PURBANCHAL UNIVERSITY
Biratangar, Nepal
Syllabus of **B.E. Electrical** (2072)

PROBABILITY AND STATISTICS

Year	**Third**	Teaching Schedule (Hours/week)	Lecture (Theory)	Practical	Tutorial
Semester	**Fifth**	Credit Hour	**3**	**-**	**-**
Course Code	BFG3O3SH	Lecture Hour	**3**	**-**	**1**

Examination System	Final		Internal Assessment		Total Marks	Remarks
	Theory	Practical	Theory	Practical		
Full Marks	**80**	**-**	**20**	**-**	**100**	
Pass Marks	**32**	**-**	**8**	**-**	**40**	
Duration	**3 Hours**	**-**	**3 Hours**	**-**	**-**	

Course Objective:
To provide the students with practical knowledge of the principles and concept of probability and statistics and their application in engineering field.

1. **Descriptive statistics and Basic probability** **(6 hours)**
   1.1 Introduction to statistics and its importance in engineering
   1.2 Describing data with graphs (bar, pie, line diagram, box plot)
   1.3 Describing data with numerical measure (Measuring center, measuring variability)
   1.4 Basic probability, additive Law, Multiplicative law, Bayes' theorem.
2. **Discrete Probability Distributions** **(6 hours)**
   2.1 Discrete random variable
   2.2 Binomial Probability distribution
   2.3 Negative Binomial distribution
   2.4 Poison distribution
   2.5 Hyper geometric distribution
3. **Continuous Probability Distributions** **(6 hours)**
   3.1 Continuous random variable and probability densities
   3.2 Normal distribution
   3.3 Gama distribution
   3.4 Chi square distribution

4. **Sampling Distribution** **(5 hours)**
    4.1 Population and sample
    4.2 Central limit theorem
    4.3 Sampling distribution of sample mean
    4.4 Sampling distribution of sampling proportion
5. **Inference Concerning Mean** **(6 hours)**
    5.1 Point estimation and interval estimation
    5.2 Test of Hypothesis
    5.3 Hypothesis test concerning one mean
    5.4 Hypothesis test concerning two mean
    5.5 One way ANOVA
6. **Inference concerning Proportion** **(6 hours)**
    6.1 Estimation of Proportions
    6.2 Hypothesis concerning one proportion
    6.3 Hypothesis concerning two proportions
    6.4 Chi square test of Independence
7. **Correlation and Regression** **(6 hours)**
    7.1 Correlation
    7.2 Least square method
    7.3 An analysis of variance of Linear Regression model
    7.4 Inference concerning least square method
    7.5 Multiple correlation and regression
8. **Application of computer on statistical data computing** **(4 hours)**
    8.1 Application of computer in computing statistical problem. eq scientific calculator, EXCEL, SPSS, Mat lab etc.

References:

1. Richard A. Johnson, "Probability and Statistics for Engineers", Miller and Freund's publication.
2. Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", Brooks/Cole publishing Company, Monterey, California.
3. Richard I. Levin, David S Rubin, "Statistics For Management", Prentice Hall publication.
4. Mendenhall Beaver Beaver, "Introduction Probability and statistics", Thomson Brooks/Cole.

Evaluation scheme

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

SYNCHRONOUS AND SPECIAL MACHINES

Year	**Third**	Teaching Schedule (Hours/week)	Lecture (Theory)	Practical	Tutorial
Semester	**Fifth**	Credit Hour	**2**	**-**	**-**
Course Code	BEG323EL	Lecture Hour	**2**	**3/2**	**1**

Examination System	Final		Internal Assessment		Total Marks	Remarks
	Theory	Practical	Theory	Practical		
Full Marks	**40**	**-**	**10**	**25**	**75**	
Pass Marks	**16**	**-**	**4**	**10**	**30**	
Duration	**1.5 Hours**	**-**	**1.5 Hours**	**-**	**-**	

Course Objectives:
To impart knowledge on constructional details, operating principle and performance of 3-phase Synchronous Machines and Fractional Kilowatt Motors.

1. Three Phase Synchronous Generator **(10 hours)**

1.1 Constructional Details, Armature Windings, Types of Rotor, Exciter
1.2 Working Principle, Rotating Magnetic Field
1.3 EMF equation, distribution factor, pitch factor
1.4 Armature Reaction and its effects
1.5 Alternator with load and its phasor diagram
1.6 Voltage Regulations
1.7 Parallel Operation and Synchronization
1.8 Operation on infinite bus

2. Three Phase Synchronous Motor **(7 hours)**

2.1 Principle of operation
2.2 Starting methods
2.3 No load and Load operation, Phasor Diagram
2.4 Effect of Excitation and power factor control, V and Inverted V Curves
2.5 Hunting
2.6 Power angle Characteristics of Cylindrical Rotor Machine
2.7 Two reaction Model of Salient pole machine
2.8 Power Angle Characteristics of Salient Pole Machine

3. **Fractional Kilowatt Motors** **(13 hours)**
   3.1 Single phase Induction Motors: Construction and Characteristics
   3.2 Double Field Revolving Theory
   3.3 Split phase Induction Motor
      3.3.1 Capacitor start motor
      3.3.2 Capacitors start and run motor
      3.3.3 Shaded pole motor
      3.3.4 Reluctance start motor
   3.4 Single phase Synchronous Motor
      3.4.1 Reluctance motor
      3.4.2 Hysteresis motor
   3.5 Universal motors
   3.6 Special Purpose Machines: Stepper motor, Schrage motor and Servo motor

References:

1. I.J. Nagrath&D.P.Kothari,” Electrical Machines”, Tata McGraw Hill
2. S. K. Bhattacharya, “Electrical Machines”, Tata McGraw Hill
3. Husain Ashfaq ,” Electrical Machines”, DhanpatRai& Sons
4. A.E. Fitzgerald, C.KingsleyJr and Stephen D. Umans,”Electric Machinery”, Tata McGraw Hill
5. P. S. Bhimbra, “Electrical Machines”’ Khanna Publishers
6. Irving L.Kosow, “Electric Machine and Tranformers”, Prentice Hall of India.
7. M.G. Say, “The Performance and Design of AC machines”, Pit man& Sons.
8. Bhag S. Guru and Huseyin R. Hizirogulu, “Electric Machinery and Transformers” Oxford University Press.

Practical:

1. To study No-load characteristics of a 3-phase synchronous generator
2. To study load characteristics of synchronous generator with (a) resistive load (b) inductive load and (c) capacitive load
3. To study the effect of excitation on performance of a synchronous motor and to plot V- curve
4. To study the effect of a capacitor on the starting and running of a single-phaseinduction motor
5. To study the operating characteristics of universal motors

CONTROL SYSTEM ENGINEERING

Year	**Third**	Teaching Schedule (Hours/week)	Lecture (Theory)	Practical	Tutorial
Semester	**Fifth**	Credit Hour	**3**	**-**	**-**
Course Code	BEG324EL	Lecture Hour	**3**	**3/2**	**1**

Examination System	Final		Internal Assessment		Total Marks	Remarks
	Theory	Practical	Theory	Practical		
Full Marks	**80**	**-**	**20**	**25**	**125**	
Pass Marks	**32**	**-**	**8**	**10**	**50**	
Duration	**3 Hours**	**-**	**3 Hours**	**-**	**-**	

Course Objectives:

To present the basic concepts on analysis and design of control system and to apply these concepts to typical physical processes.

1. **Control System Background** **(2 hours)**
   1.1 History of control system and its importance
   1.2 Control system: Characteristics and Basic features
   1.3 Types of control system and their comparison

2. **Component Modeling** **(6 hours)**
   2.1 Differential equation and transfer function notations
   2.2 Modeling of Mechanical Components: Mass, spring and damper
   2.3 Modeling of Electrical components: Inductance, Capacitance, Resistance, DC and AC motor, Transducers and operational amplifiers
   2.4 Electric circuit analogies (force-voltage analogy and force- current analogy)
   2.5 Linearized approximations of non-linear characteristics
3. **System Transfer Function and Responses** **(6 hours)**
   3.1 Combinations of components to physical systems
   3.2 Block diagram algebra and system reduction
   3.3 Signal flow graphs
   3.4 Time response analysis:
      3.4.1Types of test signals (Impulse, step, ramp, parabolic)
      3.4.2 Time response analysis of first order system
      3.4.3 Time response analysis of second order system
      3.4.4 Transient response characteristics

3.5 Effect of feedback on steady state gain, bandwidth, error magnitude and system dynamics

4. Stability **(4 hours)**

4.1Introduction of stability and causes of instability
4.2 Characteristic equation, root location and stability
4.3 Setting loop gain using Routh-Hurwitz criterion
4.4 R-H stability criterion
4.5 Relative stability from complex plane axis shifting

5. Root Locus Technique **(7 hours)**

5.1 Introduction of root locus
5.2 Relationship between root loci and time response of systems
5.3 Rules for manual calculation and construction of root locus
5.4 Analysis and design using root locus concept
5.5 Stability analysis using R-H criteria

6. **Frequency Response Techniques** **(6 hours)**

6.1 Frequency domain characterization of the system
6.2 Relationship between real and complex frequency response
6.3 Bode Plots: Magnitude and phase
6.4 Effects of gain and time constant on Bode diagram
6.5 Stability from Bode diagram (gain margin and phase margin)
6.6 Polar Plot and Nyquist Plot
6.7 Stability analysis from Polar and Nyquist plot

7. Performance Specifications and Compensation Design **(10 hours)**

7.1 Time domain specification
    7.1.1 Rise time, Peak time, Delay time, settling time and maximum overshoot
    7.1.2 Static error co-efficient
7.2 Frequency domain specification
    7.2.1 Gain margin and phase margin
7.3 Application of Root locus and frequency response on control system design
7.4 Lead, Lag cascade compensation design by Root locus method.
7.5 Lead, Lag cascade compensation design by Bode plot method.
7.6 PID controllers

8. State Space Analysis **(4 hours)**

8.1 Definition of state -space
8.2 State space representation of electrical and mechanical system
8.3 Conversion from state space to a transfer function.
8.4 Conversion from transfer functions to state space.
8.5 State-transition matrix.

Practical:

1. To study open loop and closed mode for d.c motor and familiarization with different components in D.C motor control module.
2. To determine gain and transfer function of different control system components.

3. To study effects of feedback on gain and time constant for closed loop speed control system and position control system.
4. To determine frequency response of first order and second order system and to get transfer function.
5. Simulation of closed loop speed control system and position control system and verification

References:

1. Ogata, K., “Modern Control Engineering”, Prentice Hall.
2. Gopal. M., “Control Systems: Principles and Design”, Tata McGraw-Hill.
3. Kuo, B.C., “Automatic Control System”, Prentice Hall, sixth edition.
4. Nagrath&Gopal, “Modern Control Engineering”, New Ages International

ELECTRIC MACHINE DESIGN

Year	**Third**	Teaching Schedule (Hours/week)	Lecture (Theory)	Practical	Tutorial
Semester	**Fifth**	Credit Hour	**3**	**-**	**-**
Course Code	BEG325EL	Lecture Hour	**3**	**3**	**0**

Examination System	Final		Internal Assessment		Total Marks	Remarks
	Theory	Practical	Theory	Practical		
Full Marks	**80**	**-**	**20**	**50**	**150**	
Pass Marks	**32**	**-**	**8**	**20**	**60**	
Duration	**3 Hours**	**-**	**3 Hours**	**-**	**-**	

Course Objective:
To impart knowledge on the principle of design of electrical machines like transformers, induction machines and DC machine

1. Materials used in electrical equipment **(5 hours)**

- 1.1 Review of electrical conducting materials
  - 1.1.1 Various characteristics and comparison between conducting materials
  - 1.1.2 Materials of high conductivity and high resistivity
- 1.2 Magnetic materials
  - 1.2.1 Classification, characteristics and application of magnetic materials
  - 1.2.2 Materials for steady flux (solid core materials), materials for pulsating fluxes (laminated core materials sheet)
  - 1.2.3 Special purpose alloys, hot rolled and cold rolled steel sheets, sintered power core
  - 1.2.4 Magnetic materials used in transformers, dc machines and ac machines
- 1.3 Insulating materials
  - 1.3.1 Classification, characteristics, application
  - 1.3.2 Insulating materials for transformers, dc machines and ac machines, ceramics

2. Heating and cooling of electric machine **(7 hours)**

- 2.1 Review of heat transfer: Conduction, convection and radiation
- 2.2 Internal temperature (hot spots and their calculations)
- 2.3 Temperature gradients in iron core
- 2.4 Temperature gradients in conductors placed in slots
- 2.5 Ventilation of electrical machine

2.5.1 Types of enclosure, methods of cooling, schemes of ventilation
2.5.2 Cooling of totally enclosed machines, cooling circuits, cooling systems

2.6 Temperature rise, heating time constant, final steady temperature rise, cooling time constant

2.7 Rating of electric machine based on temperature rise

2.8 Calculation of temperature rise in armature, field coils and commutators

3. Transformer Design **(14 hours)**

3.1 Review of transformer theory

3.2 Types of transformer: Power transformer, distribution transformer, core type and shell type

3.3 Design approach
3.3.1 Output equations (single and three phase), Volt per turn
3.3.2 Design of core (square core, stepped and cruciform core)
3.3.3 Choice of flux density
3.3.4 Design of winding and choice of current density
3.3.5 Design of insulation
3.3.6 Design of window and window space factor
3.3.7 Design of yoke

3.4 Calculation of operating characteristics from design data
3.4.1 Resistance of winding, leakage reactance of winding in core type transformer, iron loss, copper loss, efficiency, regulation.

3.5 Design of cooling system
3.5.1 Temperature rise in plain walled tank, design of tank and tubes

4. **Three phase induction motor design** **(10 hours)**

4.1 Review of three phase induction motor theory
4.1.1 Construction and principle of three phase induction motor
4.1.2 Various types of three phase stator winding

4.2 Design approach:
4.2.1 Output equation, choice of magnetic and electric loading
4.2.2 Choice of stator winding.stator slots and insulation, stator teeth, stator teeth, stator core and stator stamping dimension
4.2.3 Air gap length, rotor design (squirrel cage and slip ring type)
4.2.4 Leakage inductance, evaluation of equivalent circuit parameters and operating characteristics from design data.

5. DC Machine Design **(9 hours)**

5.1 Armature Winding
5.1.1 Lap and wave winding

5.2 Design Approach:
5.2.1 Output equation, choice of average gap density, choice of ampere conductors per meter
5.2.2 Choice of no of poles in DC machine, pole proportions
5.2.3 Selection of length of air gap
5.2.4 Choice of armature windings, no of armature conductors, no of coils, no of armature slots, armature conductor selection
5.2.5 Design of commutator, design of brushes, and design of compensating winding

5.2.6 Evaluation of operating characteristics from design data

Practical: Design practice

1. A detail design of core type power and distribution transformer orthographic drawing of transformer including winding, tank and tubes
2. A detail design of three phase induction motor Drawing of three phase stator winding (Mush winding, Lap winding and Wave winding)
3. A detail design of DC armature winding Drawing of Lap and wave winding used in DC machine armature

References

1. A.K. Sawhney " A course in Electrical Machine Design"
2. M.G. Say " Performance and design of AC Machines"
3. M.G. Say "Performance and design of DC Machines"

POWER SYSTEM ANALYSIS

Year	**Third**	Teaching Schedule (Hours/week)	Lecture (Theory)	Practical	Tutorial
Semester	**Fifth**	Credit Hour	**3**	**-**	**-**
Course Code	BEG326EL	Lecture Hour	**3**	**-**	**1**

Examination System	Final		Internal Assessment		Total Marks	Remarks
	Theory	Practical	Theory	Practical		
Full Marks	**80**	**-**	**20**	**-**	**100**	
Pass Marks	**32**	**-**	**8**	**-**	**40**	
Duration	**3 Hours**	**-**	**3 Hours**	**-**	**-**	

Course Objective:

The course aim to deliver the advance analysis of the interconnected power system including load flow, short circuit studies and stability analysis.

1. **Interconnected Power System** **(6 hours)**
   1.1 Introduction
   1.2 Real power/ frequency balance
   1.3 Reactive power/ voltage balance
   1.4 Node equations
   1.5 Bus admittance matrixes
   1.6 Applications of Bus admittance matrixes in Network analysis
   1.7 Basic concept of Bus impedance Matrixes

2. **Load Flow Analysis** **(9 hours)**
   2.1 Basic complex power flow equations for a power system networks
   2.2 Data for Load flow studies
   2.3 Iterative approaches for solving power flow equations
      2.3.1 Gauss-Seidal method
      2.3.2 Newton- Rapshon methods
   2.4 Introduction to advance techniques e.g. decoupled load flow
   2.5 Voltage profile and var compensation

3. **Power system fault calculation** **(4 hours)**
   3.1 Definition and purpose of fault calculation
   3.2 Types of faults in power system
   3.3 Symmetrical fault calculations

3.4 Calculation of short circuit MVA

4. Unbalance System Analysis **(6 hours)**

4.1 Symmetrical components
4.2 Sequence impedances
4.3 Sequence components of the voltages and currents
4.4 Expression for power in terms of symmetrical components
4.5 Transformer voltages and currents

5. Unsymmetrical faults on Power Systems **(10 hours)**

5.1 Sequence networks of synchronous generators
5.2 Fault calculations of a single synchronous generator
 5.2.1 Line to ground faults
 5.2.2 Line to line faults
 5.2.3 Double line to ground faults
5.3 Path for zero sequence currents in Transformers
5.4 Fault calculations on a power system networks
 5.4.1 Line to ground faults
 5.4.2 Line to line faults
 5.4.3 Double line to ground faults

6. Power System Stability **(10 hours)**

6.1Operational power balance in a synchronous generator
6.2 Classification of power system stability
6.3 Swing equation & swing curve for a single machine infinite bus system
6.4 Rotor angle stability; steady state, dynamic & transient stability
6.5 Equal area criterion
6.6 Stability enhancement techniques
6.7 Step by step method for solving swing equations by computer methods
6.8 Basic concept of voltage stability

References:

1. Power System Analysis by W.D. Stevenson, Tata McGraw Hill Publications
2. Power System Stability and Control by P. Kundur
3. Modern Power System Analysis by I.J Nagrath and D.P Kothari, Tata McGraw Hill Publications

ADVANCED INSTRUMENTATION

Year	**Third**	Teaching Schedule (Hours/week)	Lecture (Theory)	Practical	Tutorial
Semester	**Fifth**	Credit Hour	**3**	**-**	**-**
Course Code	BEG331EC	Lecture Hour	**3**	**3/2**	**1**

Examination System	Final		Internal Assessment		Total Marks	Remarks
	Theory	Practical	Theory	Practical		
Full Marks	**80**	**-**	**20**	**25**	**125**	
Pass Marks	**32**	**-**	**8**	**10**	**50**	
Duration	**3 Hours**	**-**	**3 Hours**	**-**	**-**	

Course Objective:

To introduce and apply the knowledge of microprocessor, A/D, D/A converter to design Instrumentation system and to provide the concept of interfacing with microprocessor based system and circuit design techniques

1. **Microprocessor Based Instrumentation System** **(4 hours)**
   1.1Basic Features of Microprocessor Based System
   1.2 Open Loop and Closed Loop Microprocessor Based System
   1.3 Benefits of Microprocessor Based System
   1.4 Microcomputer on Instrumentation Design
   1.5 Interfacing with Microprocessor
      1.5.1 PC Interfacing Techniques
      1.5.2 Review of Address Decoding
      1.5.3 Memory Interfacing
      1.5.4 Programmed I/O, Interrupt Driven I/O and Direct Memory Access (DMA)

2. **Parallel Interfacing with Microprocessor Based System** **(4 hours)**
   2.1Methods of Parallel Data Transfer: Simple Input and Output, Strobe I/O, Single Handshake I/O, & Double Handshake I/O
   2.2 8255 as General Purpose Programmable I/O Device and its interfacing examples
   2.3 Parallel Interfacing with ISA and PCI bus

3. **Serial Interfacing with Microprocessor Based System** **(6 hours)**
   3.1Advantages of Serial Data Transfer over Parallel
   3.2 Synchronous and Asynchronous Data Transfer

3.3 Errors in Serial Data Transfer
3.4 Simplex, Half Duplex and Full Duplex Data Communication
3.5 Parity and Baud Rates
3.6 Introduction Serial Standards RS232, RS423, RS422
3.7 Universal Serial Bus
    3.7.1 The Standards: - USB 1.1 and USB 2.0
    3.7.2 Signals, Throughput & Protocol
    3.7.3 Devices, Hosts and On-The-Go
    3.7.4 Interface Chips: - USB Device and USB Host

4. Interfacing A/D and D/A Converters (4 hours)
4.1 Introduction
4.2 General Terms Involved in A/D and D/A Converters
4.3 Examples of A/D and D/A Interfacing
4.4 Selection of A/D and D/A Converters Based on Design Requirements

5. Data Acquisition and Transmission (5 hours)
5.1Analog and Digital Transmission
5.2 Transmission Schemes
5.2.1 Fiber Optics
5.2.2 Satellite
5.2.3 Bluetooth Devices
5.3 Data Acquisition System
5.3.1 Data Loggers
5.3.2 Data Archiving and Storage

6. Grounding and Shielding (3 hours)
6.1 Outline for Grounding and Shielding
6.2 Noise, Noise Coupling Mechanism and Prevention
6.3 Single Point Grounding and Ground Loop
6.4 Filtering and Smoothing
6.5 Decoupling Capacitors and Ferrite Beads
6.6 Line Filters, Isolators and Transient Suppressors
6.7 Different Kinds of Shielding Mechanism
6.8 Protecting Against Electrostatic Discharge
6.9 General Rules for Design

7. Circuit Design (3 hours)
7.1 Converting Requirements into Design
7.2 Reliability and Fault Tolerance
7.3 High Speed Design
7.4 Bandwidth, Decoupling, Ground Bounce, Crosstalk, Impedance Matching, and Timing
7.5 Low Power Design
7.6 Reset and Power Failure Detection and interface Unit

8. Circuit Layout (3 hours)
8.1 Circuits Boards and PCBs
8.2 Component Placement

8.3 Routing Signal Tracks, Trace Density, Common Impedance, Distribution of Signals and Return, Transmission Line Concerns, Trace Impedance and Matching, and Avoiding Crosstalk.
8.4 Ground, Returns and Shields
8.5 Cables and Connectors
8.6 Testing and Maintenance

9. **Software for Instrumentation And Control Applications** **(4 hours)**
9.1 Types of Software, Selection and Purchase
9.2 Software Models and Their Limitations
9.3 Software Reliability
9.4 Fault Tolerance
9.5 Software Bugs and Testing
9.6 Good Programming Practice
9.7 User Interface
9.8 Embedded and Real Time Software

10. **Case Study** **(9 hours)**
Examples chosen from local industrial situations with particular attention paid to the basic measurement requirements, accuracy, and specific hardware employed environmental conditions under which the instruments must operate, signal processing and transmission, output devices:
- Instrumentation for a power station including all electrical and non-electrical parameters.
- Instrumentation for a wire and cable manufacturing and bottling plant.
- Instrumentation for a beverage manufacturing and bottling plant.
- Instrumentation for a complete textile plant; for example, a cotton mill from raw cotton through to finished dyed fabric.
- Instrumentation for a process; for example, an oil seed processing plant from raw seeds through to packaged edible oil product.
- Instruments required for a biomedical application such as a medical clinic or hospital.
- Other industries can be selected with the consent of the Subject teacher.

Practical:

The laboratory exercises deal interfacing techniques using microprocessor or microcontrollers. There will be about six lab sessions which should cover at least following:
1. Simple and Handshake data transfer using PPI.
2. Basic I/O device interfacing like keyboard, seven segments, motors etc
3. Analog to Digital interfacing
4. Digital to Analog interfacing
5. Design exercise (small group project)

Study in detail the instrumentation requirements of a particular proposed or existing industrial plant and design an instrumentation and data collection system for that particular industrial plant. The final report should present the instrumentation requirements in terms of engineering specifications, the hardware solution suggested, a listing of the particular devices chosen to satisfy the requirements, appropriate system flow diagrams, wiring diagrams, etc. to show how the system would be connected and operated.

References:

1. D. V. Hall, “Microprocessor and Interfacing, Programming and Hardware” Tata McGraw Hill
2. K.R. Fowler, “Electronic Instrument Design: Architecting for the Life Cycle”, Oxford University Press
3. Ramesh S. Gaonkar, “Microprocessor Architecture, Programming and Application with 8085”, Prentice Hall
4. A.K. Ray & K.M. Bhurchandi, “Advanced Microprocessors And Peripherals”, Tata McGraw Hill
5. E.O. Duebelin, “Measurement System Application And Design”, Tata McGraw Hills
6. John Hyde, "USB Design By Example", Intel Press
7. PCI bus, USB, 8255,Bluetooth datasheets
8. D. M. Consodine, "Process Instruments and Controls Handbook", McGraw-Hill, New York.
9. S. Wolf and R. F. Smith, "Student Reference Manual for Electronic Instrumentation Laboratories", Prentice Hall, Englewood Cliffs, New Jersey.
10. S. E. Derenzo, "Interfacing: A Laboratory Approach Using the Microcomputer for Instrumentation, Data Analysis, and Control", Prentice Hall, Englewood Cliffs, New Jersey.

RESEARCH METHODOLOGY

Year	**Third**	Teaching Schedule (Hours/week)	Lecture (Theory)	Practical	Tutorial
Semester	**Fifth**	Credit Hour	**2**	**-**	**-**
Course Code	**BEG 396 MS**	Lecture Hour	**2**	**-**	**1**

Examination System	Final		Internal Assessment		Total Marks	Remarks
	Theory	Practical	Theory	Practical		
Full Marks	**40**	**-**	**10**	**-**	**50**	
Pass Marks	**16**	**-**	**4**	**-**	**20**	
Duration	**1.5 Hours**	**-**	**1.5 Hours**	**-**	**-**	

Objectives:
To explain the concept of research methods and their applications which can be applied to any research studies.

Course Contents:

1. **Social Research** **(3 hrs)**
   - 1.1. Definition
   - 1.2. Objectives
   - 1.3. Types of Social Research
     - 1.3.1. Basic Research
     - 1.3.2. Applied Research
   - 1.4. Phases on Social Research
2. **Fundamental Concept on Research** **(4 hrs)**
   - 2.1. Formulation of Research Question & Hypothesis
   - 2.2. Formulation of Research Objectives
   - 2.3. Sampling, its characteristics, types, benefits and problems
3. **Research Design** **(5 hrs)**
   - 3.1. Definition of Research Design
   - 3.2. Types of Research Design (Qualitative vs. quantitative, Exploratory, Descriptive, Survey, Confirmatory, Experimental)
   - 3.3. Research proposal
   - 3.4. Basic guideline for writing a Research Proposal
   - 3.5. Selection of Topics of Research
   - 3.6. Purpose and Importance of Research Design
4. **Data Types & Data Collection Techniques** **(9 hrs)**
   - 4.1. Introduction to Data Collection
   - 4.2. Importance of Data Collection

4.3. Types of Data (Subjective vs. Objective data source, Qualitative vs. Quantitative, Secondary vs. Primary Data Source)
4.4. Source of Data Collection (primary vs. secondary)
4.5. Primary Sources of Data Collection Techniques (Survey, Interview, Questionnaire, Case Study, Observation)
4.6. Validity & Reliability of a Research Instrument
4.7. Introduction to Analysis and Presentation of Data

5. Mean, Medium and Standard Deviation **(5 hrs)**

5.1. Definition
5.2. Different methods of calculation of Mean, Medium and Standard Deviation

6. Report Writing **(4 hrs)**

6.1. Purpose and importance of research report
6.2. Organization of research report
6.3. Presentation of Tables & Diagram
6.4. Guidelines to Common Referencing Style
6.5. Common Styles of Literature Citation Guidelines
6.6. General guidelines for writing a standard research report

References Books:

1. Prem R. Panta, "Social Science Research & Thesis Writing" Budha Publisher.
2. John W. Best, "Research in Education", Prentic Hall of India, New Delhi
3. Goode William J. & Paul K.Hatt "Methods in Social Research" McGraw Hill, Kogakusha Ltd.
4. Tika Bhattarai, "Research Methodology"