PURBANCHAL UNIVERSITY

Biratangar, Nepal

B.E. (Electrical)
Syllabus (2070)

Year: II **Semester: III**

S. No.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1.	BEG201SH	Engineering Mathematics III	3	3	2	-	5
2.	BEG249ME	Fundamentals of Thermodynamics and Heat	2	2	1	2/2	4
3.	BEG223EL	Electric Circuit Theory	3	3	2	2/2	6
4.	BEG231EC	Electronic Devices and circuits	3	3	2	2/2	6
5.	BEG224EL	Electrical Engineering Material	3	3	1	-	4
6.	BEG233EC	Microprocessor	4	3	1	3	7
		Total	18	17	9	6	32

MATHEMATICS-III
BEG2O1SH

Year: II **Semester: III**

Teaching Schedule Hours/week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	T	P	Duration	Marks	Duration	Marks				
3	2	-	3	80	-	-	20	-	100	

Objectives: The purpose of this course is to round out the student's preparation more sophisticated applications with an introduction of linear algebra, a continuous of the study of ordinary differential equations and an introduction to vector algebra and Fourier series.

1.0 Matrices and Determinant 14 Hrs

1.1 Matrix and Determinant
1.2 Vector Space (Introduction), Dependent and Independent vectors
1.3 Linear Transformation
1.4 System of Linear Equations, Gauss elimination method only
1.5 Inverse of Matrix (Gauss Jordan Method)
1.6 Rank of the Matrix
1.7 Eigen Values of Matrix, Eigen Vectors and its applications

2.0 Laplace Transformation 10 Hrs

2.1 Introduction
2.2 Laplace Transform of some Elementary Functions
2.3 Properties of Laplace Transform
2.4 Inverse Laplace Transforms

3.0 Line, Surface and Volume Integrals 9 Hrs

3.1 Definition of Line Integral
3.2 Evaluation of line Integral
3.3 Evaluation of Surface and Volume Integrals
3 .4 Diritchlet Integrals

4.0 Integral Theorems 6 Hrs

4.1 Greens Theorem in the p1ane
4.2 Stoke's Theorem (without proof)
4.3 Gauss Divergence Theorem (without proof)
4.4 Consequences and Applications of Integral Theorems

5.0 Fourier Series 6 Hrs

5.1 Periodic Function
5.2 Trigonometric Series

5.3 Fourier Series
5.4 Determination of Fourier Coefficients: Euler Formulae ($-\pi, \pi$)
5.5 Fourier Series in the Intervals ($0, 2\pi$) and ($-l, l$)
5.6 Even and Odd Functions and their Fourier Series: Fourier Cosine & Sine Series
5.7 Half Range Function
5.8 Parsevals Formula
5.9 Fourier Series in Complex Form (Introduction)

Reference Books:

1. E. Kreyszig, Advanced Engineering Mathematics – 5th Edition, Wiley, New York.
2. A Text Book of Engineering Mathematics Vol. II – P. R. Pokharel.
3. A Text Book of Engineering Mathematics Vol. III – N. B. Khatakho & S. P. Pradhanang.

FUNDAMENTALS OF THERMODYNAMICS AND HEAT

BEG 249 ME

Year: II **Semester: III**

Teaching Schedule Hours/ Week			Examination Scheme						Total Marks	Remarks
			Final				Internal Assessments			
			Theory		Practical		Theory Marks	Practical Marks		
L	P	T	Duration Hours	Marks	Duration	Marks				
2	2/2	1	1.5	40			10	25	75	

Course Objective: To provide the students with a basic understanding and norms of Thermodynamics and Heat Transfer.

1.0 Basic Concepts **2 Hours**

1.0 The nature of Thermodynamics
1.1 Social value of energy
1.2 Application of energy balance approach in engineering
1.3 Work and heat transfer

2.0 Energy and Energy Transfer **4 Hours**

1.4 The meaning of energy and energy transfer,
Thermodynamic systems: boundary of closed, heterogeneous, homogeneous, isolated
1.5 Thermodynamic equilibrium and quasi – static process
1.6 Thermodynamic properties, state and process
1.7 Energy transfer as heat and work

3.0 Properties of Pure Substances (Steam): **3 Hours**

3.1 Pure substances, phase and wet steam (Two phase mixture)
3.2 Themodynamic properties: Specific Volume, internal energy, enthalpy entropy and specific heats
3.3 Common Process: Throttling, Isothermal and Isobaric
3.4 Common diagram for a pure substance: P - V, P - T, T - S, h - S or mollier
3.5 Steam Tables, Quality or Dryness fraction and measurement of steam quality

4.0 First Law of Thermodynamics and its applications: **8 Hours**

4.1 Definitions and law of conversation of energy
4.2 Application of the law to a closed system (Non - flow process)

4.3 Application of the first law of Thermodynamics to some common process:
Constant Volume, Adiabatic, Reversible, Polytropic, Constant Pressure, Constant Internal Energy
4.4 Steady flow process
4.5 Application of the first law to open system (General Energy Equation)
4.6 Energy of an isolated system
4.7 Perpetual Motion Machine of the first kind PMM 1

5.0 Second Law of Thermodynamics and Entropy: 4 Hours

5.1 Statements of second law: Clausius, Kelvin - Planck, Principle of degradation of energy, principles of increase of entropy.
5.2 The principles and properties of entropy.
5.3 Entropy and disorder, Absolute entropy and Entropy balance in open and closed system.
5.4 Reversible and Irreversible processes.
5.5 Consequences of the second law and Isentropic process.
5.6 Carnot cycle and its efficiency

6.0 Thermodynamic Power Cycles, Refrigeration and Air Conditioning 5 Hours

6.1 Heat engine cycles
6.2 External heat transfer cycles
6.3 Rankine cycles and Modified Rankine Cycle
6.4 Air standard cycles: Air standard ottocycle, Diesel cycle and dual cycle
6.5 Refrigeration, air-conditioning and heat pump cycles
6.6 Psychrometric chart and process

7.0 Introduction to Engineering Heat Transfer: 4 Hours

7.1 Basic concepts and modes of heat transfer
7.2 The common laws of heat transfer: Fourier's Law, Newton's Law and Stefan - Bortzman Law
7.3 Conduction: Critical insulation thickness of pipes, R values and electric analogies; Overall coefficient

Laboratories:

Six laboratory exercises will be performed in this course. These are:

(a) Pressure and Temperature measurement
(b) Experiment on compression and expansion of gases
(c) Heat conduction and convection
(d) Operation of refrigeration or heat pump
(e) Performance of small I.- C engine
(f) Experiment on Thermal radiation

Tutorials:

a) Three assignments in each before first and second assessments.
b) Quizzes before first and second assessments.

Recommended books/ References:

1. "Fundamentals of Engineering Thermodynamics", John R., Howell and Richard O. Bucckius, McGraw –Hill Publishers, 1987.
2. "Engineering Thermodynamics" Gupta C. P. and Prakash R., Nem - Chand and Broj; Roorkee 1991.
3. "Engineering Thermodynamics" Nag P. K., Tata Mc - Grawhill, New Delhi, second edition
4. "Engineering Heat Transfer", Gupta C. P. and Prakash R; Nemchand and Broj, Roorkee, 1994
5. "Heat Transfer", J. P. Holman, Mc Grawhill, 1981
6. "Heat Transfer - A Basic Approach" M. N. Ozicik Mc Grahill, 1985

ELECTRIC CIRCUIT THEORY
BEG223EL

Year: II **Semester: I**

Teaching Schedule Hours/Week			Examination Scheme				
Theory	Tutorial	Practical	Internal Assessment		Final		Total
3	2	2/2	Theory	Practical*	Theory**	Practical	125
			20	25	80	-	

Course Objectives:

To continue work in Basic Electrical Engineering including the use of the Laplace Transform to determine the time and frequency domain responses of electric circuits.

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To continue work in Basic Electrical Engineering including the use of the Laplace Transform to determine the time and frequency domain responses of electric circuits.

1. Introduction (8 hours)

1.1 Introduction: Continuous & Discrete, Fixed & Time varying, Linear and Step, Ramp, Impulse, Sinusoidal, Square, Saw tooth signals.
1.2 Nonlinear, Lumped and Distributed, Passive and Active networks and systems.
1.3 Independent & Dependent sources
1.4 Mesh and Nodal analysis with dependent and independent sources

2. Initial Conditions: (2 hours)

2.1 Characteristics of various network elements
2.2 Initial value of derivatives
2.3 Procedure for evaluating initial conditions
2.4 Initial condition in the case of R-L-C network

3. Transient analysis in RLC circuit by direct solution (6 hours)

3.1 Introduction
3.2 First order differential equation
3.3 Higher order homogeneous and non-homogeneous differential equations
3.4 Particular integral by method of undetermined coefficients
3.5 Response of R-L, R-C circuit with DC excitation
3.6 Response of series and parallel R-L-C circuit with DC excitation

4. Transient analysis in RLC circuit by Laplace Transform (12 hours)

4.1 Introduction
4.2 The Laplace Transformation
4.3 Important properties of Laplace transformation
4.4 Use of Partial Fraction expansion in analysis using Laplace Transformations
4.5 Heaviside's partial fraction expansion theorem
4.6 Response of R-L circuit with
    4.6.1 DC excitation
    4.6.2 Sinusoidal excitation
    4.6.3 Exponential excitation
4.7 Response of R-C circuit with
    4.7.1 DC excitation
    4.7.2 Sinusoidal excitation
    4.7.3 Exponential Excitation
4.8 Response of series R-L-C circuit with
    4.8.1 DC excitation
    4.8.2 Sinusoidal excitation
    4.8.3 Exponential excitation
4.9 Response of parallel R-L-C circuit with exponential excitation
4.10 Transfer functions Poles and Zeros of Networks

5. Frequency Response of Network (6 hours)

5.1 Introduction
5.2 Magnitude and phase response
5.3 Bode diagrams
5.4 Basic concept of filters, high pass, low pass, band pass and band stop filters

6. Fourier Series and transform (4 hours)

6.1 Basic concept of Fourier series and analysis
6.2 Evaluation of Fourier coefficients for periodic non-sinusoidal waveforms in electric networks
6.3 Introduction of Fourier transforms

7. Two-port Parameter of Networks (7 Hours)

7.1 Definition of two-port networks
7.2 Short circuit admittance parameters
7.3 Open circuits impedance parameters
7.4 Transmission Short circuit admittance parameters
7.5 Hybrid parameters
7.6 Relationship and transformations between sets of parameters
7.7 Application to filters
7.8 Applications to transmission lines
7.9 Interconnection of two-port network (Cascade, series, parallel)

Practicals:

1. Transient Response in first Order System passive circuits
    - measure step and impulse response of RL and RC circuit using oscilloscope
    - relate time response to analytical transfer functions calculations
2. Transient Response in Second Order System passive circuits

- measure step and impulse response of RLC series and parallel circuits using oscilloscope
- relate time response to transfer functions and pole-zero configuration

3. Frequency Response of first order passive circuits
   - measure amplitude and phase response and plot bode diagrams for RL, RC and RLC circuits
   - relate Bode diagrams to transfer functions and pole zero configuration circuit

5 Frequency Response of second order passive circuits
   - measure amplitude and phase response and plot bode diagrams for RL, RC and RLC circuits
   - relate Bode diagrams to transfer functions and pole zero configuration circuit

References:

1. M. E. Van Valkenburg, "Network Analysis", third edition Prentice Hall, 2010.
2. William H. Hyat. Jr. & Jack E. Kemmerly, "Engineering Circuits Analysis", Fourth edition, McGraw Hill International Editions, Electrical Engineering Series, 1987.
3. Michel D. Cilletti, "Introduction to Circuit Analysis and Design", Holt, Hot Rinehart and Winston International Edition, New York, 1988.
4. A. Chakrabarti, Circuit Theory, Dhanpat Rai &Co. (pvt) Ltd.
5. K.M. Soni, Circuits and Systems, Sixth Edition, Galgottia's College of Engineering and Technology, Greater Noida

ELECTRONIC DEVICES AND CIRCUITS
BEG231EC

Year: II Semester: I

Teaching Schedule Hours/Week			Examination Scheme				
Theory	Tutorial	Practical	Internal Assessment		Final		Total
3	2	2/2	Theory	Practical	Theory	Practical	125
			20	25	80	-	

1. **Semiconductor diode** [8 hrs]
   - 1.1 Review of p-n junction diode
   - 1.2 Analysis of diode circuits
   - 1.3 Applications of p-n junction diode
     - 1.3.1 Clipping and Clamping circuits
     - 1.3.2 Rectification(half wave , full wave and bridge rectifier)
   - 1.4 Types of diode (Schottky, varactor, tunnel, zener)
   - 1.5 Zener diode as a voltage regulator

2. **Bipolar Junction Transistor** [18hrs]
   - 2.1 Construction of a BJT
   - 2.2 Ebers-Molls Equation
   - 2.3 Basic Transistor Equation
   - 2.4 CB, CC, CE Configurations
   - 2.5 Load line analysis
   - 2.6 Transistor as an amplifier
   - 2.7 Types of biasing
   - 2.8 Biasing stabilization and thermal runaway
   - 2.9 Small signal analysis (h-parameter and r_e ‘ model)
   - 2.10 High Frequency t-model

3. **Applications of BJT** [11hrs]
   - 3.1 Power amplifiers (Class A, B, C, AB and efficiency calculation)
   - 3.2 BJT as a switch
   - 3.3 Cascaded amplifier (Single stage and multistage)
   - 3.4 Untuned amplifier
     - 3.4.1 Frequency and phase response of RC coupled amplifier
   - 3.5 Differential Amplifiers

4. **Field Effect Transistors** [8hrs]
   - 4.1 **Junction field effect transistor (JFET)**
     - 4.1.1 Construction and characteristics
     - 4.1.2 Biasing of JFET
     - 4.1.3 Small signal analysis of JFET
     - 4.1.4 UJT as an oscillator

4.2 **MOSFET**

4.2.1 Construction, characteristics and types

4.2.2 Biasing of MOSFET

4.2.3 NMOS (Depletion and enhancement type)

4.2.4 Introduction to CMOS

Laboratory (In Trainer kits, Multisim and P Spice):

1. Measurement of characteristics of diode, zener diode.
2. Rectifier circuits
3. Measurement of input and output characteristics of CE configurations
4. Single stage BJT amplifier
5. Measurement of input and output characteristics of JFET
6. Measurement of input and output characteristics of MOSFET

Reference books:

1. A.S. Sedra and K.C. Smith," *Microelectric Circuits*", 6th Edition, Oxford University Press
2. Theodorre S. Bogart, " *Electronic Devices and Circuits"*
3. Millman and Halkias, " *Electronic Devices and Circuits"*, McGraw Hill
4. Robert Boylestad," " *Electronic Devices and Circuits"*

References:

1. MN Horenstein,"Microelectronic Circuits and Devices", second edition, Prentice Hall

ELECTRICAL ENGINEERING MATERIALS

BEG224EL

Year: II **Semester: I**

Teaching Schedule Hours/Week			Examination Scheme				
Theory	Tutorial	Practical	Internal Assessment		Final		Total
3	1	-	Theory Marks	Practical Marks	Theory Marks **	Practical Marks	100
			20	-	80	-	

*** Continuous**
**** Duration:** 3 hours

Course Objectives:-The objectives of this course are to understand the properties of dielectric materials in static and alternating fields, to understand the properties of insulating and magnetic materials , to understand the optical properties and to understand the properties of conductors and semiconductor

1. Theory of Metal [10hrs]

1.1 Elementary Quantum Mechanical Ideas. De Broglie's Equations, Einstein's Equations, Heisenbergs Uncertainty Principles

1.2 Free Electron Theory, Energy well model of a metal

1.3 Bond theory of solids, electron effective mass, energy bands, density of states

1.4 Collection of particles, Boltzmann Classified statistics, Fermi-Dirac Distribution functions.

1.5 Fermi Energy, metal oxide contact, the seeback effect and thermocouple

1.6ThermonicEmission,Richardson-DushmanEquation,Field Assisted Emission, the schottky effect, work function.

2. Free Electron Theory of Conduction in Metals [4hrs]

2.1Thermal velocity of electrons

2.2 Electron mobility, conductivity, resistivity

2.3 Diffusion of Electron, Diffusion co-efficient, Einstein relationship between mobility and diffusion co-efficient.

3. Semi-conductor materials [12hrs]

3.1 Electron and holes conduction in semi-conductor , electrons and holes concentrations,

3.2 Intrinsic and Extrinsic semiconductor, compensation doping, Energy band diagrams for Uniformly doped and graded P and N type materials

3.3 Generation and recombination of electrons and holes, concept of lifetime

3.4 Diffusion and conduction equations , mobility and diffusion co-efficient, steady state diffusion and continuity equations.

3.5 Ideal PN junctions : No bias , forward bias, reverse bias , PN junction band diagram, tunneling phenomena in PN junctions, metal and semiconductor contact.
3.6 Working of BJT based on energy diagram, field control devices.

4. Semiconductor device fabrication [5hrs]

4.1 Silicon purification process, Czoralsky method.
4.2 Expitaxial growth, photolithography
4.3 PN junction fabrication, NPN transistor fabrication.

5. Optical properties of material [7hrs]

5.1 Classification of optical process, optical co-efficient, complex refractive index, dielectric constants.
5.2 Optical materials : crystalline insulator and semi-conductors
5.3Intrabandobsorption :Intraband transition, transition rate for direct absorption, band edge absorption in direct and indirect gap semiconductor.
5.4 Opto electronic devices : Photodiodes, photoconductive devices, photo voltaic devices.

6.Magnetic material and superconductivity [3hrs]

6.1 Review of magnetic vector, permeabililty, susceptibility and field intensity
6.2 Magnetic material classification : Para magnetic, diamagnetic and ferromagnetic, antiferromagnetic
6.3 Superconductivity : Zero resistance and Meissener effect, Type I , Type II superconductor, critical current density

7. Dielectric Materials [4hrs]

7.1 Matter Polarization and Relative permittivity : Relative Permittivity dipole moment and electronic polarization, polarization vector P Local field Eioc and Clausius- Mossotti Equation
7.2 Polarization Mechanism: Electronic Polarisation, orientational polarization, interfacial polarization, total polarization
7.3 Dielectric Contract and dielectric losseSs, Frequency and temperature effect
7.4 Dielectric Strength and breakdown : dielectric strength ,dielectric breakdown
7.5 Ferro-Electricity and Piezoelectricity

Reference Books:

1. R.A Colcaser and S.Diehl-Nagle , " Material and Devices for Electrical Engineer and Physicists, MCGraw-Hill, New York,198ss5.
2. R.C Jaeger," Introduction to Microelectronic Fabrication-Volume IV", Addison- Wesley Publishing Company Inc,1988.
3. S O Kasap , Principal of Electrical Engineering Device, Mcgraw Hill 2000
4. Ben Streetman, "Solid state Electronic Devices 4^{th} edition

MICROPROCESSOR
BEG233EC

Year: II **Semester: III**

Teaching Schedule hours/Week			Examination Scheme				
Theory	Tutorial	Practical	Internal Assessment		Final		Total
3	1	3	Theory	Practical	Theory	Practical	
			20	50	80	-	150

Course Objectives: The objective of this course is to provide fundamental knowledge to understand the operation, programming and application of 8085 and 8086 microprocessor.

1. Introduction 2Hrs
1.1 Evolution of microprocessor
1.2 Block diagram of Microcomputer System.
1.3 Application of microprocessors

2. Intel 8085 Microprocessor 10 Hrs
2.1 Internal Architecture
2.2 Pin diagram and pin function
2.3 Addressing modes
2.4 Instruction Set

3. Intel 8086/8088 Microprocessor 10 Hrs
3.1 Internal Architecture
3.2 Pin diagram and pin function
3.3 Addressing modes
3.4 Instruction Set

4. Assembly Language Programming 3 Hrs
4.1 Introduction to assembly Language Programming
4.2 Assembler instruction format: Opcodes, mnemonics and operands
4.3 Assembler operation: Sample assembly language program and code generation
4.4 One pass and two pass assembly
4.5 Macro assemblers, linking assembler directives
4.6 Programs using 8085 and 8086

5. I/O Interface 7 Hrs
5.1 Introduction to I/O Port Addressing and Decoding
5.2 Serial and parallel communication
5.3 8255 Programmable Peripheral Interface
5.4 Programmable Communication Interface 8251
5.5 RS-232C

6. Interrupts 3 Hrs
6.1 Introduction Basic Interrupt Processing
6.2 Different types of Interrupts

7. Memory Interface **4 Hrs**

7.1 Introduction to Memory Devices
7.2 Address Decoding.
7.3 8085 Memory Interface
7.4 8086 Memory Interface

8. Direct Memory Access **3 Hrs**

8.1 Introduction
8.2 Basic DMA Operation.

9. Comparative Study of higher series of Intel Microprocessor **3 Hrs**

Laboratory:

12 laboratory exercises using the microprocessor trainer kit and assembler and at least 6 Interfacing programs

Reference books:

1. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Application with 8085", 5th Edition 2002, Prentice Hall
2. Peter Abel, "IBM PC Assembly Language and Programming", 5th Edition 2001, Pearson Education Inc.
3. D. V. Hall, "Microprocessor and Interfacing, Programming and Hardware", 2nd Edition 1999, Tata McGraw Hill
4. John Uffenbeck, "Microcomputers and Microprocessors, The 8080, 8085 and Z-80 Programming, Interfacing and Troubleshooting" 3rd Edition 1999, Prentice Hall
5. Walter A. Triebel and Avtar Singh, "The 8088 and 8086 Microprocessors, Programming, Interfacing, Software, Hardware and Applications", 4th Edition 2003, Prentice Hall
6. William Stalling, "Computer Organization and Architecture", 8th Edition 2009, Prentice Hall