

YEAR IV
SEMESTER - VIII

Biomedical Embedded System Design
BEG 3C2 BM
Micro syllabus

SN	Chapters	Descriptions	Time ,Hrs	Hours	Weight
1	Unit 1. Background	Introduction to Embedded System	0.5	3	4
		Introduction to Real Time System <ul style="list-style-type: none"> • Feature of Real Time System 	1		
		Architecture and design of an Embedded System	0.5		
		Example of Embedded system	1		
2	Unit 2. Hardware Fundamentals	Terminology <ul style="list-style-type: none"> • PCB • schematic diagrams • VCC • Ground 	0.5	3	4
		Gates and its implementation in Practical consideration <ul style="list-style-type: none"> • Review of Gates(AND,OR,NOT, NAND,NOR) 	0.5		
		Other Basic Consideration <ul style="list-style-type: none"> • Power and Decoupling • decoupling capacitor • Open Collector • Tri-Stating Outputs • Floating Signals <ul style="list-style-type: none"> ▪ Pull up Resistor ▪ Pull Down Resistor 	1		
		Memory <ul style="list-style-type: none"> • ROM Design • SRAM Definition with circuit diagram • DRAM definition with circuit diagram 	1		
3	Unit 3Advanced Hardware Fundamentals	Microprocessors Introduction	0.5	5	8
		Buses <ul style="list-style-type: none"> • Introduction • Bus Handshaking • No Handshaking • Wait state 	1		
		DMA <ul style="list-style-type: none"> • Architecture of System with DMA • Read Operation with timing Diagram • Write Operation with timing Diagram 	1.5		
		Interrupts	1		

		<ul style="list-style-type: none"> • Interrupts Connection • Operation 			
		Timer <ul style="list-style-type: none"> • Watch dog Timer • Timer in watch mode • Timer in Counter mode 	1		
4	Unit 4: Assembly Language Programming	Basic Concepts of MASM and NASM	0.5	6	Only used for Practical
		Optimization	2		
		Construction of Graphics Routine	2		
		Device Driver Concepts Examples	1		
		Recent Software Tools for ALP	0.5		
5	Unit 5. Microcontroller	Introduction	1	6	16
		Architecture of Microcontroller AT89c51/52/55 Architecture <ul style="list-style-type: none"> • Pin Diagram • Function of Pin 			
		8255 PPI <ul style="list-style-type: none"> • Block Diagram • Interfacing with Microcontroller • Modes of operation • Example 	1		
		Microcontroller Based Medical Instruments <ul style="list-style-type: none"> • Block Diagram and function of Medical Meter • Blood Pressure Monitor • End Scope • Infusion pump 	4		
6	Unit 6. Embedded software Development Tools	Cross Assemblers	0.5	2	Only used for Practical
		Cross Compilers	0.5		
		Debuggers	0.5		
		Downloader	0.5		
7	Unit 7. System design with microcontrollers	Design and build a bioelectric amplifier <ul style="list-style-type: none"> • Block Diagram • Operation 	3	10	24
		Pulse Oximeters <ul style="list-style-type: none"> • Block Diagram • Function 	3.5		
		Doppler Ultrasound <ul style="list-style-type: none"> • Block Diagram and Design Consideration 	3.5		
8	Unit 8. Emerging concept	VLSI <ul style="list-style-type: none"> • Introduction • Building blocks of VLSI system on chip 	1	10	24
		VLSI application in machine	1		
		VLSI sensors for biomedical signals	1		

		<ul style="list-style-type: none"> • Block diagram of a generic VLSI sensor • Operation 			
		VLSI design with VHDL/Verilog <ul style="list-style-type: none"> • PLD Design Flow Steps • Design Entry • State Diagram • HDL Code Entry • Compilation • Functional Simulation/ Verification • Synthesis • Implementation • Features of VHDL • Examples • Adder • Subtractor • Decoder • Encoder • Counter 	7		
			Total	45	80

Laboratory:

1. Interfacing standard Parallel and serial port
2. Real life Projects with Microcontrollers
 - a. Simple Flashing LED
 - b. Flashing LED with Push Buttons
 - c. Seven Segment Display Interfacing
 - d. Keypad Interfacing
 - e. Keypad with Seven Segment Display
 - f. Stepper Motor Control
3. LCD Display using Microcontroller Programming
 - a. Introduction to LCD and its Programming Protocols
 - b. LCD with Microcontroller
 - c. LCD programming with Keypad
4. System Interfacing with Microcontroller
 - a. Serial Data Communication
 - b. Interrupts and Interrupts Service routine
 - c. ADC with Microcontroller
 - d. Activity and Posture recorder
5. Interfacing on PIC Microcontroller
6. Simple projects on VHDL in FPGA Board

Project:

Students have to prepare one project using FPGA or Microcontroller related to Biomedical instruments.

Text Books:

1. Embedded System Primer, Simon
2. The 8051 microcontroller Architecture, Programming and Application, Kenneth J. Ayala
3. IBM PC Assembly Language and Programming, Peter Abel
4. The 8051 Microcontroller and Embedded System, Muhammad Ali Mazidi & Janice Gillispie Mazidi

Reference Books:

1. Biomedical Digital Signal Processing, Willis J. Tompking

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**MEDICAL INDUSTRY MANAGEMENT
BEG 4B4 BM**

Semester VIII

Year IV

Teaching Schedule Hours/Week			Examination Schedule						Total Marks	Remarks
			Final				Internal Assessment			
			Theory		Practical		Theory Marks	Practical Marks		
L	T	P	Duration	Marks	Duration	Marks				
3	1		3	80			20		100	

COURSE OBJECTIVE: To give an overview of medical industries including hospitals and device industries and to introduce the standards and norms of the medical industries and their products.

1.0 Introduction:

(1 hour)

- 1.1. Introduction
 - 1.1.1. Definition of medical devices.
(Harmonized definition of medical device.)
 - 1.1.2. Medical device definition (consensus)
 - 1.1.3. Risk classification of medical device
 - a) Low risk
 - o Low risk and reusable
 - o Low risk and sterile
 - o Low risk with measure function
 - b) Medium risk
 - c) High risk
 - d) Custom made medical device.
- 1.2. New medical technology
- 1.3. Medical device – Borderline issues
 - 1.3.1. Medical purpose and principle intended action.
 - 1.3.2. Analyzing tools.
- 1.4. Medical devices and invitro examination

2.0 Types of Medical Devices:

(2 hours)

- 2.1. Different Types Of Medical Device Companies.
 - 2.1.1. Manufacturers
 - 2.1.2. Packers and sterilizers
 - 2.1.3. Banks
 - 2.1.4. Consultants
 - 2.1.5. Hospitals and other health care centers.
- 2.2. Classification of medical devices.
 - 2.2.1. Class I (Is and Im)
 - 2.2.2. Class II (IIa and IIb)
 - 2.2.3. Class III
- 2.3. Factors governing the classification of medical devices.
- 2.4. Intended purpose of use and the class determination of medical device.
- 2.5. Class I medical devices.
 - 2.5.1. Steps for Class I medical device compliance
 - 2.5.2. Conformity assessment route.

2.5.3.CE marking routes for Class I medical devices.

2.6. Class II medical devices.

2.6.1.Class IIa medical devices.

2.6.1.1. Steps for Class IIa medical device compliance

2.6.1.2. Conformity assessment route.

2.6.1.3. CE marking routes for Class IIa medical devices.

2.6.2.Class IIb medical devices.

2.6.2.1. Steps for Class IIb medical device compliance

2.6.2.2. Conformity assessment routes.

2.6.2.3. CE marking routes for Class IIb medical devices.

2.7. Class III medical devices

2.7.1.Steps for Class III medical device compliance

2.7.2.Conformity assessment routes.

2.7.3.CE marking routes for Class I medical devices.

2.8. Essential principles of safety and performance of medical devices.

2.8.1. Harmonization of safety and performance criteria

2.8.2. General requirements of safety and performance that apply to all medical devices

2.8.3. Relevant essential principals of safety and performance.

2.8.3.1. General requirement 1

2.8.3.2. General requirement 2

2.8.3.3. General requirement 3

2.8.3.4. General requirement 4

2.8.3.5. General requirement 5

2.8.3.6. General requirement 6

3.0 Structure of Multinationals:

(2 hours)

- General organization chart.
- Types of structure of organization.
 - Functional structure
 - Geographical structure
 - Product structure
 - Hybrid structure
- Organizational structures for international strategies
 - Export department
 - International division
 - Pressure to abandon the international division
 - Worldwide geographic, product, hybrid and matrix structure
 - Transnational network structure
- Strategy and structure
- Control and coordination system

3.1. Finance and investment

3.2. Board of Directors

3.3. Scientific Advisory Boards

4.0 Roles of the Medical Device Industry:

(3 hours)

4.1. European, USA Procedures

5.0 International Standards:

(2 hours)

5.1. international standards: definition

- 5.2. categorization of standards: classification, guide, practice, specification, performance, terminology, test method
- 5.3. ISO 13485:2003, an overview : key sections, process oriented structure
 - 5.3.1. 4.0 Quality management system
 - 5.3.1.1. 4.1 General requirements
 - 5.3.1.2. 4.2 Documentation requirements
 - 5.3.1.3. Product realization – exclusion
 - 5.3.1.4. Product realization – non-applicability
 - 5.3.2. 5.0 management responsibility
 - 5.3.2.1. 5.1 Management commitment
 - 5.3.2.2. 5.2 Customer focus
 - 5.3.2.3. 5.3 Quality policy: case study
 - 5.3.2.4. 5.4 Planning
 - 5.3.2.5. 5.5 Responsibility, authority and communication
 - 5.3.2.6. 5.6 Management review: case studies
 - 5.3.3. 6.0 Resource management
 - 5.3.3.1. 6.1 Provision of resources
 - 5.3.3.2. 6.2 Human resources
 - 5.3.3.3. 6.3 Infrastructure: case study
 - 5.3.3.4. 6.4 Work environment: case study
 - 5.3.4. 7.0 Product realization
 - 5.3.4.1. 7.1 Planning of product realization
 - 5.3.4.2. 7.2 Customer related processes
 - 5.3.4.3. 7.3 Design and development: design inputs, design outputs, design reviews, design verification, design validation: case studies
 - 5.3.4.4. 7.4 Purchasing: case study
 - 5.3.4.5. 7.5 Production and service provision: process validation, identification, traceability. : case study
 - 5.3.4.6. 7.6 Control of monitoring and measuring devices
 - 5.3.5. 8.0 Measurement, analysis and improvement
 - 5.3.5.1. 8.1 General
 - 5.3.5.2. 8.2 Monitoring and measurement
 - 5.3.5.3. 8.3 Control of non-conforming products
 - 5.3.5.4. 8.4 Analysis of data: case study
 - 5.3.5.5. 8.5 Improvement: corrective actions, preventive actions

6.0 Risk Assessment and Management: (3 hours)

- 6.1. Failure Modes and Effects Analysis
 - 6.1.1. Determination of acceptable levels of risk
 - 6.1.2. Risk analysis
 - 6.1.3. Determination of risk reduction measures
 - 6.1.4. Risk control and monitoring activities

7.0 Product Liability: (2 hours)

- 7.1.1. Product liability: definition
- 7.1.2. Types of defective product liability
 - 7.1.2.1. Defectively manufactured products
 - 7.1.2.2. Medical devices with a defective design
 - 7.1.2.3. Defectively marketed medical device
- 7.1.3. Theories of liability
 - 7.1.3.1. Liability in contract
 - 7.1.3.2. Fault or negligence liability
 - 7.1.3.3. Strict liability: case studies

- 7.1. Medical Device Litigation
- Defect
 - Proof and causation
 - Defenses
 - Liability issues
 - Limitation of liability issues
 - Medical device liability issues
 - Adequate warning

8.0 Clinical Requirements and Their Implication in Device Design: (3 hours)

9.0 Protection of Intellectual Property: (1 hour)

- Intellectual property: introduction
- Patent
- Patent bargain
- Protection by patent
- Rights of patent owner
- End of patent
- Necessity of patent
- Process of patent granting
- Inventions which can be patented
- Patent granting authority
- Worldwide patent

10.0 Introduction of Clinical Evaluation of Medical Devices: (3 hours)

10.1. Control of Clinical Trials, Post Market Surveillance

- Clinical trial: definition
- Valid scientific evidence
- Designing a trial
 - a) Trial objective
 - b) Pilot or feasibility study
 - c) Identification and selection of variables
 - ❖ Outcome variables
 - ❖ Influencing variables
 - d) Study population
 - e) Control population
 - ❖ Types of control population: concurrent control, passive concurrent control, self-control or crossover control, historical control
 - ❖ Comparison of controls
 - f) Method of assigning intervention
 - g) Specific trial designs
 - h) Sample size and statistical power
 - i) Masking (blinding)
 - ❖ Investigator bias, evaluator bias, placebo or sham effect.
 - ❖ Single mask, double mask, third party mask.
 - j) Study site and investigator
- The protocol
- Clinical trial conduct
 - a) Trial monitoring
 - b) Baseline evaluation
 - c) Intervention
 - d) Follow-up

- e) Collection and validation of data
- Clinical trial analysis
 - a) Validation of assumptions
 - b) Hypothesis and statistical tests
 - c) Pooling
 - d) Accountability for patients
- Consent of patients
- Assent
- Consent form
- Quality system requirements to medical devices intended to be used in clinical trial
- Devices needing clinical trial
- Exemption

10.2. Epidemiological Aspects of Device Performance

11.0 Case Studies: Implantable Devices: (3 hours)

12.0 Case Studies: Tissue Engineering Products: (3 hours)

13.0 Case Studies: Other Devices: (3 hours)

14.0 Architectural Planning of Hospitals: (2 hours)

15.0 Basics of Hospital Management: (3 hours)

- 15.1. WHO definition of a hospital
- 15.2. Planning a new hospital
- 15.3. Stages in hospital establishment
- 15.4. How and what to do
- 15.5. Opening a new hospital
- 15.6. Organizational chart
- 15.7. Management of a hospital: Hierarchical line and Professional line
- 15.8. Conflict due to types of physicians
- 15.9. Conflicts between systems
- 15.10. Professional management of the hospital
- 15.11. Recruitment and selection
- 15.12. Architecture of a hospital
- 15.13. Points to consider
- 15.14. Constituents of a hospital
- 15.15. Essentials of hospital architecture
- 15.16. Key traffic flow within a hospital
- 15.17. Plan

16.0 Selection and Purchase of Medical Equipment: (2 hours)

- 16.1. Medical equipment life cycle: major phases of life cycle (7 phases)
- 16.2. Total life cycle: Three main stages (Provision, Acquisition and Utilization)
- 16.3. Management of medical equipment
- 16.4. The nature of medical equipment management
- 16.5. The purpose and main elements of medical equipment management
- 16.6. Medical equipment planning, procurement and management
- 16.7. Medical equipment planning:
 - Need analysis
 - Audit existing technology
 - Faculty evaluation
 - Financial evaluation

- Decision process
- 16.8. Medical equipment procurement
 - Life cycle cost
 - Methods of procurement: traditional and modern
 - Procurement-decisions
 - Criteria for selection
- 16.9. Medical equipment management
 - Component
 - Management of medical equipment means
 - Some chart modules of medical equipment management
 - a) ECRI
 - b) HIMSS
 - c) DBE
- 16.10. Some important notes within the different phases of medical equipment management
 - In the planning phase
 - In the procurement phase
 - In the incoming inspection phase
 - In the inventory and documentation phase
 - In the commissioning and acceptance phase
 - In the monitoring of use and performance phase
 - ❖ Where and when to use the result of monitoring and performance
 - In maintenance phase
 - ❖ Determined and clear working maintenance procedures
 - In de-commissioning phase
 - ❖ When to replace an equipment
 - Can replace equipment be used?

17.0 Peripheral Devices Used in Hospitals:

(8 hours)

- 17.1. Electro power System
- 17.2. Refrigeration
- 17.3. Air-conditioning
- 17.4. Heating

Laboratories:

- 1.0 Air-conditioning Principles
- 2.0 Refrigeration Principles
- 3.0 Electro-power Principles

Text Book:

- 1.0 Principles of Hospital Administration and Management, R Bindra Hands-out

MEDICAL INFORMATICS (BEG 4C3 BM)

Semester VIII			Examination Schedule						Year IV	
Teaching Schedule Hours/Week			Final				Internal Assessment		Total Marks	Remarks
			Theory		Practical		Theory Marks	Practical Marks		
L	T	P	Duration	Marks	Duration	Marks				
3	1	2	3	80	-	-	20	25	125	

COURSE OBJECTIVE: To provide the basic concepts of Computer Applications in various medical fields.

1. **Computer Applications:**

10 hrs

- > Electronic Health Record software design,
 - Bottom Up Approach
 - Top Down Approach
- > System selection; requirement analysis and information engineering
 - Analysis and Requirement using SRS
 - Design using DFD and Flowchart
- > System/ software development life cycle; models
 - Waterfall/Linear sequential
 - Prototype
 - Spiral
 - Win-win Spiral
- > Integration with medical imaging and peripheral devices
 - PACS,
 - Imaging systems and
 - API modules
- > Computer based patient record system
 - Application and embedded Database system
- > Secure system design
 - Using various security standards

2. Database Management system

8 hrs

- > Database architecture,
 - ANSI/SPARC Architecture
 - MYSQL Architecture
- > Design issues,
 - Conceptual Design
- > Levels of Abstraction
- > SQL Query Languages
- > Integrity constraints
- > Data Models, Languages, structure
 - DDL
 - DML
- > Proper database management system,
- > Entity Relationship diagram (ER-Diagram),
- > Relational database design

Note: Database requires additional Lab Hours beside lecture classes for practical.

Database Lab Exercises (Lab Hours-15)

Experiment-1:

Introduction to SQL, an exercise on data types in SQL & data definition language Commands

Experiment-2:

Exercise on data manipulation language and transaction control commands

Experiment-3:

Exercise on types of data constraints

Experiment-4:

Exercise on joins (single-table or multi-table) and using normalization

Experiment-5:

Exercise on group-by clause and date arithmetic.

Experiment-6:

Exercise on different functions (aggregate, math and string)

Experiment-7:

Mini-project on designing and implementing one database management system

3. Computer Networks

6 hrs

- > Telecommunication and Computer network
 - Point –to-Point
 - Broadcast
- > Types of Network
 - LAN
 - MAN
 - WAN
- > Communication Channels
 - Coaxial cable
 - Twisted Pair
 - Fiber-optics
 - Wired and wireless
- > Network Topology
 - Star, Bus and Ring
- > TCP/IP reference model, OSI reference Model
- > Protocols
 - LAN and WAN

4. Medical Information Security

8 hrs

- > Privacy and confidentiality
 - Privacy Legislation and framework
 - Evolution of Privacy Liability
- > Importance of security; security best practices;
- > Access control and authorization
- > Encryption and decryption;
 - public and private key
 - Symmetric Encryption Algorithm (DES, AES, IDEA)
 - Asymmetric Encryption Algorithm (RSA, HASH)

- > Digital Certificate/ Digital Signature/ PKI

5. Medical Informatics application to health services

8 hrs

- > Standards in medical informatics
 - DICOM, HL7, ISO, IEEE, EDIFACT, etc
- > Medical data acquisition, storage and use
 - Medical datum
 - Types of Data
 - Use of Medical Data
- > Computer based patient record system
 - Patient Monitoring in ICU
 - Use of computers in ICU
- > Information retrieval system
 - Data acquisition and signal processing
- > Advantage of Built in Microcomputers

6. Expert system and clinical decision support system

6 hrs

- > Expert system
 - Evolution of Expert system
 - Types of Expert System: DENDRAL, MYCIN
 - Components of Expert System
 - Hierarchy of expert system development process
 - Programming languages for expert system development
- > Architecture of expert system
- > Artificial Intelligence
 - Approaches of AI
- > AI Techniques, goals
- > Case study of expert system (as a clinical decision support system)

Chapter	Lecture Hours	No. of Questions	Marks
Computer Applications	10	1 Long, 1 short	15
Database Management system	8	1 Long, 1 short	15
Computer Networks	6	1 Long and/or 1 short	10-15
Medical Information Security	8	1 Long, 1 short	15
Medical Informatics application to health services	8	1 Long, 1 short	15
Expert system and clinical decision support system	6	1 Long and/or 1 short	10-15
Total	46	8 (7 Long +1 short notes)	80

**ENGINEERING PROFESSIONAL PRACTICE
BEG 4B5 BM**

Semester VIII

Year IV

Teaching Schedule Hours/Week			Examination Schedule						Total Marks	Remarks
			Final				Internal Assessment			
			Theory		Practical		Theory Marks	Practical Marks		
L	T	P	Duration	Marks	Duration	Marks				
2	1	-	2	40			10		50	

COURSE OBJECTIVES: To introduce the ethical and legal environment in which engineering is practiced.

1.0 Background Perspective: (6 hours)

- 1.1 Background of engineering
 - 1.1.1 History of Engineering practice
 - 1.1.2 Key roles of engineers in the developmental activities
- 1.2 Impacts and consequences of technology on society:
 - 1.2.1 Society, its type and its features
 - 1.2.2 Effects of major technological development as positive as well as negative impacts such as printing, gunpowder, mechanization, computers, organic chemistry, communication satellites.
- 1.3 Cultural motivations and limitations, eastern Vs western philosophy of change and development.
 - 1.3.1 Eastern societies
 - 1.3.2 Western societies
 - 1.3.3 Eastern societies vs. western societies
- 1.4 Political and social limitations.
- 1.5 Individual freedoms Vs societal goals.
- 1.6 Exponential growth.
- 1.7 Alternative use of scarce resources and causes of international tensions.
- 1.8 Risk and overall cost/benefit ratio analysis in engineering decision making.
- 1.9 Education and training of technologists, scientists and engineers.

2.0 Ethics and Professionalism: (3 hours)

- 2.1 Perspective on morals, ethics and professionalism.
 - 2.1.1 Engineering morals, ethics and professionalism
 - 2.1.2 Laws of ethics
 - 2.1.3 Features of a profession
- 2.2 Codes of ethics and guidelines for professional engineering practice.
 - 2.2.1 The fundamental principles for engineers to uphold and advance the integrity
 - 2.2.2 Fundamental canons for the professional engineers
- 2.3 Relationship of the engineering profession to basic science and technology, relationship to other professions.

3.0 Roles of Professional Association:(1 hour)

3.1 Regulation of the practice of the profession, licensing, guidance for training, new entrants into the profession, advice and assistance to engineering colleges, upgrading and maintaining the professional and technical competence of member, providing technical expertise as requested for the guidance and assistance of legislators, seeing to the matter of safety and general welfare of the public in engineering works.

3.1.1 Nepal Engineering Association and its structures

3.1.2 Objectives Of NEA

3.1.3 Professionals practice sectors in Nepal

3.1.4 Nepal Engineering Council

3.1.5 Duties of NEC

3.1.6 NEC Ain

3.1.7 Structures of NEC

3.1.8 Registration Process in NEC

4.0 Legal Aspect of Professional Engineering in Nepal: (9 hours)

4.1 The Nepalese legal system as it affects the practice of engineering.

4.1.1 Different acts and Administration related with development works

4.2 Contract law.

4.2.1 Essential elements of contract law

4.2.2 Types of contract

4.3 Tendering.

4.3.1 Tender document

4.3.2 Tendering process in Nepal

4.3.3 Tender notice details for Nepalese as well as for foreigner parties

4.4 Contract documents.

4.4.1 Preparation of contract documents

4.4.2 Finalizing the contract Documents

4.4.3 Method of work execution

4.5 Liability and negligence.

4.5.1 Tort liability and its type

4.5.2

4.6 Business and labor laws.

4.6.1 Source of business law in Nepal

4.6.2 Types of business enterprises

4.6.3 Company Ain

4.6.4 Labor law

4.6.5 Labor Act 2048

4.6.6 Labor recruited and appointed procedures

4.6.7 Condition of work

4.6.8 Compensation

4.6.9 Health and security provisions

4.6.10 Employee welfare

4.6.11 Disciplining

4.6.12 Process for collective bargaining

4.6.13 Process to go on strike

4.7 Relationship to foreign firms working in Nepal.

4.7.1 Coordination with other agencies

5.0 The Roles and Practice of Professional Engineering in Other Countries:

(2 hours)

- 5.1 Other Asian countries.
- 5.2 The USSR and Eastern Europe.
- 5.3 Western Europe.
- 5.4 North America.

6.0 Case Studies Involving Professional Ethical Issues Chosen From a Wide Range of Topics:

(9 hours)

- 6.1 Intellectual property rights: copyrights and patent protection.
 - 6.1.1 Ownership of copy right
 - 6.1.2 Terms of copyrights
 - 6.1.3 Registration of copyright
 - 6.1.4 Patent**
 - 6.1.5 Right over the Patent
 - 6.1.6 Apply for Acquiring Patent Right
 - 6.1.7 Examination of Patent Application
 - 6.1.8 Certificates of Patent Application
 - 6.1.9 Publication of Registered Patent
 - 6.1.10 Term and Renewal
- 6.2 Personal privacy and large computerized data bases.
- 6.3 Industrialization Vs protection of the environment.
- 6.4 Risk/benefit considerations in public transportation.
- 6.5 Engineers and the military.
- 6.6 Science and technology for medicine.
- 6.7 Engineers in international development.

Reference Book:

- 1.0 Carson Morrison and Philip Hughes, "Professional Engineering Practice – Ethical Aspects", McGraw-Hill Ryerson Ltd., Toronto, 1982.

Chapter	Lecture Hours	No. of Questions	Mark distribution in
1	6	1	6-8
2	2	1	6
3	2	1	6
4	9	1	6-8
5	2	1	6
6	9	1	6-8
Total	30		40