.
2. Factors leading to Muslim separatism
3. People and Land

Indus Civilization Muslim advent

Location and Geo-Physical features.

### 1. Government and Politics in Pakistan, Political and constitutional phases

- a. 1947-58
- b. 1958-71
- c. 1971-77
- d. 1977-88
- e. 1988-99
- f. 1999 onward

### 1. Contemporary Pakistan

1. Economic institutions and issues
2. Society and social structure
3. Ethnicity
4. Foreign policy of Pakistan and challenges
5. Futuristic outlook of Pakistan

### 2. Foreign Policy

1. Relations of Pakistan with neighbors
2. Super powers
3. Muslim world

### 3. Human Rights

1. Conceptual foundations
2. Local and international issues ### **Suggested Teaching Methodology:** Lecturing

Written Assignments Report Writing ### **Suggested Assessment: Theory (100%)**

Sessional (20%)

Quiz (12%)

Assignment (8%)

Midterm (30%)

Final Term (50%) ##### **Recommended Text and Reference Books:** 1. Burki, Shahid Javed. State & Society in Pakistan, The Macmillan Press Ltd 1980. 1. Akbar, S. Zaidi. Issue in Pakistan's Economy. Karachi: Oxford University Press, 2000. 1. S.M. Burke and Lawrence Ziring. Pakistan's Foreign policy: A Historical analysis. Karachi: Oxford University Press, 1993. 1. Mehmood, Safdar. Pakistan Political Roots & Development. Lahore, 1994. 1. Wilcox, Wayne. The Emergence of Bangladesh., Washington: American Enterprise, Institute of Public Policy Research, 1972. 1. Mehmood, Safdar. Pakistan Kayyun Toota, Lahore: Idara-e-Saqafat-e- Islamia, Club Road, nd. 1. Ziring, Lawrence. Enigma of Political Development. Kent England: Wm Dawson & sons Ltd, 1980. 1. Zahid, Ansar. History & Culture of Sindh. Karachi: Royal Book Company, 1980. 1. Afzal, M. Rafique. Political Parties in Pakistan, Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research, 1998.

**\*Introduction / Objectives\*\***

The course has been designed as a compulsory subject for the students studying for Bachelor's degree, general or professional. The course is of 3 credit hours carrying 100 marks (recommended). The teaching work is comprised of three dimensions: Historical Perspective (20%); Government and Politics (40%); and Contemporary Pakistan (40%).

The course framework is issue-oriented. It has many dimensions, the historical and ideological background of Pakistan the process of governance and national development as well as the issues arising in the modern, age and posing challenges to Pakistan. The course has been designed with a vision that Pakistan Studies should open a window to future.

**Course Outline:**

**1. Historical Perspective**

1. Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-i-Azam Muhammad Ali Jinnah.
2. Factors leading to Muslim separatism
3. People and Land
  1. Indus Civilization
  2. Muslim advent
  3. Location and Geo-Physical features.

**2. Government and Politics in Pakistan**

Political and constitutional phases:

- a. 1947-58
- b. 1958-71
- c. 1971-77
- d. 1977-88
- e. 1988-99
- f. 1999 onward

**1. Contemporary Pakistan**

1. Economic institutions and issues
2. Society and social structure
3. Ethnicity
4. Foreign policy of Pakistan and challenges
5. Futuristic outlook of Pakistan ##### **Books Recommended**

2. Burki, Shahid Javed. *State & Society in Pakistan*, The Macmillan Press Ltd 1980.
3. Akbar, S. Zaidi. *Issue in Pakistan's Economy*. Karachi: Oxford University Press, 2000.
4. S.M. Burke and Lawrence Ziring. *Pakistan's Foreign policy: An Historical analysis*. Karachi: Oxford University Press, 1993.
5. Mehmood, Safdar. *Pakistan Political Roots & Development*. Lahore, 1994.
6. Wilcox, Wayne. *The Emergence of Banglades.*, Washington: American Enterprise, Institute of Public Policy Research, 1972.
7. Mehmood, Safdar. *Pakistan Kayyun Toota*, Lahore: Idara-e-Saqafat-e- Islamia, Club Road, nd.
8. Amin, Tahir. *Ethno - National Movement in Pakistan*, Islamabad: Institute of Policy Studies, Islamabad.
9. Ziring, Lawrence. *Enigma of Political Development*. Kent England: WmDawson & sons Ltd, 1980.
10. Zahid, Ansar. *History & Culture of Sindh*. Karachi: Royal Book Company, 1980.
11. Afzal, M. Rafique. *Political Parties in Pakistan*, Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research, 1998.
12. Sayeed, Khalid Bin. *The Political System of Pakistan*. Boston: Houghton Mifflin, 1967.

13. Aziz, K.K. *Party, Politics in Pakistan*, Islamabad: National Commission on Historical and Cultural Research, 1976.
  14. Muhammad Waseem, *Pakistan Under Martial Law*, Lahore: Vanguard, 1987.
  15. Haq, Noor ul. *Making of Pakistan: The Military Perspective*. Islamabad: National Commission on Historical and Cultural Research, 1993.
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## (HS-200) - Community Service

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# **(HS-202) - Business Communication**

## **Course Outline:**

- 1. Essay Writing and 7C's of Communication**
  1. Kinds of Essays
  2. Ways to Develop a Proper Beginning, Middle and Ending of Essay
  3. 7C's of Communication
- 2. Use of Library and Internet Resources**
  1. Defining "The Library" and "The Internet"
  2. Researching in the library
  3. Researching on the internet
- 3. Correction of Sentences and Question Tags**
  1. General rules of correction
  2. Examples
  3. Uses and Forms of Question Tags
  4. Procedure adding a Question Tag
- 4. Précis Writing**
  1. Rules for Précis Writing
  2. Examples
- 5. Verbal Communication: Strategies and Activities**
  1. Group Discussions
  2. Brainstorming
  3. Interviewing
  4. Creating a Newscast
- 6. Paraphrasing**
  1. Introduction
  2. Uses of Paraphrasing
  3. Characteristics of a good Paraphrase
  4. Method of procedure
  5. Specimens
- 7. Report Writing**
  1. Importance of Reports;
  2. Guidelines for Informal Report Writing;
  3. Informal Report Writing Practice sessions
- 8. Curricula Vitae:**
  1. Introduction
  2. General Format
  3. Types of CV'
  4. Template for CV
  5. Optional Features
  6. Sample CV
- 9. Minutes of Meeting**
  1. Introduction
  2. Meeting minutes Format
  3. Common Problems while taking Minutes of a Meeting
  4. Solution of Problems
  5. Sample Minutes of a Meeting
- 10. Writing Memorandum**
  1. Introduction
  2. Audience and Purpose
  3. Format
  4. Sample Memo
- 11. Resume Writing**

1. What is Resume
2. Kinds of Resume
3. Role of a Resume
12. **Job Application Materials**
  1. Job Application Letter, Acceptance, Follow-up, and Recommendation Letters
  2. Examples and Practice Sessions
  3. Planning the Resume and Letter
13. **Presentations Skills**
  1. Individual & Group Presentation
  2. Teaching Presentation as a Skill
  3. Project Work on Power Point Presentations

### **Suggested Teaching Methodology:**

- Lecturing
- Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**
- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

### **Recommended Text and Reference Books:**

1. Exploring The World Of English, Sadat Ali Shah
  2. High School English Grammar & Composition P. C. Wren & H. Martin
  3. Practical English Grammar by A. J. Thomson and A. V. Martinet. Exercises
- \2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.
1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 45-53 (note taking).
  2. Writing. Upper-Intermediate by Rob Nolasco. Oxford Supplementary Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).
  3. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0.
  4. Reading and Study Skills by John Langan
  5. Study Skills by Riachard Yorky.

### **ORGANIZATIONAL BEHAVIOUR 3 Credit Hrs**

#### Introduction to Organizational Behaviour

- Organizational Disciplines and topics
- Psychological Perspective
- Social-Psychological Perspectives

#### Structure and Control in Organization o Introduction

- Bureaucracy
- Managerial Work o

#### Contingency theory

- Organizational Design

## Individual and Work Learning

- Learning Theories
- Learning and Work

## Stress

- Types of Stress and Work
- Occupational Stress Management

## Individual Differences

- Personality and its factors
- Personality dimensions and social learning
- Intelligence

## Motivation and Job Satisfaction

- Needs at Work
- Theories of Motivation and job satisfaction
- Correlates of Job satisfaction
- Correlates of Job satisfaction

## Group and Work

- Social Interaction
- Dramaturgy and impression Management
- Social Skill

## Group and Inter group Behaviour

- Group Structure & Norms
- Group Processes
- How throne Studies Leadership
- Leadership as an attribute
- Leadership Style

## Patterns of Work

- Work-the classical approach
- Marx, Weber, & The critique of labor
- Foucault & Disciplinary Power

## Conflict and Consent in Work

- The labor Process debate
- Work place control and resistance
- Industrial conflict and industrial relations

## Organizational culture

- Organizational culture and strategic management
- Exploring organizational culture
- Evaluating concept of culture

## Books Recommended:

1. Fincham, R., & Rhodes, P. (2003), Principles of Organizational Behaviour, 3rd Oxford.
2. Noe, R., Hollenbeck, J. Gerhart, B., & Wright, P. (2006), Human Resource Management, 5th ed., McGraw Hill.
3. Newstrom John W. (2007), Organizational Behaviour, (12th Ed),

McGraw Hill.

1. Luthan Fred, (2005), Organizational Behaviour, McGraw Hill Inc.
2. Robins, Stephen, (2005), Organizational Behaviour, McGraw Hill Inc.

## **INTRODUCTION TO SOCIOLOGY 3 Credit Hrs**

### The Nature of Sociology

0. The study of social life
  1. Exploring the global village
  2. Sociology as a science
  3. The Sociological imagination
  4. The development of Sociology
  5. Pioneers of Sociology
  6. Nature, scope and subject matter of Sociology
  7. Brief historical development of Sociology
  8. Society and community
  9. Relationship with other social sciences
10. Social Interaction Processes Social groups
11. Definition and functions
12. Types of social groups

### Social institutions

0. Definition
  1. Structure and function of social institutions
  2. Inter-relationships among various social institutions Culture and related concepts
  3. Definition and aspects of culture
  4. Elements of culture
  5. Organization of culture
  6. Other concepts, cultural relativism, sub cultures, ethnocentrism, culture lag

### Socialization and personality

0. Role and status
  1. Socialization
  2. Culture and personality Deviance and social control
  3. Definition and types of deviance
  4. Juvenile delinquency
  5. Formal and information methods of social control

### Social stratification

0. Approach to study social stratification
  1. Caste class and race as basics of social stratification

### Major perspectives in Sociology

0. Functionalist perspective
  1. Conflict perspective
  2. Interactionstic perspective

### Social Control and deviance

0. Agencies of social control

### Social stratification

0. Determinants of social stratification
  1. Social mobility, types and definition
  2. Dynamics of social mobility

### Concept of social movement



0. Theories of social movement
1. Social and cultural change Social and cultural change
2. Definition of social change
3. Dynamics of social change
4. Impact of globalization on society and culture
5. Resistance to change

#### Collective behaviour

0. Definition
1. Characteristics
2. Causes
3. Types
4. Social movements
5. Mob and crowd behaviour

#### Books Recommended

1. Neulreck, Kenneth, J. 2005, Sociology: Diversity, Conflict and Change, Boston
  2. Barnard, Andy. 2004. Sociology, Cambridge University Press
  3. Giddens, Anthony, 2004, Sociology 4th edition, Cambridge Polity Press
  4. Albrow, Martin, 2003, Sociology, London Routledge.
  5. Richard, T. Schaefer, 2003, Sociology 5th edition, McGraw Hill College
  6. Kendall, Diana, 2004. Sociology in our Times, 4th ed, Wadsworth
  7. Tyler Melissa, Wallace Claire & Abbott Pamela, 2005, An Introduction to Sociology, 3rd ed. Routledge.
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## (HS-205) - Islamic Studies

### Course Outline:

1. **Introduction to Quranic Studies**
  1. Basic Concepts of Quran
  2. History of Quran
  3. Uloom-ul-Quran
2. **Study of Selected Text of Holy Quran**
  1. Verses of Surah Al-Baqra Related to Faith (Verse No-284-286)
  2. Verses of Surah Al-Hujrat Related to Adab Al- Nabi (Verse No-1-18)
  3. Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11)
  4. Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-77)
  5. Verses of Surah Al-Inam Related to Ihkam (Verse No-152-154)
3. **Study of Selected Text of Holy Quran**
  1. Verses of Surah Al-Ihzab Related to Adab al-Nabi (Verse No. 6,21,40,56,57,58.)
  2. Verses of Surah Al-Hashar (18,19,20) Related to thinking, Day of Judgment
  3. Verses of Surah Al-Saf Related to Tafakar, Tadabar (Verse No-1,14)
4. **Seerat of Holy Prophet (S.A.W) I**
  1. Life of Muhammad Bin Abdullah ( Before Prophet Hood)
  2. Life of Holy Prophet (S.A.W) in Makkah
  3. Important Lessons Derived from the life of Holy Prophet in Makkah
5. **Seerat of Holy Prophet (S.A.W) Ii**
  1. Life of Holy Prophet (S.A.W) in Madina
  2. Important Events of Life Holy Prophet in Madina
  3. Important Lessons Derived from the life of Holy Prophet in Madina
6. **Introduction to Sunnah**
  1. Basic Concepts of Hadith
  2. History of Hadith
  3. Kinds of Hadith
  4. Uloom –ul-Hadith
  5. Sunnah & Hadith
  6. Legal Position of Sunnah
7. **Selected Study from Text of Hadith:**
8. **Islamic Law & Jurisprudence**
  1. Basic Concepts of Islamic Law & Jurisprudence
  2. History & Importance of Islamic Law & Jurisprudence
  3. Sources of Islamic Law & Jurisprudence
  4. Nature of Differences in Islamic Law
  5. Islam and Sectarianism
9. **Islamic Culture & Civilization**
  1. Basic Concepts of Islamic Culture & Civilization
  2. Historical Development of Islamic Culture & Civilization
  3. Characteristics of Islamic Culture & Civilization
  4. Islamic Culture & Civilization and Contemporary Issues
10. **Islam & Science**
  1. Basic Concepts of Islam & Science
  2. Contributions of Muslims in the Development of Science
  3. Quran & Science
11. **Islamic Economic System**
  1. Basic Concepts of Islamic Economic System
  2. Means of Distribution of wealth in Islamic Economics
  3. Islamic Concept of Riba
  4. Islamic Ways of Trade & Commerce

## 12. Political System of Islam

1. Basic Concepts of Islamic Political System
2. Islamic Concept of Sovereignty
3. Basic Institutions of Govt. in Islam

## 13. Islamic History

1. Period of Khlaft-e-Rashida
2. Period of Ummayyads
3. Period of Abbasids

## 14. Social System of Islam

1. Basic concepts of Social System of Islam
2. Elements of Family
3. Ethical values of Islam

### Suggested Teaching Methodology:

Lecturing

Written Assignments Report Writing ### Suggested Assessment: Theory (100%)

Sessional (20%)

Quiz (12%)

Assignment (8%)

Midterm (30%)

Final Term (50%) ##### **Text and Reference Books:** 1. Hameed ullah Muhammad, "Emergence of Islam", IRI, Islamabad 1. Hameed ullah Muhammad, "Muslim Conduct of State" 1. Hameed ullah Muhammad, 'Introduction to Islam 1. Mulana Muhammad Yousaf Islahi," 1. Hussain Hamid Hassan, "An Introduction to the Study of Islamic Law" leaf Publication, Islamabad, Pakistan. 1. Ahmad Hasan, "Principles of Islamic Jurisprudence" Islamic Research Institute, International Islamic University, Islamabad (1993) 1. Mir Waliullah, "Muslim Jrisprudence and the Quranic Law of Crimes" Islamic Book Service (1982) 1. H.S. Bhatia, "Studies in Islamic Law, Religion and Society" Deep & Deep Publications New Delhi (1989) 1. Dr. Muhammad Zia-ul-Haq, "Introduction to Al Sharia Al Islamia" Allama Iqbal Open University, Islamabad (2001).

### ISLAMIC STUDIES (Compulsory) ##### COURSE PROFILE

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#### UNIT NO.1: INTRODUCTION TO QURANIC STUDIES

- 1) Basic Concepts of Quran
- 2) History of Quran
- 3) Uloom-ul -Quran

#### UNIT No.2 : STUDY OF SELLECTED TEXT OF HOLLY QURAN

- 1) Verses of Surah Al-Baqra Related to Faith(Verse No-284-286)
- 2) Verses of Surah Al-Hujrat Related to Adab Al-Nabi

(Verse No-1-18)

- 1) Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11)
- 2) Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-77)
- 3) Verses of Surah Al-Inam Related to Ihkam(Verse No-152-154)

#### UNIT No.3 : STUDY OF SELLECTED TEXT OF HOLLY QURAN

- 1) Verses of Surah Al-Ihzab Related to Adab al-Nabi (Verse No.6,21,40,56,57,58.)
- 2) Verses of Surah Al-Hashar (18,19,20) Related to thinking, Day of Judgment
- 3) Verses of Surah Al-Saf Related to Tafakar,Tadabar (Verse No-1,14)

#### **UNIT NO.4: SEERAT OF HOLY PROPHET (S.A.W) I**

- 1) Life of Muhammad Bin Abdullah ( Before Prophet Hood)
- 2) Life of Holy Prophet (S.A.W) in Makkah
- 3) Important Lessons Derived from the life of Holy Prophet in Makkah

#### **UNIT NO.5: SEERAT OF HOLY PROPHET (S.A.W) II**

- 1) Life of Holy Prophet (S.A.W) in Madina
- 2) Important Events of Life Holy Prophet in Madina
- 3) Important Lessons Derived from the life of Holy Prophet in Madina

#### **UNIT NO.6: INTRODUCTION TO SUNNAH**

- 1) Basic Concepts of Hadith
- 2) History of Hadith
- 3) Kinds of Hadith
- 4) Uloom –ul-Hadith
- 5) Sunnah & Hadith
- 6) Legal Position of Sunnah

#### **UNIT NO.7 SELLECTED STUDY FROM TEXT OF HADITH**

#### **UNIT NO.8 INTRODUCTION TO ISLAMIC LAW & JURISPRUDENCE**

- 1) Basic Concepts of Islamic Law & Jurisprudence
- 2) History & Importance of Islamic Law & Jurisprudence
- 3) Sources of Islamic Law & Jurisprudence
- 4) Nature of Differences in Islamic Law
- 5) Islam and Sectarianism

#### **UNIT NO.9: ISLAMIC CULTURE & CIVILIZATION**

- 1) Basic Concepts of Islamic Culture & Civilization
- 2) Historical Development of Islamic Culture & Civilization
- 3) Characteristics of Islamic Culture & Civilization
- 4) Islamic Culture & Civilization and Contemporary Issues

#### **UNIT NO.10:ISLAM & SCIENCE**

- 1) Basic Concepts of Islam & Science
- 2) Contributions of Muslims in the Development of Science
- 3) Quranic & Science

#### **UNIT NO.11:ISLAMIC ECONOMIC SYSTEM**

- 1) Basic Concepts of Islamic Economic System
- 2) Means of Distribution of wealth in Islamic Economics
- 3) Islamic Concept of Riba
- 4) Islamic Ways of Trade & Commerce

#### **UNIT NO.12: POLITICAL SYSTEM OF ISLAM**

- 1) Basic Concepts of Islamic Political System
- 2) Islamic Concept of Sovereignty
- 3) Basic Institutions of Govt. in Islam

#### **UNIT NO.13: ISLAMIC HISTORY**

- 1) PERIOD OF KHLAFT-E-RASHIDA
- 2) PERIOD OF UMMAYYADS
- 3) PERIOD OF ABBASIDS

#### UNITNO.14 : SOCIAL SYSTEM OF ISLAM

- 1) BASIC CONCEPTS OF SOCIAL SYSTEM OF ISLAM
- 2) ELEMENTS OF FAMILY
- 3) ETHICAL VALUES OF ISLAM

#### REFERENCE BOOKS:

- 1) HAMEED ULLAH MUHAMMAD, “**EMERGENCE OF ISLAM**” , IRI, ISLAMABAD
- 2) HAMEED ULLAH MUHAMMAD, “**MUSLIM CONDUCT OF STATE**”
- 3) HAMEED ULLAH MUHAMMAD, ‘**INTRODUCTION TO ISLAM**
- 4) MULANA MUHAMMAD YOUSAF ISLAHI,”
- 5) Hussain Hamid Hassan, “**An Introduction to the Study of Islamic Law**” leaf

Publication Islamabad, Pakistan.

- 2) Ahmad Hasan, “**Principles of Islamic Jurisprudence**” Islamic Research Institute, international Islamic University, Islamabad (1993)
- 3) Mir Waliullah, “**Muslim Jrisprudence and the Quranic Law of Crimes**” Islamic Book Service (1982)
- 4) H.S. Bhatia, “**Studies in Islamic Law, Religion and Society**” Deep & Deep

Publications New Delhi (1989)

- 2) Dr. Muhammad Zia-ul-Haq, “**Introduction to Al Sharia Al Islamia**” Allama Iqbal Open University, Islamabad (2001)
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## (HS-219) - Professional Ethics

(For Engineers)

**Objectives:** The main objective of this course is to apprise potential engineers about social factors that contribute towards enhancing their professional performance for the good of society and the country. This course is culture specific and has to be taught within the context of local and national socio-economic environment. The engineers are expected to supervise several people in different capacities and their understanding about human behaviour is critical for their optimum performance. Modification of human behaviour or getting work done from sub-ordinates and seniors remain a major challenge for all the professional engineers. This course will enhance understanding about the determinants of human behaviour, which ultimately will result in improved individual efficiency.

### 1. Introduction to Sociology

1. What is sociology?
2. Nature, Scope, and Importance of Sociology
3. Social Interactions
4. Social Groups
5. Social Institutions

### 2. Culture and Related Concepts

1. Definition of Culture
2. Types of Culture
3. Elements of Culture
4. Role of Culture in Organization
5. Socialization and Personality

### 3. Interpersonal Relations

1. Interpersonal Behaviour
2. Formation of Personal Attitudes
3. Language and Communication
4. Motivations and Emotions
5. Public Opinion

### 4. Social Stratification

1. Factors of Social Stratification
2. Caste and class
3. Power, Prestige, and Authority
4. Social Mobility
5. Migration

### 5. Human Ecology

1. Ecological Processes
2. Ecosystem and energy
3. Ecosystem and Physical Environment
4. Solid Waste Disposal
5. Pollution

### 6. Population Dynamics

1. World Population Growth and Distribution
2. Population Dynamics in Pakistan
3. Causes and Consequences of Urbanization
4. Population Policy in Pakistan
5. Population and Development

### 7. Community Development

1. Meaning, Scope, and Subject Matter of Community Development
2. Processes of Community Development
3. Community Development Programs in Pakistan
4. Community Organization and Related Services
5. Cooperation and Conflict in Community Development

## 8. Deviance and Crime

1. Crime as a Social and Cultural Phenomenon
2. Crime and Social Organization
3. Organized Crime
4. Culture Based Crime
5. Economics of Crime

## 9. Sociology of Change and Development

1. What is Social Change and Development?
2. Dynamics of Social Change
3. Role of NGOs in Development
4. World System and Development
5. Gender and Development

## Recommended Readings

1. Allport, G. W. (1985). *The Historical Background of Modern Social Psychology*. New York, Random House.
2. Bernard, A. and T. Burgess (2004). *Sociology*, Cambridge University Press.
3. DuBrin, A. J. (2007). *Human Relations: Interpersonal Job Oriented Skills*. New York, Prentice Hall.
4. Gardezi, H. N., Ed. (1991). *Understanding Pakistan: The Colonial Factor in Societal Development*. Lahore, Maktaba Fikr-o-Danish.
5. Hafeez, S. (1991). *Changing Pakistan Society*. Karachi, Royal Book Company. Gardezi, H. N., Ed. (1991).
6. Jones, G. W. (2005). "Why are Population and Development Issues not Given Priority?" *Asia-Pacific Population Journal* 20(1).
7. \*Maconis, J. J. (1999). *Sociology* 7th Edition, National Book

Foundation, Islamabad

1. Maser, C. (1997). *Sustainable Community Development: Principles and Concepts*. Florida St. Lucie Press.
2. Nelson, N. and S. Wright (1995). *Power and Participatory Development: Theory and Practice*. London, Intermediate Technology Publications.
3. Syed, S. H. (2003). *The State of Migration and Multiculturalism in Pakistan: The Need for Policy and Strategy*. Islamabad, UNESCO: 1-30.
4. Utton, A. E. (1976). *Human Ecology*, West View Press.
5. Webster, A. (1990). *Introduction to Sociology of Development*. London, Macmillan Education Ltd.
6. Weiss, A. M. (2001). *Power and civil society in Pakistan*, Oxford University press.

## SOCIAL ANTHROPOLOGY

### (For Engineers)

Objectives: The students are expected to learn anthropological skills for application by professional engineers and other related practitioners. Societal growth needs are to be understood within our own cultural environment. Such a body of applied knowledge will result in improving the professional performance of would-be engineers. As culture and society play an important role towards all human activities, this course will help students relate technical skills to the societal needs and requirements.

### 1. Introduction

1. Anthropology and Social Anthropology
2. Fields of Anthropology
3. Anthropological Research Methods
4. Social Anthropology and other Social Sciences
5. Significance of Social Anthropology

2. **Culture**
  1. Definition, Properties and Taxonomy
  2. Evolution of Growth and Culture
  3. Evolution of Man: Religious and Modern Perspectives
  4. Evolution of Culture
  5. Culture and Personality
3. **Evolution and Growth of Culture**
  1. Evolution of Man
  2. Schools of Thought in Cultural Anthropology
  3. Acculturation
  4. Enculturation
  5. Ethnocentrism and Xenocentrism
4. **Language and Culture**
  1. Communication
  2. Structural Linguistics
  3. Historical Linguistics
  4. Relationship between Language and Culture
  5. Ethnography
5. **Economic System**
  1. Global Economic System
  2. The Allocation of Resources
  3. The Conversion of Resources
  4. The Distribution of Goods and Services
  5. Poverty and Inequality
6. **Marriage and Family**
  1. Marriage and Mate Selection
  2. The Family: Types and Functions
  3. Kinship System
  4. Structure and Function of Family
  5. Gender Relations
7. **Political Organization**
  1. Political Sociology
  2. Origin of Political Organization and Organizational System
  3. Types of Political Organizations
  4. Power Politics and Factionalism in Pakistan
  5. Resolution of Conflict
8. **Religion and Magic**
  1. The Universality of Religion
  2. Comparative Religions
  3. Religion and Society
  4. Religious Beliefs and Practices
  5. Witchcraft and Sorcery

## **XI Culture Change**

1. Forms of Art
2. Expressive Culture
3. Process of Cultural Change
4. Cultural Change in the Modern World
5. Cultural Change in Pakistani society

## **Recommended Books**

1. Ahmad, Akbar S. 1990. *Pakistani Society*, Karachi, Royal Books Co.
2. Bernard, H. Russel. 1994. *Research Methods in Anthropology, Qualitative and Quantitative Approaches*. London: Sage Publications



3. Bodley, John H. 1994. *Cultural Anthropology*, California: Mayfield Publishing Co.
4. Brogger, Jan. 1993. *Social Anthropology and the Lonely Crowd*. New Delhi: Reliance Publishing
5. Ember, Carol R. & Ember Melvin. 2005. *Anthropology*, 11th ed. Englewood

Cliffs: Prentice Hall, Ince. Harper and Row

1. Harris Marvin. 1987. *Cultural Anthropology*. New York: Harper and Row
2. \*Harris Marvin. 1985. *Culture, People, nature; An Introduction to General Anthropology* London: Harper and Row
3. Haviland, W. A. (2005). *Anthropology: The Human Challenge*. New York, Thomson Learning Inc.
4. Hertzler J. O. 1981. *The Social Structure of Islam*. Cambridge: Cambridge University Press.
5. Keesing, Roger m. 1998. *Cultural Anthropology: A contemporary perspective*. 3rd ed. New York: Harcourt Brace College Publishers.
6. Kottak, Conard Phillip. 2002. *Anthropology: The Exploration of Human Diversity*. 9th ed. Boston: McGraw Hill Higher Education.
7. Kennedy, Charles H. 1992. *Pakistan* London: Westview Press,.
8. Marron, Stanley. 1957. *Pakistani Society and Culture*. New Heaven
9. Wilson, Richard A. 1996. *Human Rights, Culture and Context: Anthropological Perspective*. London: Pluto Press.

## Psychology

### Courses for BSc/BE in Engineering Programme

Course-I **Understanding Psychology and Human Behaviour** 3 credit hrs

- What is Psychology?
- Nature, Scope and Application with Special Reference to Pakistan
- Different Schools of Psychology
- Methods of Psychology
- Learning
- Intelligence and Artificial Intelligence
- Personality and its Assessment
- Understanding Maladjustive Behaviour
- Positive Emotional States and Processes
- Stress Management and Anger Management Books Recommended
  1. Atkinson R.C., & Smith E.E. (2000), *Introduction to Psychology* (13th ed.), Harcourt Brace College Publishers.
  2. Fernald, L.D., & Fernald, P.S. (2005), *Introduction to Psychology*, USA: WMC Brown Publishers.
  3. Hergenhahn, B.R. (2001). *An Introduction to the History of Psychology*, New York: Wadsworth.
  4. Goodwin, C.J, (2000) *Research in Psychology: Methods and Design*, (3rd ed.), New York: John Wiley & Sons.
  5. Synder, C.R., & Lopez, S.J. (2007) *Positive Psychology*, USA, Sage Publications.
  6. Allen, B.P. (1997), *Personality Theories: Development, Growth and Diversity*, (2nd Ed.), Boston: Allyn & Bacon.
  7. Cohen, R.J., & Swerdlik, M.E. (2005) *Psychological Testing & Assessment* (6th ed.), New York: McGraw-Hill.
  8. Corcini, R., (2000). *Current Psychotherapies*. London: Thompson & Co Publishers.
  9. Comer, R.J. (2004). *Abnormal Psychology*, USA: Freeman & Company.
  10. Schwartz, B., Wasserman, E., & Robbins, S. (2002), *Psychology of Learning and Behaviour*, 5th Ed. Norton and Company.

Course II **Professional Psychology** 3 credit hrs

- Introduction to Professional Psychology
- Psychological Testing
- Educational Psychology
- Industrial/Organizational Psychology
- Social Psychology
- Health Psychology
- Clinical Psychology
- Positive Psychology
- Legal, Ethical, and Professional Issues. ##### **Books Recommended:**

1. Crow, L., & Crow, A. (2000) Educational Psychology, New Delhi: Euroasia Publishing House Ltd.
2. Spiegel, P.K., & Koocher, G.P. (1998), Ethics in Psychology, New York: Oxford University Press
3. Snyder, C.R., & Lopes, S.J. (2000), Handbook of Positive Psychology, New York: Oxford University Press.
4. Compton, W.C. (2005), Introduction to Positive Psychology, USA, Thomson Wadsworth.
5. Debra, L.N. & James Campbell Quick, (2000) Organizational Behaviour (3rd ed), Cincinnati: South Western.
6. Fred Luthans, Alexander, D.S. & Edwin, A. Locke (2000) (Eds), Handbook of Principles of Organizational Behaviour, London: Blackwell.
7. Brannon, L. & Reist, J. (2000), Health Psychology: An Introduction to Behaviour and Health (4th ed.), USA Wadsworth.
8. Donohue, W. & Ferguson, K. (Eds), (2003), Handbook of Professional Ethics for Psychologists; Issues, Questions and Controversies, London: Sage Publications.
9. Meyers, D. (2005), Social Psychology, 8th Ed. McGraw Hill Inc.
10. Cooper, J. & Hogg, M. (2003) Handbook of Social Psychology, Sage Publications
11. Halgin, R.P., Whitbourne, S.K., & Halgin, R. (2004), Abnormal Psychology: Clinical Perspectives on Psychological Disorders, New York: McGraw Hill.
12. Thorndike R.L., & Hage, E.P. (1995), Measurement and Evaluation in Psychology and Education (4th Ed), New York, MacMillan.

**PROFESSIONAL ETHICS ##### Course Description:** Prerequisite: None ##### **Corequisite: None**

This course introduces contemporary and controversial ethical issues facing the business community. Topics include moral reasoning, moral dilemmas, law and morality, equity, justice and fairness, ethical standards, and moral development. Upon completion, students should be able to demonstrate an understanding of their moral responsibilities and obligations as members of the workforce and society.

### **Course Objectives:**

At the completion of the course requirements, the student will be able to:

1. Define business ethics
2. Describe the evolution of business ethics
3. Describe major ethical perspectives
4. Understand and apply an ethical decision-making framework
5. Understand social responsibility from several dimensions
6. Understand how the organization influences ethical decision-making
7. Examine how significant others influence ethical decision-making
8. Develop an effective ethics programme.
9. Understand international business ethics.

### **Course Outline:**

**An Overview of Business Ethics:** Business Ethics Defined, Social Responsibility, and Business Ethics, The Development of Business Ethics, Why study Business Ethics?, Framework for Studying Business Ethics.

**Ethical issues in Business:** Foundation of Ethical Conflict, Classifications of Ethical, Issues, Ethical Issues Related to Participants and Functional Areas of Business, Recognizing an Ethical Issue.

**Applying Moral Philosophies to Business Ethics:** Moral Philosophy Defined, Moral Philosophy Perspectives.

**Social Responsibility:** The Economic Dimension, The legal Dimension, The Ethical Dimension, the Philanthropic Dimension.

**An Ethical Decision-Making Framework:** Ethical Issue Intensity, Individual Factors: Stages of Cognitive Moral Development, Corporate Culture, Significant others, Opportunity, Business Ethics Evaluations and Intentions, Using the Ethical Decision-Making Framework to Improve Ethical Decisions.

**How the Organization Influences Ethical Decision Making:** Organizational Structure and Business Ethics, the role of Corporate Culture in Ethical Decision- Making, Group Dimensions of Organizational Structure and Culture, Implications of Organizational Relationships for Ethical Decisions.

**The Role of Opportunity and Conflict:** Opportunity, Conflict.

**Development of an Effective Ethics Programme:** An Effective Ethical Compliance, Programme, Codes of Ethics and Compliance Standards, High- Level Manager's Responsibility for Ethical Compliance Programme and the Delegation of Authority, Effective Communication of Ethical Standards, Establishing Systems to Monitor, Audit, and Enforce Ethical Standards, Continuous Improvement of the Ethical Compliance Programme, The Influence of Personal Values in Business Ethics Programmes, The Ethical Compliance Audit.

**International Business Ethics:** Ethical Perceptions and International Business, Culture As a Factor in Business, Adapting Ethical Systems to a Global Framework: Cultural Relativism, the Multinational Corporation, A universal Set of Ethics, Ethical Issues Around the Globe.

Text Books:

Ferrell, O.C., and Fraedrich, John, Ethical Decision Making and Cases, New York: Houghton Mifflin.

## **INTRODUCTION TO PHILOSOPHY 3 Credit Hrs**

Definition and Nature of Philosophy Theory of Knowledge

0. Opinion and Knowledge
1. Plato, the Republic Selection
2. Knowledge through Reason
3. Descartes Meditation on First Philosophy
4. Knowledge through Experience
5. Hume an Inquiry concerning Human Understanding (Selection)
6. Experience Structured by the Mind
7. Kant Critique of Pure Reason (Selection)
8. Knowing and Doing
9. James Pragmatism (Selection)
10. Knowledge and Emotion
11. Jaggar Love and Knowledge (Selection) PAGE 221

Philosophy of Religion

- Proving that Existence of God
- Anselm, Aquinas, Paley, Dawkins (Selection)
- Justifying Religious Beliefs
- Pascal Pensees (Selection)
- James The will to Believe Selection
- Freud the Future of An Illusion (Selection)
- Confronting the Problems of Evil
- Mackie Evil and Omnipotence (Complete)

- Hick Philosophy of Religion (Selection)

## Metaphysics

- Idealism and Materialism
- Berkeley Three Dialogues Between Hylas and Pholonus (Selection)
- Armstrong Naturalism, Materialism and First Philosophy (Selection)
- The Mid-Body Problem
- Descartes Meditations on First Philosophy (Selection)
- O'Hear Introduction to the Philosophy of Science (Selection)
- Dennett The Origins of Selves (Complete)
- Pali Canon (Selection)
- Penelhum Religion and Rationality (Selection)

## Freedom to Choose

- Libertarianism
- James The Dilemma of Determinism (Selection)
- Taylor Metaphysics (Selection)
- Determinism
- Hospers Meaning and Free Will (Selection)
- Skinner Walden Two (Selection)
- Compatibilism
- Stace Religion and the Modern Mind (Selection)
- Radhakrishnan Indian Philosophy (Selection)

## Ethics

- Fulfilling Human Nature
- Aristotle Nicomachean Ethics (selection)
- Loving God
- Augustine The Morals of the Catholic Church and the City of God (Selection)
- Following Natural Law
- Aquinas Summa Theologiae (Selection)
- Doing One's Duty
- Kant Fundamental Principles of the Metaphysics of Morals (Selection)
- Maximizing Utility
- Mill Utilitarianism (Selection)
- Turning Values of Upside Down
- Nietzsche Human, All too Human and Beyond Good and Evil (Selection)
- Creating Ourselves
  - Sartre Existentialism is a Humanism (Selection)
  - Hearing the Feminine Voice
  - Gilligan In a Different Voice (Selection)
  - Baier What do Women Want in a Moral Theory (Selection) Political and Social Philosophy
  - The State as Natural
  - Plato the Republic (Selection)
  - Aristotle Politics (Selection)
  - The State as a Social Contract
  - Hobbes Philosophical Rudiments Concerning Government and Society (Selection)
  - Locke the Second Treatise of Government (Selection)
  - Liberty of the Individual
  - Mill On Liberty (Selection)
  - Alienation in Capitalism
  - Marx Economic and Philosophic Manuscripts of 1844 (Selection)
  - Justice and Social Trust
  - Rawls A Theory of Justice (Selection)

- Nozick Anarchy, State, and Utopia (Selection)
- Held Rights and Goods (Selection)
- Women in Society
- Wollstonecraft A Vindication of the Rights of Women (Selection)
- De Behaviour The Second Sex (Selection)
- The Value of Philosophy
- Russel The Problems of Philosophy (Selection)
- Midgley Philosophical Plumbing (Selection)

#### **BOOKS RECOMMENDED**

1. Abel Donald C., Stumpf Samuel Enoch, 2002. Elements of Philosophy: An Introduction, 4th Ed. McGraw Hill.
  2. Scruton Roger, 2001. A short History of Modern Philosophy, 2nd ed. Routledge.
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# (MG-481) - Entrepreneurship

## Course Outline:

1. **Course Overview and Introduction to Entrepreneurship**
  1. Entrepreneurship Jigsaw Puzzle.
  2. Intrapreneurship & Entrepreneurship
  3. Allocation of projects
2. **Nature & Development of Entrepreneurship**
  1. Types of Start-Ups
  2. Role of Entrepreneurship in Economic Development.
  3. Skill Requirements for Entrepreneurship
  4. Ethics & Social Responsibility of Entrepreneurs
  5. Future of Entrepreneurship.
3. **Identifying & evaluating the opportunity**
  1. Developing the Business Plan
  2. Determining the resources required for managing the Enterprise.
  3. Managerial Versus Entrepreneurial Decision Making
  4. Causes for Interest in Entrepreneurship
  5. Corporate Versus Intrapreneurial Culture
  6. Comparison of Entrepreneurial
  7. Intrapreneurial& Traditional Managers.
  8. Climate for Intrapreneurship
  9. Intrapreneurial Leadership Characteristics.
  10. Establishing Intrapreneurship in the Organization.
  11. Problems and Successful Efforts.
4. **The Individual Entrepreneur**
  1. Discuss basic criteria for evaluating business ideas
5. **Entrepreneurial Strategy**
  1. Entrepreneurial Feelings.
  2. Entrepreneurial Background and Characteristics.
  3. Motivation for Entrepreneurship.
  4. Role Models and Support Systems.
  5. Entrepreneurs versus Inventors.
  6. Non-Entrepreneurial Profiles
  7. Twenty Principles of Entrepreneurship
  8. Writing and Using the Business Plan.
  9. Planning for business operation.
  10. Guest Speaker Session.
6. **Product Development**
  1. Essentials of New Product Development.
  2. Examples of change in Product Design & Manufacturing
  3. Development processes & Organizations
  4. Guest Speaker Session.
  5. Identifying Customer Needs
  6. Establishing Product Specifications
  7. Sustainable Manufacturing
7. **Marketing, Organizational and Financial plan**
  1. Introduce basic marketing plans for entrepreneurial firms
  2. Examine basic organizational forms for entrepreneurial firms
8. **Entrepreneurial Financing:**
  1. Discuss financing issues for new ventures
  2. Introduce venture capital investment process
9. **Project Management Skills for Entrepreneurial projects**

## 10. Project Presentations

### Suggested Teaching Methodology:

- Lecturing
- Guest lectures Project
- Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**
- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

### Laboratory (100%)

- Labs
- Open-Ended Labs

### Recommended Text and Reference Books:

1. “Entrepreneurship (5th Edition), Robert D. Hisrich& Michael P. Peters. McGraw-Hill Irwin. Product Design & Development, Karl T Ulrich & Steven D. Eppinger.
  2. Case studies and others will be placed with the photocopier and soft copies of presentations will be uploaded on LMS.
  3. Technology Ventures (2013 Edition), Richard C. Dorf & Thomas H. Byers.
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# (MT-100) - Introduction To Mathematics (for pre-medical students)

## Course Outline:

1. **Algebra**
  1. Complex Numbers
  2. Properties of complex numbers
  3. Conjugates and modulus
  4. Geometrical representation of complex numbers  $a + ib$ .
2. **Quadratic Equations**
  1. Roots of a quadratic equation (real, distinct, equal and imaginary roots)
  2. Formation of quadratic equation when the roots are given
3. **Cube Root of Unity**
  1. Properties of cube root of unity;
4. **Matrices**
  1. Properties, sum, difference and multiplication of matrices
  2. Cramer's rule
  3. Solution of linear equations of three unknowns
5. **Determinants**
  1. Properties: addition, subtraction and multiplication of determinants
  2. Sequence and series
  3. Arithmetic progression
  4. Standard forms of an A. P.
  5. Arithmetic means
  6. Geometric progression
  7. Standard forms of a G. P.,
  8. Sum of Infinite geometric series
  9. Geometric means
  10. Harmonic progression
  11. Harmonic means
  12. Relation between H.M., A.M. and G.M.
6. **Binomial Expansion**
  1. Expansion of type  $(a+b)^n$  for positive integer of 'n'
  2. Use of the general term and determine the middle term or terms of the expansion.
7. **Partial Fractions**
  1. Resolve into partial fractions
  2. Proper and improper fraction
8. **Functions:**
  1. One-one function
  2. Onto function
  3. Even function
  4. Odd function
  5. Exponential function
  6. Trigonometric function
  7. Logarithmic function
9. **Circular Measure**
  1. Understand the definition of radians and use the relationship between radians and degrees.
10. **Trigonometric Functions**
  1. Basic functions e.g. sine, cosine, tangent etc. relation between them
  2. Trigonometric identities, sum and difference formulae, multiple angle formulae
  3. Express type  $a(\sin\theta) + b(\cos\theta)$  into  $R\sin(\theta + -\varphi)$  etc.
  4. Inverse functions
11. **Differential Calculus**



1. Limits: Basic concepts
2. Limit of form  $(\sin\theta)/\theta = 1$ ; when  $\theta$  tends to zero.
3. Exponent functions and type  $a^x$  etc.
12. **Differentiation**
  1. Differentiation of  $\chi^n$  product and quotient formula
  2. Trigonometric, exponents and logarithmic functions
  3. Differentiation of implicit function, parametric function
  4. Higher order Derivatives
  5. Applications of differentiations
  6. Minima and maxima
  7. Tangent and normal velocity and acceleration
  8. Rate of reaction
13. **Integral Calculus**
  1. Basic Integration
  2. Integrals of sum of powers of ' $\chi$ '
  3. Trigonometric, exponent and logarithmic functions
  4. Integration by parts: e.g  $\chi \sin\chi, \chi e^\chi$  and  $\log\chi$  etc.
  5. Substitution method
14. **Coordinate Geometry**
  1. Lines
  2. Find length, mid-point, gradient of line segment, given the coordinates of end points
  3. Different forms of equation of a line
  4. Angle between two lines, distance of a point from a line

### Suggested Teaching Methodology:

- Lecturing
- Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**
- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

### Recommended Text and Reference Books:

1. FSC Maths Part I /II
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## (MT-114) - Calculus

### Course Outline:

#### 1. Set and Functions:

1. Define rational, irrational and real numbers;
2. Rounding off a numerical value to specified value to specified number of decimal places or significant figures;
3. Solving quadratic, and rational inequalities in involving modulus with graphical representation;
4. Definition of set, set operations, Venn diagrams, DeMorgan's laws, Cartesian product, Relation, Function and their types (Absolute value, greatest integer and combining functions).
5. Graph of some well-known functions.
6. Limit of functions and continuous and discontinuous functions with graphical representation.

#### 2. Differential Calculus:

1. Differentiation and Successive differentiation and its application: Leibnitz theorem.
2. Taylor and Maclaurin theorems with remainders in Cauchy and Lagrange form, power series.
3. Taylor and Maclaurin series, L Hopitals rule, extreme values of a function of one variable using first and second derivative test.
4. Asymptotes of a function.
5. Curvature and radius of curvature of a curve.
6. Partial differentiation.
7. Exact differential and its application in computing errors.
8. Extreme values of a function of two variables with and without constraints.
9. Solution of non-linear equation, using Newton Raphson method.

#### 3. Integral Calculus

1. Indefinite integrals and their computational techniques.
2. Reduction formulae.
3. Definite integrals and their convergence.
4. Beta and Gamma functions and their identities.
5. Applications of integration.
6. Centre of pressure and depth of centre of pressure.

#### 4. Sequence & Series:

1. Sequence.
2. Infinite Series.
3. Application of convergence tests such as comparison, Root, Ratio, Raabe's and Gauss tests on the behavior of series.

#### 5. Complex Number:

1. Argand diagram.
2. De Moivre formula.
3. Root of polynomial equations, curve and regions in the complex plane.
4. Standard functions and their inverses (exponential, circular and Hyperbolic functions).

### Suggested Teaching Methodology:

- Lecturing
- Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**
- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

**Recommended Text and Reference Books:**

1. Advanced Engineering Mathematics, by Erwin Kreyszig, 8th Edition
  2. Calculus & Analytical Geometry, Howard Anton. Fifth Edition.
  3. Calculus, Thomas & Finney, 1994
  4. Calculus And Analytical Geometry, Schaum's Series
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## (BM-223) - Differential Equations and Fourier Series

### Course Outline:

#### 1. 1-st Order Differential Equations:

1. Basic concept;
2. Formation of differential equations and solution of differential equations by direct integration and by separating the variables;
3. Homogeneous equations and equations reducible to homogeneous form;
4. Linear differential equations of the order and equations reducible to the linear form;
5. Bernoulli's equations and orthogonal trajectories; Application in relevant Engineering.

#### 2. 2nd and Higher Orders Equations:

1. Special types of 2nd order differential equations with constant coefficients and their solutions;
2. The operator  $D$ ;
3. Inverse operator  $1/D$ ;
4. Solution of differential by operator  $D$  methods;
5. Special cases, Cauchy's differential equations;
6. Simultaneous differential equations; simple application of differential equations in relevant Engineering.

#### 3. Partial Differential Equation:

1. Basic concepts and formation of partial differential equations;
2. Linear homogeneous partial differential equations and relations to ordinary differential equations;
3. Solution of first order linear and special types of second and higher order differential equations;
4. D' Alembert's solution of the wave equation and two dimensional wave equations;
5. Lagrange's solution: Various standard forms.

#### 4. Laplace Integral & Transformation:

1. Definition.
2. Laplace transforms of some elementary functions.
3. First translation or shifting theorem.
4. Second translation or shifting theorem.
5. Change of scale property.
6. Laplace transform of the  $n$ th order derivative.
7. Initial and final value theorem.
8. Laplace transform of integrals.
9. Laplace transform of functions  $t^n F(t)$  and  $F(t)/t$ .
10. Laplace transform of periodic function.
11. Evaluation of integrals,
12. Definition of inverse Laplace transform and inverse transforms.
13. Convolution theorem.
14. Solutions of ordinary differential using Laplace transform.

#### 5. Fourier series:

1. Periodic functions and expansion of periodic functions in Fourier series and Fourier coefficients;
2. Expansion of function with arbitrary periods. Odd and even functions and their Fourier series;
3. Half range expansions of Fourier series, "DFT and FFT, Fourier Spectrum".

#### 6. Fourier Transform

1. Fourier transform of simple functions
2. Magnitude and phase spectra
3. Fourier transform theorems
4. Inverse Fourier transform
5. Solution of differential equation using Fourier transform

### Suggested Teaching Methodology:

- Lecturing

- Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**
- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

#### **Laboratory (100%)**

- Labs
- Open-Ended Labs

#### **Recommended Text and Reference Books:**

1. Erwin Kreyszig, Advance Engineering Mathematics, 10th Edition, ISBN: 9780470458365
  2. Robert L. Borrelli and Courtney S. Coleman, Differential Equations: A Modeling Perspective, 2nd Edition, ISBN: 9780471433323
  3. Dennis G. Zill and Warren S. Wright, Differential Equations with Boundary- Value Problems, 8th Edition, ISBN: 9781111827069
  4. Eric W. Hansen, Fourier Transforms: Principles and Applications, 1st Edition, ISBN: 9781118479148
  5. J. F. James, A Student's Guide to Fourier Transforms: With Applications in Physics and Engineering, 3rd Edition, ISBN: 9780521176835
  6. R. J. Beerends and H. G. ter Morsche, Fourier and Laplace Transforms, 2003, ISBN: 9780521806893
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# (MT-272) - Linear Algebra And Geometry

## Course Outline:

### 1. Linear Algebra:

1. Linearity and linear dependence of vectors.
2. Basis Vector.
3. Dimension of a vector space.
4. Field matrix and type of matrices (singular, non- singular, symmetric, non- symmetric, upper, lower, diagonal tri-diagonal matrix).
5. Rank of a matrix using row operations and special method, echelon and reduced echelon forms of a matrix.
6. Determination of consistency of a system of linear equation using rank, transitions matrix.

### 2. Euclidean Spaces and Transformation:

1. Geometric representation of vector.
2. Norm of vector.
3. Euclidean inner product projections and orthogonal projections.
4. Euclidean n spaces n properties Cauchy-Schwarz inequality.
5. Euclidean transformations.
6. Apply geometric transformations to plane figure composition of transformations.

### 3. Application of linear Algebra:

1. Leontief Economic models.
2. Electrical Networks
3. Scaling, Translation, Rotation, and projection etc.

### 4. Eigen values & Eigen Spaces

1. Interpret eigenvectors and eigenvalues of a matrix in terms of transformation it represents.
2. Convert a transformation into a matrix eigen value problem.
3. Find the eigenvalues and eigenvectors of order not more than  $3 \times 3$  matrices algebraically.
4. Determine the modal matrix for a given matrix, reduce a matrix to diagonal (form and Jordan form, state the Cayley-Hamilton theorem and use it to find powers and the inverse of a matrix.
5. Understand a simple numerical method for finding the eigenvectors of a matrix.
6. Use appropriate software to compute the eigenvalues and eigenvectors of a matrix.
7. Define quadratic form and determine its nature using eigenvalues.

### 5. Solid Geometry:

1. Coordinate Systems in three dimensions.
2. Direction cosines and ratios, vector equation of a straight line, plane and sphere.
3. Curve tracing of a function of two and three variables.
4. Surfaces of revolutions.
5. Transformations (Cartesian to polar & cylindrical).

## Suggested Assessment:

### Theory (100%)

- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

### Laboratory (100%)

## Text and Reference Books:

1. Howard Anton, Elementary Linear Algebra, 11th Edition, ISBN: 9781118473504
2. Gilbert Strang, Introduction to Linear Algebra, 5th Edition, ISBN: 9780980232776

3. Sheldon Axler, Linear Algebra Done Right, 3rd Edition, ISBN: 9783319110790
  4. David C. Lay and Steven R. Lay, Linear Algebra and Its Applications, 5th Edition, ISBN: 9780321982384
  5. Bernard Kolman and David Hill, Elementary Linear Algebra with Applications, 9th Edition, ISBN: 9780132296540
  6. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, ISBN: 9780470458365
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# (PH-126) - Physics

## Course Outline:

### Theory:

#### 1. Vectors:

1. Vectors & vector derivatives.
2. Gradient of a scalar functions.
3. Line and surface integrals.
4. Curl & divergence.

#### 2. Mechanics:

1. Coordinate systems.
2. Motion under constant acceleration.
3. Uniform circular motion.
4. Projectile motion.
5. Frictional forces.
6. Fluid friction.
7. Work and energy principle.
8. Angular momentum.

#### 3. Elasticity:

1. Stress and strain;
2. Elastic properties of matter;
3. physical basis of elasticity;
4. tension;
5. compression and sharing;
6. modulus of rigidity;
7. relation between three types of elasticity.

#### 4. Wave, Optics and Laser:

1. Standing waves and its analytical treatments;
2. travelling waves;
3. interference;
4. diffraction and polarization phenomenon;
5. laser;
6. stimulated emission;
7. population inversion;
8. laser applications.

#### 5. Modern Physics:

1. Inadequacy of classical physics:
  1. Black body radiation;
  2. photoelectric effect;
  3. Compton scattering;
2. De-Broglie wave particle duality hypothesis;
3. Uncertainty principle;
4. Quantum physics.
5. Atomic spectrum:
  1. Atomic spectra;
  2. Bohr theory and hydrogen spectrum; Modification and generalization.

#### 6. Nuclear physics:

1. Properties of nuclear;
2. nuclear stability;
3. Alpha, Beta and Gamma decay.
4. Radioactivity & radioactive equilibrium;
5. secular equilibrium;
6. radiation detectors;



7. GM tube;
  8. counters and nuclear reactor.
  7. **Thermodynamics:**
    1. Closed and open systems;
    2. specific heats;
    3. thermal expansion;
    4. internal energy;
    5. enthalpy and specific heat of ideal gasses;
    6. heat transfer;
    7. energy transfer by work;
    8. mechanism of heat transfer;
    9. Zeroth law, first law; (application for closed and open systems);
    10. second law and third law of thermodynamics; ### **Practical:**
  8. Study of Hook's Law
  9. Measuring stress, strain and Young's Modulus of different materials
  10. Study of Surface Tension and Viscosity of liquids
  11. Study of Boiling points of liquids
  12. Study of Gas laws
  13. Venturi effect of liquids in motion
  14. Heat transfer and entropy
  15. Study of light, Color addition, Refraction and Prism
  16. Measurement of Snell's Law
  17. Convex and Concave Lens
  18. Study of reversibility and Dispersion of Light
  19. Focal point and Magnification of Thin lens
  20. Focal point and Magnification of Concave Mirror
  21. Telescope and Microscope
  22. Calculation of speed of Sound
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### Suggested Teaching Methodology:

- Lecturing
- Written Assignments Report Writing

### Suggested Assessment:

#### Theory (100%)

- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm(30%)
- Final Term (50%)

#### Laboratory (100%)

- Labs

### Text and Reference Books:

1. David Halliday, Robert Resnick and Jearl Walker, WIE Fundamentals of Physics, 7th ed. 2005, John Wiley & Sons, ISBN:0471465097
2. Arthur Beiser, " Schaum's Outline of Applied Physics, 4th ed. 2004, McGraw-Hill, ISBN:0071426116
3. Hobbie, Russell, Intermediate physics for medicine and biology-4th edition, 2007

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# (TC-201) - Digital Logic Design

## Course Outline:

### Theory:

#### 1. Computer Operations:

1. Evaluation of the computer.
2. Basic organization of digital computer.
3. Instruction formats.
4. Different types of computers, special purpose and general purpose computers.

#### 2. Number Systems:

1. Conversion between bases.
2. Arithmetic with bases other than ten, negative numbers, binary coded decimal numbers, octal, and hexadecimal number systems.

#### 3. Truth Function:

1. Binary connectives.
2. Evaluation of truth functions.
3. Many statement compounds.
4. Physical realizations.
5. Sufficient sets of connectives.
6. Digital computer examples.

#### 4. Boolean Algebra:

1. Truth functional calculus as Boolean algebra.
2. Duality, fundamental theorems of Boolean algebra.
3. Examples of Boolean simplifications.
4. Remarks on Switching functions.

#### 5. Switching Devices:

1. Switches and relays logic circuits.
2. Speed and delays in logic circuits.
3. integrated logic circuits.

#### 6. Minimization of Boolean Functions:

1. Standard forms of Boolean functions.
2. Minterm and maxterm.
3. Designation of Boolean functions.
4. Karnaugh map representation of Boolean functions.
5. Simplification of functions on Karnaugh maps.
6. Map minimization of product of sums expressions.
7. Incompletely specified functions.

#### 7. Tabular Minimization:

1. Cubical representation of Boolean functions.
2. Determination of prime implicants.
3. Selection of an optimum set of prime implicants.
4. Design of NAND and NOR Networks and properties of combinational network.
5. Introduction to design of NAND and NOR Networks.
6. Switching expressions for NAND and NOR Networks.
7. Transient response of combination Networks.

#### 8. Introduction to sequential Networks:

1. Latches.
2. Sequential Networks in fundamental mode.
3. Introduction to the Synthesis of Sequential Networks.
4. Minimization of the number of states.
5. Clocked Networks.

**9. Introduction to Verilog HDL and VHDL Lab work: ## List of Practicals:**

10. Digital Logic Gates
11. Simplification of Boolean Functions
12. Combinational Circuits
13. Code Converters
14. Design with Multiplexers
15. Adders and Subtractors
16. Flip Flops
17. Sequential Circuits
18. Counters
19. Shift Registers
20. Serial Addition
21. Memory Unit
22. Clock Pulse Generator
23. Parallel Adder
24. Binary Multiplier
25. Asynchronous Sequential Circuits ## **Suggested Teaching Methodology:**

- Lecturing
- Written Assignments Report Writing ## **Suggested Assessment: ### Theory (100%)**
- Sessional (20%)
- Quiz (12%)
- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

**Laboratory (100%)**

- Labs
- Open-Ended Labs

**Recommended Text and Reference Books:**

1. M. Morris Mano, Digital Logic & Computer Design
2. D. J. Comer, Digital Logic and State Machine Design, Oxford University Press.
3. Victor P. Nelson, et al, Digital Logic Circuit Analysis and Design
4. Brian Holdsworth, Clive Woods, Digital Logic Design, Fourth Edition
5. M. Rafiquzzaman, Fundamentals of Digital Logic and Microcomputer Design, 5th Ed.

6. Tocci, Ronald J, Digital Systems principles and application. 10th Ed, 2009.
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