Advanced Instrumentation (3-1-2)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:
These chapters of study aims to provide students with an advanced understanding of Microprocessor/Microcontroller, Optical, Biomedical and ion based instrumentation from signal acquisition through to process control and measurements.

Course Contents:

1. **Measurements and Calibration:** 4 hrs
   - 1.1 Review on measurement and measurement units
   - 1.2 Elements of measurement system and Choosing of appropriate measurement Instruments
   - 1.3 Basics on: Accuracy & Inaccuracy, Precision/Repeatability/Reproducibility, Tolerance, Range or Span, Sensitivity of measurements.
   - 1.4 Measurements in electric Circuit.
   - 1.5 Calibration, Calibration versus ranging.
   - 1.6 Calibration procedures, Necessity for calibration and typical calibration errors.
   - 1.7 Introduction to: Process Instrumentation, Environment Instrumentation, Automobile Instrumentation and Power plant instrumentation.

2. **Digital Instrumentation** 4 hrs
   - 2.1 Sample Data system, Components of data acquisition system,
   - 2.2 Data acquisition (brief definition on : Scanning, logging, smoothing & Filtering, Data compression, short and long term storage,, archiving).
   - 2.3 Sample and hold circuits.

3. **Introduction to Biomedical Instrumentation** 8 hrs
   - 3.1 Origin of Biopotential, Electrical activity of cell, Action Potential and its Propagation.
   - 3.2 Measurement of Biochemical and Bioelectric potentials (Biochemical transducers pH, PO2, PCO2, Bio-potential electrodes, bio-potential amplifier)
   - 3.3 Blood Pressure Measurement (Invasive and Noninvasive), Cardiac Output and Heart sound measurement.
   - 3.4 Basics of Diagnostic Instruments: EMG, EEG, ECG, Pacemaker, X-Ray Generation and X-Ray Machine, CT Scanning, Ultrasound Imaging, Magnetic Resonance Imaging.

4. **Introduction to Fiber optic Instrumentation:** 7 hrs
   - 4.1 Optical fiber measurements: measurements of attenuation, dispersion, refractive Index profile, fiber cutoff wavelength, numerical aperture, OTDR.
   - 4.2 Introduction to fiber optic sensing (FOS), Advantages & Disadvantages of

FOS. Transduction technique based on intensity modulation, Encoding based position sensing.

4.3 Distributed optical fiber sensing, Optical amplifier & fiber amplifier.

5. Analytical and Testing Instrumentation **6 hrs**

5.1 Infrared, Ultraviolet and X-ray spectroscopy, Mass Spectrometry,

5.2 Nuclear magnetic resonance instruments, ionizing radiation for instrumentation purpose, Nuclear radiation for instrumentation, Microscopy (STM : definition & Working, Instrumentation)

5.3 Non-destructive testing for industry.

6. Microprocessor Based Instrumentation: **6 hrs**

6.1 Microprocessor as instrumentation system and its components,

6.2 Basic features of microprocessors, Microprocessor hardware used in instrumentation, Basic elements of microprocessor based systems,

6.3 Interfacing between analog devices and microprocessors. Generating square wave on port pins, Interlacing keyboard, 7 segments displays).

7. Microcontroller/ Embedded System Instrumentation: **10 hrs**

7.1 Embedded system Instrumentation : Definition, embedded system overview, classifications,

7.2 Design challenges, processor technology, IC technology and Design Technology and tradeoffs, Examples of embedded system.

7.3 8051 Programming: Assembly language programming process. Programming tools. Instruction set, addressing modes. Assembly language Programming

7.4 Practice using assembly & C compiler (Stepper motor control, Sped control of DC Motor, Generating square wave on port pins, Interlacing keyboard, 7 segments displays)

List of Practical:

1. To study attenuation/dispersion losses in optical fiber.
2. To study OTDR.
3. Perform at least 2 examples of programming on 8051 microcontroller.
4. Field Visit for Demonstration of medical diagnostic equipments in local hospitals.
5. Projects related to chapters.

Text Books:/ References:

1. Mazadi M.A., *The 8085 Microcontroller & Embedded systems,* Pearson Education Second edition.
2. Biomedical Instrumentation and Measurements By Cromwell, 2nd edition, Pearson education.
3. Optical Fiber Sensing Technology, Jose Miguel Lopez-Higuera, John Wiley & Sons,2002.
4. S. Wolf and R.F.T Smith "Students reference Manual for Electronic Instrumentation laboratories" Prentice hall.
5. E .O Deobchin "Measurements Systems : Application + Design, Mc Graw Hill.
6. R. Rasad, Electronic Measurement and Instrumentation. Khanna Publisher.

Transmission Line Design (3-0-2)

Evaluation:

	Theory	Practical	Total
Sessional	50		50
Final	50		50
Total	100		100

Course Objectives:
To impart the knowledge about the design aspects of a power transmission systems.

1. **Distribution system planning and design** **[6hrs]**
   1.1 Distribution system planning , short term planning , long term planning and dynamic planning
   1.2 Sub-transmission and substation design
   1.3 Sub-transmission networks configuration , substation bus schemes
   1.4 Distribution substation ratings , service area calculation and Substation application curves

2. **Transmission system design consideration** **[4hrs]**
   2.1 Route selection and preliminary study, Right –of –way (ROW), survey and drawing
   2.2 Codes and standards, legal permits and licenses, easements, franchise and authorization
   2.3 Topographical features (terrain, altitude, seismic hazards) and climate condition (wind, temperature, lightening), environmental and cultural heritage requirements
   2.4 Transmission line design planning and factors to be considered

3. **Transmission voltage level and number of circuit selection** **[8hrs]**
   3.1 Advantage and disadvantage of High voltage transmission, effect of high voltage in power and energy losses, conductor and insulator economy
   3.2 Technical aspects of alternating current overhead line, power and VAR transmission capability as a function of line length, line impedance and voltage level
   3.3 Choice of voltage level for transmission in single circuit , double and multiple circuit.
   3.4 Compensation techniques (series and shunt)

4. **Conductor size and tower Design** **[10hrs]**
   4.1 Conductor material and preliminary size selection, computation of ampacity of cables
   4.2 Electrical requirements, voltage regulation, efficiency, corona etc
   4.3 Conductor choice and types, vibration of conductor and conductor volume requirement for three phase three wire and three phase four wire
   4.4 Cost analysis and economic size determination, selection of earth wire
   4.5 Line supports type (Tower and poles), and selection of tower structure , span and ground clearance , tower height calculation , bending moment acting on tower , tower grounding and methods , tower weight computation and cost analysis of tower

4.5 Calculation of Sag and Tension considering all possible conditions

5. **Overhead line insulator design** **[4hrs]**
   - 5.1 Factors affecting insulator design
   - 5.2Air clearance computation, shield wires, tower grounding
   - 5.3 Overhead line insulator materials, types
   - 5.4 Advantage of string insulator, string efficiency and its improvements methods, string insulator configuration
   - 5.5 Selection of overhead line insulators discs considering continuous operating voltage , switching transient and lighting surge overvoltage

6. **Extra High Voltage(EHV) Transmission line** **[8hrs]**
   - 6.1. Introduction to EHV Transmission , configuration , necessity , advantages and disadvantages
   - 6.2 Standard rated voltages for EHV-AC line, Design consideration of EHV lines
   - 6.3 Importance and use of bundle conductor, comparison between bundle and single conductor, effect on power losses
   - 6.4 Standard suspension , self –supporting and guyed-suspension towers for EHV

7. **Case study** **[5hrs]**
   - 7.1 Design and cost analysis of HV overhead transmission line
   - 7.2 Design and cost analysis of EHV overhead transmission line

Test Books

1. M.V. Deshpandey, "Electrical Power System design" Tata McGraw-Hill
2. U.A.Bakshi, M.V.Bakshi "Elements of Power System" Technical Publication Punne

References

1. U.S. Department Of Agriculture " Design Manual of High Voltage Transmission Lines"
2. Argonne "The Design , construction and operation of long –distance high voltage electricity transmission technologies", U.S department of energy laboratory
3. Ergon Energy , "Standards for sub-transmission line design "
4. S.Ray , " Electrical power system : concept , theories and practices" PHI publication

Project I (0 – 0 - 2) for Electrical and Electronics / Project II (0 – 0 - 2) for Electronics and Communication

Evaluation:

	Theory	Practical	Total
Sessional	-	20	20
Final	-	-	-
Total	-	20	20

Objectives:

1. To gain the practical knowledge of project undertaking by focusing on planning, requirements elicitation, design, development and implementation.
2. To gain the knowledge of circuitry, programming and designing tools.
3. To be able to solve problem in a team environment.
4. To gain the knowledge of project formulation, report writing and presentation.

Procedures:

The project course requires the development of electronics/electrical hardware circuits/ systems with necessary software to operate the system. Project groups consisting of 3-4 group members (the Project Team) jointly develop the project under the direct supervision of faculty member/s of the corresponding department. The project may be selected in consultation with the industries.

Project Work Phases:

The entire project work shall be divided in to three phases to be completed in two consecutive semesters; in which first phase of the project will be carried out in seventh semester under the course Project I for Electrical & Electronics (Project II for Electronics & Communication) and rest of the phases will be completed in eighth semester. The project evaluation shall be done accordingly.

First Phase (Proposal Submission):

The project team shall be formed by the students themselves or by the college/department. The project team come up with a conceptual framework for their project work which must be documented in the form of a proposal and presented to the college/department evaluation committee as a formal presentation lasting for about 10 minutes, on the date prescribed by the college or concerned department. This phase holds 20% of the total project marks allocated, shall be based on the following criteria:

- Project proposal (project title, objectives, background/feasibility study, requirements analysis and specification, literature review, methodology, time plan, cost estimation if any) (10%)
- Creativity, Innovativeness and Usefulness of the idea (10%)

Engineering Economics (3-2-0)

Evaluation:

	Theory	Practical	Total
Sessional	50	-	50
Final	50	-	50
Total	100	-	100

Course Objective:

After completing this course, students will be able to

- understand and describe the basic concept of economics, engineering economics, cost accounting and time value of money,
- assist in the valuation of engineering projects in the public and private sector to take investment decisions,
- analyze the project risk and understand the concept of ecological limit and economic development,
- calculate depreciation, taxation and its application in analysis and
- identify different financing options and general accounting procedures.

Course Contents:

1. **Basics of Engineering Economics** **(3 hrs)**
   - 1.1. Definition of Economics, Demand, the Law of Demand, Law of Diminishing Utility, Marginal Utility, Supply, Law of Supply, Law of Supply and Demand
   - 1.2. Engineering Economics, Principles of Engineering Economy and its application

2. **Cost Concept and Fundamentals of Cost Accounting** **(3 hrs)**
   - 2.1. Cost Terminology: Manufacturing Cost and Non-Manufacturing Cost
   - 2.2. Cost for Business Decision: Differential Cost and Revenue; Opportunity Cost,Sunk Cost and Marginal Cost

3. **Time Value of Money** **(4 hrs)**
   - 3.1. Interest, Simple Interest, Compound Interest, Nominal Rate of Interest, Effective Rate of Interest
   - 3.2. Economic Equivalence: Present Worth, Future Worth and Annual Worth
   - 3.3. Development of Formulas for Equivalence Calculation

4. **Basic Methods of Engineering Economic Studies** **(7 hrs)**
   - 4.1. Minimum Attractive Rate of Return - MARR
   - 4.2. Payback Period Method – Simple and Discounted
   - 4.3. Equivalent Worth Methods; Present Worth Method, Future Worth Method and Annual Worth Method
   - 4.4. Rate of Return Methods: Internal Rate of Return (IRR) MethodandExternal/Modified Rate of Return(ERR/MIRR) Method
   - 4.5. Benefit Cost Ratio Method

5. **Comparative Analysis of Alternatives** **(6 hrs)**
   - 5.1. Comparing Mutually Exclusive Alternatives having Same useful life by Payback Period Method, Equivalent Worth Method; Rate of Return Methods and Benefit Cost Ratio Method
   - 5.2. Comparing Mutually Exclusive Alternatives having different useful lives byRepeatability Assumption, Co-terminated Assumption, Capitalized Worth Method
   - 5.3. Comparing Mutually Exclusive, Contingent and Independent Projects in Combination.

6. **Risk Analysis** **(4 hrs)**
   - 6.1. Origin/Sources of Project Risks.
   - 6.2. Methods of Describing Project Risks; Sensitivity Analysis, Breakeven Analysis, Scenario Analysis

7. **Ecological Limits and Economic Development** **(3 hrs)**
   - 7.1. Economic Theory and Ecological Limit,
   - 7.2. Concept of sustainable development,
   - 7.3. Ecological Footprint and
   - 7.4. Overcoming Ecological Limits

8. **Depreciation and Corporate Income Taxes** **(5 hrs)**
   - 8.1. Depreciation and its causes, Asset Depreciation and Accounting Depreciation
   - 8.2. Basic Methods of Depreciation; Straight line method, Declining Balance Method, Sinking Fund Method, Sum of the Year Digit Method, Unit of Production Method, Modified Accelerated Cost Recovery System (MACRS)
   - 8.3. Introduction to Corporate Income Tax. Taxation Law, Depreciation Rates Personal Tax, Corporate Tax, VAT
   - 8.4. After Tax Cash flow Estimate, General Procedure for Making After Tax Economic Analysis

9. **Enterprise Financing and Capital Investment** **(4 hrs)**
   - 9.1. Method of Financing: Equity Financing, Debt Financing and Capital Structure
   - 9.2. Cost of Capital: Cost of Equity, Cost of Debt and calculating cost of capital
   - 9.3. Project Funding Mechanism: Government budget, Public Private Partnership and Private Investment
   - 9.4. FIRR, EIRR and Return on Equity

10. **Basic Accounting Procedure** **(6 hrs)**
   - 10.1. Accounting Terminologies; Asset and liabilities: Fundamental equation of accounting
   - 10.2. Financial statements: The Balance Sheet, Income Statement and Cashflow Statements
   - 10.3. Using Ratios to make Decisions: Debt Ratio, Current Ratio, Quick Ratio – Acid Test Ratio, Inventory Turnover Ratio, Total Asset Turnover, Profit Margin on Sales, Return on Total Assets, Price Earnings Ratio and Book Value per Share

Tutorials:

Two assignments and 1 case study.

Text Book:

1. Chan S. Park. *Contemporary Engineering Economics.* PHI Learning Private Limited.

References:

1. E. Paul De Garmo, William G. Sullivan and James A. Bontadelli. *Engineering Economy.* MC Milan Publishing Company.
2. James L. Riggs, David D.Bedworth and Sabah U. Randhawa.*Engineering Economics.* Tata MCGraw Hill Education Private Limited.
3. N.N. Borish and S. Kaplan.*Economic Analysis for Engineering and Managerial Decision Making.* MC Gran Hill Publishing Company.
4. Adhikari, D.*Principle's of Engineering Economic Analysis.* Nepal: Global Publication.
5. SenGupta, Ramprasad.*Ecological Limits and Economic Development.* Oxford University Press.