Purbanchal University

Faculty of Engineering

Biratnagar, Nepal

Third Semester's Course Structure

Program: Bachelor in Electrical Engineering

Effective from 2021 (2078) Batch

Year-II **Semester-III**

S.N.	Course code	Subject	Credit Hours	L	T	P	Total	Internal		Final		Total
								Th.	P	Th.	P	
1		Mathematics-III	3	3	3	-	6	40		60	-	100
2		Fundamentals of Thermodynamics and Heat	2	2	1	2/2	4	20	25	30	-	75
3		Network Analysis	3	3	1	3/2	5.5	40	10	60	15	125
4		Electronic Devices and Circuits	3	3	1	3/2	5.5	40	25	60	-	125
5		Electrical Engineering Material	3	3	2	-	5	40	-	60	-	100
6		Microprocessor	3	3	1	3	7	40	50	60	-	150
		Total	17	17	9	7	33					675

Note- **L:** Lecture **T:** Tutorial **P :** Practical **Th. :** Theory

Purbanchal University

Faculty of Engineering, Biratnagar, Nepal

Syllabus

Level: Bachelor

Program: Bachelor in Biomedical/Civil/Computer/Electrical/Electronics Comm. & Automation/Geomatic Engineering

Subject: BSH---- MATHEMATICS III

Year: II **Semester: III**

Teaching Schedule Hours/Week					Examination Schedule						Total Marks
					Final				Internal Assessment		
					Theory		Practical		Theory Marks	Practical Marks	
Credit Hours	L	T	P	Total	Duration	Marks	Duration	Marks	40	-	100
3	3	3	-	6	3 Hrs.	60	-	-			

Note: **L:** Lecture **T:** Tutorial **P:** Practical

OBJECTIVES: The main objective of this course is to provide students a sound knowledge of Linear Algebra, Laplace Transform, Vector Calculus with Integral Theorems, Fourier series and Linear Programming Problems with respective applications.

1. Determinants and Matrices **11 Hrs**

1.1 Review of Matrices: types, transpose and inverse with properties (without proof) and applications

1.2 Review of Determinants: Introduction, Properties (without proof), applications

1.3 Vector spaces: Introduction, Dependent and independent Vectors, Linear transformation

1.4 System of linear equation and techniques to solve it (Gauss elimination method only), Elementary row operations, Gauss-Jordan method to find inverse of a matrix.

1.5 Rank of the matrix: Echelon Form and Normal Form, Application of the Rank

1.6 Eigen values and Eigen Vectors of matrix with applications, Cayley-Hamilton Theorem and its applications in finding inverse of a matrix

2. Laplace Transform **10 Hrs**

2.1 Introduction

2.2 Laplace Transforms of elementary functions

2.3 Properties of Laplace Transform

2.4 Inverse Laplace transforms

2.5 Application of Laplace Transform in solving differential equations with initial conditions

2.6 Convolution of Laplace transform, Inverse of Laplace transform using convolution

3. Line Integrals, Surface Integrals and Volume Integrals **13 Hrs**

3.1 Line Integrals: Introduction, evaluation, application as work done, independent of Path, Conservative fields

3.2 Surface Integrals: Introduction, evaluation, application as flux

3.3 Volume Integrals: Introduction, evaluation, Dirichlet's Integral

3.4 Integral Theorems

- Green's Theorem in the plane (without proof), its applications.
- Stoke's Theorem (without proof), its applications.
- Gauss' Divergence Theorem (without proof), its applications.

4. Fourier Series **6 Hrs**

4.1 Introduction, Periodic Functions, odd and even functions

4.2 Fourier Series: Introduction, evaluation (Period 2π and arbitrary period)

4.3 Half Range Fourier (sine and cosine) Series: Introduction, evaluation

4.4 Parseval's Formula

5. Linear Programming Problem **5 Hrs**

5.1 Review of Simplex method and duality (Converting in to dual)

5.2 Big-M Method and Two Phase Method

Text Book

1. Zill D., Wright W. S. and M. R. Cullen, *Advanced Engineering Mathematics*, Jones and Bartlett Publishers Inc.
2. Kreyszig, E. (1999), *Advanced Engineering Mathematics, 9th Edition*, John Wiley and Sons.
3. Peter V. O'Neil , *Advanced Engineering Mathematics* , 8th Edition , University of Alabama at Birmingham

Evaluation Scheme

Internal Assessment: 40

Final Examination: 60

Chapter-wise Marks Division for Final Exam

Unit	Chapter Name	Short questions (2 marks)	Long questions (4 marks)	Total Marks
1	Determinants and Matrices	4	2	16
2	Laplace Transform	3	2	14
3	Line Integrals, Surface Integrals and Volume Integrals	1	4	18
4	Fourier Series	2	1	8
5	Linear Programming Problem	-	1	4
	Total	10	10	60

NOTE: *There may be at most one OR question from each unit 1, unit 2 and unit 3. There will be altogether three OR questions in the final question paper.*

Sample Question Paper

PURWANCHAL UNIVERSITY
3rd SEMESTER (NEW)

Level- B.E (civil/ computer/Electronics and Communication/ Electrical/ B.Arch)

Subject- BOE, SH Engineering Mathematics – III
Time – 3:00 hrs

Full marks- 60
Pass marks- 24

GROUP -A

Answer all the questions: [10X2 = 20]

1. Find the value of determinant $\begin{vmatrix} 1 & w & w^2 \\ w & w^2 & 1 \\ w^2 & 1 & w \end{vmatrix}$
2. Define the Hermitian matrix with example
3. If A is the Hermatian matrix, then show that iA is skew Hermatian matrix.
4. Define adjoint and inverse of a 3x3 matrix.
5. Find the inverse transformation of $y_1 = 3x_1 - x_2$, $Y_2 = -5x_1 + 2x_2$
6. Find the Laplace transform of tcosat.
7. Find the inverse transform of $\frac{1}{s(s+1)}$,
8. Evaluate $\int_c \vec{f}.\overrightarrow{dx}$, where $\vec{f} = x^2y^2\vec{i} + y\vec{j}$ and c is the curve $y^2 = 4x$ from (0, 0) to (4,4).
9. Definer Fourier cosine series.
10. Show that the given functions are odd or even:
    (a) $\frac{e^x + e^{-x}}{2}$ (b) $2 - 3x^4 + \sin^2 x$

GROUP – B

Answer all questions (4 X 10 = 40)

11. Solve the system of linear equation s x- 2y+3z= 11, 3x+y-z= 2, 5x+3y+2z=3 by Gauss Jordan method.
12. Find the rank of the matrix $\begin{bmatrix} 1 & 2 & 1 & 0 \\ -2 & 4 & 3 & 0 \\ 1 & 4 & 2 & -8 \end{bmatrix}$ by reducing to normal form.

    Or

    Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 2 & 0 & 1 \\ 1 & 1 & 1 \\ 1 & -1 & 3 \end{bmatrix}$.
13. Find the inverse of Laplace transform of $\frac{1}{s^2(s^2+a^2)}$ by using convolution theorem.

14. Solve the equation by transform method
    $Y'' + y' - 2y = t$, $y(0) = 1$, $y'(0) = 0$

    Or

    Solve $\frac{dx}{dt} - y = e^t$, $\frac{dy}{dx} + x = \sin t$ given that $x(0) = 1$, $y(0) = 0$
15. Show that $\vec{F} = (x^2-yz)\vec{i} + (y^2 = zx)\vec{j}+(z^2-xy)\vec{k}$ is irrotational. Also find its scalar potential function.
16. Find the flux of $\vec{F}$ through surfaces where $\vec{F} = 3x\vec{i} +3y\vec{j} +3\vec{k}$ and part of the surface $x^2+y^2+z = 9$ with $z \geq 0$.
17. Evaluate by Green's theorem $\int (y - \sin x)dx + \cos x dy$ where c is the plane triangle enclosed by the lines $y = 0$, $x = \frac{\pi}{2}$ and $y = \frac{2x}{\pi}$.
18. Apply Stoke's theorem to evaluate $\int_c (x + y)dx + (2x - z)dy + (y + x)dz$, where c is the boundary of the triangle with vertices (2,0,0) ,(0,3,0) and (0,0,6).

    Or

    Evaluate $\iint_s (\vec{F} . \hat{n})ds$ where $\vec{F} = 2x\vec{i} + 3y\vec{j} + 4z\vec{k}$ and S is the surface of sphere $x^2 + y^2 + z^2 = 1$ by Gauss's divergence theorem.
19. Find the Fourier series $F(x) = 2x - x^2$ in the interval (0, 2).
20. By using Big M method, minimize $z = x_1-3x_2+2x_3$ subject to the condition

$$3x_1 - x_2+2x_3 \leq 7$$
$$- 2x_1 + 4x_2 \leq 12$$
$$- 4x_1 + 3x_2 + 8x_3 \leq 10$$
$$x_1, x_2, x_3 \geq 0$$

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Purbanchal University

Faculty of Engineering, Biratnagar, Nepal

Syllabus

Level: Bachelor
Program: Bachelor in Electrical Engineering

Subject: Fundamentals of Thermodynamics and Heat
Subject Code: BME----

Year: II **Semester:** III

Teaching Schedule Hours/Week					Examination Schedule						Total Marks
					Final				Internal Assessment		
					Theory		Practical		Theory Marks	Practical Marks	
Credit Hours	L	T	P	Total	Duration	Marks	Duration	Marks	20	25	75
2	2	1	2/2	4	1.5 Hrs.	30	-	-			

Note: L: Lecture T: Tutorial P: Practical

Course Objectives:

To provide the students with a basic understanding and norms of Thermodynamics and HeatTransfer

Course Content:

1. **Basic Concepts (3 hours)**
   - 1.1. Definition and Application areas of Thermodynamics
   - 1.2. Concepts and Definitions
     - 1.2.1. System, Surroundings, Boundary and Universe
     - 1.2.2. Thermodynamic Properties: Intensive, Extensive and Specific Properties
     - 1.2.3. Thermodynamic State and equilibrium and quasi-static process
     - 1.2.4. Thermodynamic Processes and Cycles: Isobaric, isothermal and isochoric processes CyclicProcess, Quasi-equilibrium Process, Reversible and Irreversible Process
   - 1.3. Common Properties: Pressure, Specific Volume, Temperature
   - 1.4. Zeroth Law of Thermodynamics, Equality of Temperature
   - 1.5. Value of energy to society

2. **Energy and Energy Transfer (4 hours)**
   - 2.1. Energy and its Meaning
   - 2.2. Stored Energy and Transient Energy; Total Energy
   - 2.3. Energy Transfer as heat and work
   - *2.4.* Expressions for displacement work transfer (*Isobaric work, Isochoric Work, Isothermal and Polytropic work)*
   - 2.5. Power

3. Properties of Common Substances (4 hours)

3.1. Ideal Gas (*Boyles Law, Charles Law) and Combined Gas Equation*
3.2. Saturation curves For Two- Phase Mixture (T-v and P-v) Diagrams
3.3. Two Phase (Liquid and Vapor) Systems: Phase Change; Subcooled Liquid, Saturated Liquid, Wet Mixture, Critical Point, Quality, Moisture Content, Saturated Vapor and Superheated Vapor
3.4. Other Thermodynamic Properties: Internal Energy, Enthalpy, *Specific heat Capacities*
3.5. Numerical related to Steam Table (Specific Properties related to quality)

4. First Law of Thermodynamics (6 hours)

4.1. Introduction and law of conservation of energy
4.2. First Law of Thermodynamics for closed systems; First Law of Thermodynamics for closed system Undergoing Cyclic Process
4.3. Application of the First law of Thermodynamics to Closed systems undergoing some common process: Constant Volume, Adiabatic, Constant Pressure, Constant Internal Energy.
4.4. First Law of Thermodynamics for open systems (Control Volume)
  4.4.1. Conservation of mass, expression of mass flow rate, flow work and general energy equations
  4.4.2. Steady State Analysis and applications
4.5. Other Statements of the First Law
4.6. Perpetual Motion Machine of the kind PMM I

5. Second Law of Thermodynamics (7 hours)

5.1. Necessity of Formulation of Second Law
5.2. Kelvin-Planck and Clausius Statements of the Second Law of Thermodynamics
5.3. Heat Engine and Thermal Efficiency, Heat Pump, Refrigerator and coefficient of Performance (COP) (*Theory and Numerical*)
5.4. Entropy and entropy change *(introduction and definition*)
5.5. Reversible and Irreversible Process
5.6. Entropy and Process Relation for an Ideal Gases
5.7. Isentropic Process for an Ideal Gas
5.8. Air Standard Otto Cycle and Diesel Cycle (*Theory and Numerical*)

6. Introduction to Engineering Heat Transfer:(6 hours)

6.1. Basic concepts and modes of heat transfer
6.2. One Dimensional Steady State Heat Conduction through a Plane Wall/Flat Plate
6.3. Radial Steady State Heat Conduction through a Hollow Cylinder
6.4. Heat Flow through Composite Structures
  a. One Dimensional Steady State Heat Conduction through a Composite Wall
  b. Radial Steady State Heat Conduction through a Multilayer Tube
6.5. Overall heat transfer for Plane composite wall
6.6. Electrical Analogy for Thermal Resistance

Laboratories:

- Temperature measurement
- Experiment related to heat pump or refrigerator
- Experiment related to heat transfer conduction, radiation and Convection

Tutorials:

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

b) Quiz before first and second assessments.

Final Examination Scheme:

Chapters	Marks*	Remarks
1	2	
2	4	
3 and 4	7	
5	9	
6	8	
Total	**30**	

***There may be minor deviation in marks distribution.**

References: (in APA style)

1. C.P., G., & R., P. (1991). *Engineering Thermodynamics.* Roorkee: Nemchand & Broj.
2. Cengel, Y. A., Boles, M. A., & Kanoglu, M. (2019). *Thermodynamics: An Engineering Approach.* McGraw-Hill Education.
3. Howell, J. R., & Buckius, R. O. (1987). *Fundamental of Engineering Thermodynamics.* Mc Graw Hil Publishers.
4. P.K., N. (n.d.). *Engineering Thermodynamics.* New Delhi: Tata Mc Graw Hill.

PURBANCHAL UNIVERSITY(Model Question)

Model Question 2023

F.M=30 P.M=12 Time: 1.5hr

Program: Bachelor in Electrical Engineering
Semester: III
Subject: BME---- Fundamentals of Thermodynamics and Heat

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicates full marks.

Answer ALL questions

1. Define thermodynamics system, surrounding, boundary and reversible process. 2
2. Define saturation temperature, critical point and superheated vapour. 2
3. What do you mean by work transfer? Derive an expression to calculate work transfer during isothermal process. 4
4. Explain an air standard otto cycle on P-V and T-S diagram 4
5. Establish the relation to calculate the overall heat transfer coefficient of a composite wall. 4
6. An exterior wall of a house may be approximated by a 10cm layer of common brick(k=0.7W/m0C) followed by a layer of a 3.8cm of a cement plaster (k=0.48W/m0C)). What thickness of loosely packed rock-wool insulation (k=0.065W/m0C) should be added to reduce the heat loss (or gain) through the wall by 80 percent? 4
7. 5 kg of H_2O is contained in a closed rigid container with as initial pressure and quality of 1000 kPa and 40% respectively. Heat is added to the system until the container holds only saturated vapour. Sketch the process on P-v and T-v diagram and determine: (Refer to steam table)
   - the volume of the container, and
   - the final temperature 5
8. At the beginning of the compression process of an air standard Diesel cycle operating with a compression ratio of 18, the temperature is 300K and the pressure is 0.1MPa. The cutoff ratio for the cycle is 2. Determine
   - The temperatures and the pressure at the end of each process of the cycle.
   - The thermal efficiency 5

Properties of Saturated water- pressure table

P kPa	T °C	v_l m³/kg	v_{lg} m³/kg	v_g m³/kg	h_l kJ/kg	h_{lg} kJ/kg	h_g kJ/kg
100	99.632	0.001043	1.6933	1.6943	417.51	2257.6	2675.1
1000	179.92	0.001127	0.1933	0.1944	762.88	2014.8	2777.7
2500	223.99	0.001197	0.07875	0.07995	961.97	1840.2	2802.2
2750	229.11	0.001207	0.07151	0.07272	985.85	1817.2	2803.0

Properties of superheated steam

P kPa	T °C	v m^3/kg	u kJ/kg	h kJ/kg	s kJ/kg.K
400	(143.64)	(0.4625)	(2553.5)	(2738.5)	(6.8961)
	150	0.4708	2564.4	2752.8	6.9300
	200	0.5342	2646.4	2860.1	7.1699
	250	0.5951	2725.6	2963.6	7.3779
	300	0.6548	2804.4	3066.3	7.5654
	350	0.7139	2883.8	3169.4	7.7378
	400	0.7726	2964.3	3273.3	7.8982
	450	0.8311	3046.0	3378.5	8.0489
	500	0.8894	3129.3	3485.0	8.1914

Purbanchal University

Faculty of Engineering, Biratnagar, Nepal

Syllabus

Level: Bachelor

Program: Bachelor in Electrical/ Electronics Communication & Automation Engineering

Subject: NETWORK ANALYSIS

Subject Code: BEL----

Year: II **Semester: III**

Teaching Schedule Hours/Week					Examination Schedule						Total Marks
					Final				Internal Assessment		
					Theory		Practical		Theory Marks	Practical Marks	
Credit Hours	L	T	P	Total	Duration	Marks	Duration	Marks	40	10	125
3	3	1	2	6	3 Hrs.	60	-	15			

Note: **L:** Lecture **T:** Tutorial **P:** Practical

Course Objective: - To provide the knowledge of transient and steady state behavior of various electric networks subjected to different types of inputs, synthesize one port network functions and introduce two port network parameters.

1. **Matrix methods in Network Analysis [4 hours]**
   Review of Mesh analysis and nodal analysis involving independent and dependent sources; Solution of mesh analysis using Gauss elimination, Gauss Jordan and Cramer's rule; Solution of nodal analysis using Gauss elimination, Gauss Jordan and Cramer's rule

2. **Classical solution of First order differential equation [6 hours]**
   Differential operator, operational impedance, Forced and transient solution, formulation of differential equations; Initial conditions, procedure to evaluate initial condition, transient and steady state response, zero input response and zero state response; Complete response of series RL circuit to step, exponential and sinusoidal inputs using classical approach, Time constant of RL circuit; Complete response of series RC circuit to step, exponential and sinusoidal inputs using classical approach, Time constant of RC circuit

3. **Classical solution of Second order differential equation [6 hours]**
   Formulation of second order differential equation in second order circuit (series or parallel RLC circuit), Nature of solution of homogeneous and non-homogeneous differential equation , General solution for underdamped, critically damped and overdamped second order network; Step voltage response of series RLC network, step current response of parallel RLC network; Particular integral by the method of undetermined coefficients; Complete response of RLC (series or parallel) circuit with exponential and sinusoidal input; Response of series RLC circuit as related to the S-plane location of roots

4. **Laplace and Inverse Laplace Transform [4 hours]**
   Definitions and properties used for Network Analysis; Laplace transform of common forcing functions, step, ramp, impulse and sinusoidal functions, shifted functions; Initial value theorem, final

value theorem, first and second shifting theorem; Use of partial fraction expansion in analysis using Laplace transformation, Heaviside's partial fraction expansion theorem

5. **Solution of ordinary differential equations using Laplace transformation technique [7 hours]**
   Complete response of series RL circuit to step, exponential and sinusoidal inputs; Complete response of series RC circuit to step, exponential and sinusoidal inputs; Complete response of series RLC networks to step, exponential and sinusoidal inputs; Complete response of series RLC networks to step, exponential and sinusoidal inputs; Laplace transform of some special waveforms like staircase, truncated ramp etc. that can be synthesized using step and ramp signals, RL and RC excitation using these waveforms as forcing function

6. **Transfer Functions [4 hours]**
   Transform impedance and admittance; Network functions for One-port network; Network functions for a two-port network; Transfer function- Transform impedance, Transform admittance, driving point impedance, driving point admittance, voltage transfer ratio, current transfer ratio, transfer admittance, transfer impedance; Poles and Zeros plot and analysis; Time-domain behavior from pole-zero locations; Stability and Routh's Criteria

7. **One -Port Passive Networks [7 hours]**
   Hurwitz polynomial and properties of Hurwitz polynomial; Positive real function and properties of p.r.f.; Properties of LC, RL and RC network functions; Synthesis of RL, RC and LC network functions in Foster and Cauer forms.

8. **Two- Port parameters of Networks [7 hours]**
   Definition of two-port network, Open circuit impedance parameters**,** Short circuit admittance parameters, Transmission parameters and hybrid parameters; Reciprocity and symmetry in two port networks in terms of Z, Y, T and h parameters; Relationship between parameters of two port network; Series-series, Parallel-Parallel, cascade and series-parallel connection of two port networks

Practical: There shall be at least 6 laboratories involving following topics

1. Transient and steady state responses of first order Passive network
2. Transient and Steady state responses of second order Passive network
3. Determination of Z, Y, T and h parameters of two port resistive networks and verify the result by direct calculation.
4. Determination of appropriate parameters of interconnected two port resistive networks and verify the result by direct calculation.

Reference Books:

1. M.E. Van Valkenburg, "Network Analysis", 3rd Edition, Prentice Hall of India
2. K.M. Soni, "Network Analysis and Synthesis". S.K. Kataria & Sons, India
3. G.K. Mithal, "Network Analysis", Khanna Publishers, India

Chapter Wise Marks Distribution for Final Examination

SN	Chapter	Lecture hour	Marks distribution	Types of Questions			Remarks
				Very Short	Short	Long	
1	Chapter 1	4	8	✓	✓	✓	(2Very short+1short) or (2 short) or (1 long)
2	Chapter 2	6	8	✓	✓	✓	(2Very short+1short) or (2 short) or(1 long)
3	Chapter 3	6	8	✓	✓	✓	(2Very short+1short) or (2 short) or (1 long)
4	Chapter 4	4	4	✓	✓	×	(2Very short) or (1 short)
5	Chapter 5	7	8	✓	✓	✓	(2Very short+1short) or (2 short) or (1 long)
6	Chapter 6	4	8	✓	✓	✓	(2Very short+1short (2 short) or (1 long)
7	Chapter 7	7	8	✓	✓	✓	(2Very short+1short) or (2 short)or (1 long)
8	Chapter 8	7	8	✓	✓	✓	(2Very short+1short) or (2 short) or (1 long)
	Total	45	60				

Note: All the questions in very short type must be theoretical questions. There shall be 4 very short questions each carrying 2 marks.

In Short type questions there can't be any breakdown and question can be theoretical or numerical question. There shall be 7 short questions each carrying 4 marks.

In Long type question there can be some breakdown and questions may be numerical/Derivational/ Theoretical. There shall be 3 long questions each carrying 8 marks.

Purbanchal University
Model question 2023

Program: Bachelor in Electrical/ Electronics Communication & Automation Engineering
Semester: III
Subject: BEL---- **Network Analysis**

FM: 60
PM: 24
Time: 3 hours

Attempt all questions

Group-A

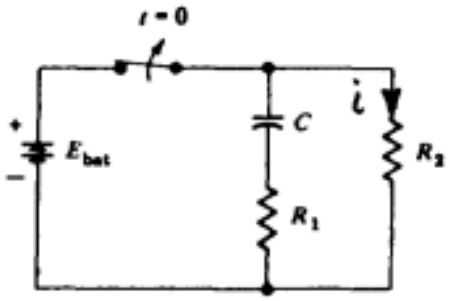
Very Short questions [4×2 = 8]

1. What is transient?
2. Define time constant of RL series circuit.
3. State Initial value theorem.
4. State differentiation and integration properties of Laplace transform.

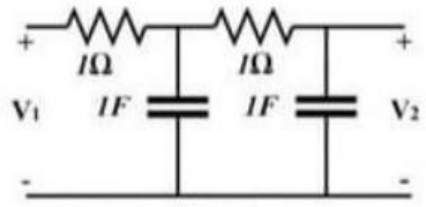
Group-B

Short questions [7×4 = 28]

5. The circuit shown in figure 1c is in steady state condition with E_{bat} = 10 V, C=0.15F, R_1 = 2 ohm and R_2 = 4 ohm. If switch is opened at t=0, determine current in 4-ohm resistance and voltage across capacitance at t =0.



6. Use pole – zero plot to determine residues and hence obtain time response of the given transfer function
$$G(s) = \frac{s(s+5)}{(s+1)(s+3)}$$
7. Determine voltage transfer ratio for the given network. (Chapter 6)



8. Enumerate the properties of positive real function.
9. Synthesize the network function in Cauer I form.

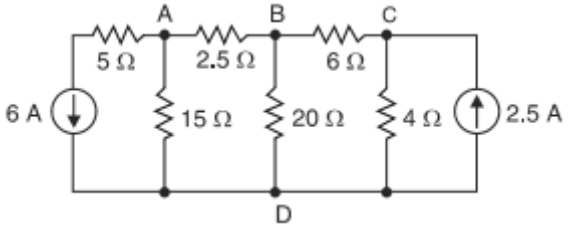
$$Z(s) = \frac{(s+1)(s+4)}{s(s+2)(s+5)}$$

10. Derive the condition for reciprocity of 2 port network in terms of ABCD parameters.
11. The Z parameters of two-port network are Z_{11} = 30 Ω, Z_{12}=15 Ω, Z_{21}=15 Ω and Z_{22}=10 Ω. Calculate the hybrid parameters for the network and hence write the network equation using hybrid parameters.

Group C

Long questions [3×8 = 24]

12. Develop the matrix model using nodal analysis for the network shown in the figure below and hence solve for node voltages using Gauss elimination method.



13. A series RLC circuit with R= 200 Ω, L =0.5 H and C= 100μF has a sinusoidal voltage source of 300 sin (500t+α) volts. Find the resulting current transient if the switch is closed when α= 30^0. Use Laplace transformation method for solving differential equation.

14. A step dc current of 2A is suddenly applied to parallel RLC circuit with C=1F, R=0.5Ω and L = 0.5 H. Obtain the total solution of voltage appearing across capacitor. Assume there is no charge initially on inductor and capacitor.

Detailed Syllabus of Network Analysis

Note: Define(SD), Description(D), Derive(Dr), Illustration(I), Explanation(E), Application(A), Experimental(Ex), Numerical(N)

Ch No.	Topic		Subtopic	Depth								Hour	Remarks
				SD	D	DR	I	E	A	EX	N		
1	Matrix methods in Network Analysis	1.1	Review of Mesh analysis and nodal analysis involving independent and dependent sources	✓	✓		✓	✓			✓	2	
		1.2	Solution of Mesh analysis using Gauss elimination, Gauss Jordan and Cramer's rule	✓	✓		✓				✓		
		1.3	Solution of Nodal analysis using Gauss elimination, Gauss Jordan and Cramer's rule	✓	✓		✓				✓	2	
2	Classical solution of First order differential equations	2.1	Differential operator, operational impedance, Forced and transient solution, formulation of differential equations	✓	✓		✓	✓			✓	1	
		2.2	Initial conditions, procedure to evaluate initial condition, transient and steady state response, zero input response and zero state response	✓	✓			✓			✓	1	
		2.3	Complete Response of first order RL circuit with step, exponential and sinusoidal input, Time constant of RL circuit	✓	✓	✓	✓	✓			✓	2	
		2.4	Complete Response of first order RC circuit with step, exponential and	✓	✓	✓	✓	✓			✓	2	

			sinusoidal input, Time constant of RC circuit										
3.	Classical solution of Second order differential equations	3.1	Formulation of second order differential equation in second order circuit (series or parallel RLC circuit), Nature of solution of homogeneous and non-homogeneous differential equation, General solution for underdamped, critically damped and overdamped second order network	✓	✓			✓				3	
		3.2	Step voltage response of series RLC circuit, step current response of parallel RLC network		✓			✓					
		3.3	Particular integral by the method of undetermined coefficients	✓	✓			✓				3	
		3.4	Complete response of RLC series or parallel circuit with exponential and sinusoidal input	✓	✓			✓					
		3.5	Response of series RLC circuit as related to the S-plane location of roots		✓	✓		✓			✓		
4	Laplace and Inverse Laplace transform	4.1	Definition and properties used for Network Analysis	✓	✓	✓		✓			✓	1	
		4.2	Laplace transform of common forcing functions, step, ramp, impulse and sinusoidal functions, shifted functions	✓	✓	✓		✓			✓	1	
		4.3	Initial value theorem, final value theorem, first and second shifting theorem	✓	✓	✓		✓			✓	1	
		4.4	Use of partial fraction expansion in analysis using Laplace transformation, Heaviside's partial fraction expansion theorem	✓	✓			✓			✓	1	

5	Solution of ordinary differential equations using Laplace transformation technique	5.1	Complete response of series RL circuit to step, exponential and sinusoidal inputs	✓	✓	✓	✓	✓			✓	3	
		5.2	Complete response of series RC circuit to step, exponential and sinusoidal inputs	✓	✓	✓	✓	✓			✓		
		5.3	Complete response of series and parallel RLC networks to step, exponential and sinusoidal inputs	✓	✓	✓	✓	✓			✓	3	
		5.4	Complete response of series and parallel RLC networks to step, exponential and sinusoidal inputs	✓	✓	✓	✓	✓			✓		
		5.5	Laplace transform of some waveforms like staircase, truncated ramp etc. that can be synthesized using step and ramp signals, RL and RC excitation using these waveforms as forcing function	✓	✓	✓	✓	✓			✓	1	
6	Transfer Functions	6.1	Transform impedance and admittance; Network functions for One-port network; Network functions for a two-port network	✓	✓		✓	✓				2	
		6.2	Transfer function- Transform impedance, Transform admittance, driving point impedance, driving point admittance, voltage transfer ratio, current transfer ratio, transfer admittance, transfer impedance	✓	✓	✓	✓	✓			✓		
		6.3	Poles and Zeros plot and analysis; Time-domain behavior from pole-zero locations	✓	✓		✓	✓			✓	2	

		6.4	Stability and Routh's Criteria	✓	✓		✓	✓			✓		
7	One-port Passive Network	7.1	Hurwitz polynomial and properties of Hurwitz polynomial	✓	✓			✓			✓	1	
		7.2	Positive real function, properties of prf	✓	✓			✓			✓		
		7.3	Properties of LC Network function, synthesis of LC network in Foster I, Foster II, Cauer I and Cauer II	✓	✓			✓			✓	2	
		7.4	Properties of RL impedance or RC admittance Network function, synthesis of RL impedance or RC admittance network in Foster I, Foster II, Cauer I and Cauer II	✓	✓			✓			✓	2	
		7.5	Properties of RC impedance or RL admittance Network function, synthesis of RC impedance or RL admittance network in Foster I, Foster II, Cauer I and Cauer II	✓	✓			✓			✓	2	
8	Two-Port Parameters of Networks	8.1	Definition of two-port network, Open circuit impedance parameters, short circuit admittance parameters, Transmission parameters and hybrid parameters	✓	✓	✓		✓			✓	2	
		8.2	Reciprocity in terms of Z, Y, T and h parameters	✓	✓	✓		✓			✓	1	
		8.3	Symmetry in terms of Z,Y,T and h parameters	✓	✓	✓		✓			✓	1	
		8.4	Relationships between parameter sets	✓	✓	✓		✓			✓	2	

		8.5	Series-series, Parallel-Parallel, cascade and series-parallel connection of two port networks	✓	✓	✓		✓			✓	1	

Purbanchal University

Faculty of Engineering, Biratnagar, Nepal

Syllabus

Level: Bachelor
Program: Bachelor in **Computer/Electrical** Engineering
Subject: BEC---- ELECTRONICS DEVICES AND CIRCUITS
Year: II **Semester:** III

Teaching Schedule Hours/Week					Examination Schedule						Total Marks
					Final				Internal Assessment		
					Theory		Practical		Theory Marks	Practical Marks	
Credit Hours	L	T	P	Total	Duration	Marks	Duration	Marks	40	25	125
3	3	1	3/2	5.5	3 Hrs.	60	-	-			

Note: L: Lecture T: Tutorial P: Practical

Course Objectives: To introduce students about working principles and applications of basic semiconductor devices like diodes, BJTs and FETs.

1.0 Semiconductor: **[15 hours]**
- 1.1 Semiconductor and its types
- 1.2 PN junction
- 1.3 PN junction as a diode:
  - 1.3.1. VI characteristics of PN junction diode
  - 1.3.2. Effect of temperature on VI characteristics of PN junction diode
- 1.4 Zener diode and its VI characteristics:
  - 1.4.1. Zener diode as a voltage regulator
- 1.5 Schottky diode
- 1.6 Applications of PN junction diode:
  - 1.6.1. Rectifier and its types
  - 1.6.2. Clippers and clamper

2.0 Bipolar junction Transistor: **[14 hours]**
- 2.1 Construction and its types
- 2.2 Different Configuration of BJT
  - 2.2.1. Input and output characteristics of CB, CE and CC
- 2.3 BJT as an amplifier
- 2.4 BJT as a switch
- 2.5 Types of biasing

3.0 Field Effect Transistors: **[8 hours]**
- 3.1 Junction Field Effect Transistors:
  - 3.1.1 Construction and characteristics
  - 3.1.2 Biasing of JFET
- 3.2 Metal Oxide Semiconductor Field Effect Transistor
  - 3.2.1 Construction, characteristics and types
  - 3.2.2 NMOS(Depletion and Enhancement types)

4.0 Operational Amplifier: **[8 hours]**
- 4.1 Ideal and non-ideal characteristics
- 4.2 Inverting and non-inverting configuration
- 4.3 Op-amp as adder , subtractor, differentiator, integrator

Practicals:
1. Measurement of characteristics of PN junction diode, zener diode
2. Half wave and full wave rectifier with and without filter capacitor
3. Measurement of input and output characteristics of CE configuration
4. Observe the output of op-amp in inverting and non-inverting configuration

References:

1. Theodorre S. Bogart, "Electronic Devices and Circuits"
2. Robert Boyelstad, " Electronic Devices and Circuits"
3. A.S. Sedra and K.C. Smith, "Microelectronic Circuits", 6th Edition, Oxford University Press
4. J.B. Gupta, "Electronic Devices and Circuits"

Question pattern:

Chapter	Hours	Marks
1.	15	20
2	14	20
3	8	10
4	8	10

Model Questions

Attempt All Questions

Group A

[4*2=8]

1. What is semiconductor? Describe its types
2. Describe clipper circuits briefly.
3. Differentiate between BJT & FET.
4. Differentiate between ideal and non ideal op-amp.

Group B

[7*4=28]

1. When the voltage across a forward biased diode at T=10°c is 0.621V, the current is 4.3 mA. If the current is held constant, what is the voltage when T=40°c .
2. Explain how BJT acts as a switch.
3. What is rectifier? Describe its types
4. State the different transistor configurations used in a BJT. Explain input characteristics of Common emitter configuration.
5. Define bias stabilization. What are the factors which may affect it?
6. Design a summing inverting amplifier with 3 inputs V1=2V,V2=3V & V3=4V and R1=R2=R3=RF= 1KΩ and calculate output voltage.
7. What is op-amp? Describe its inverting mode.

[3*8=24]

Group C

1. Explain VI characteristic curve of zener diode and explain the significance of reverse bias mode of zener diode to realize it as a voltage regulator circuit.

2. A Si transistor with β=100 is to be used in the self biasing circuit such that Q point corresponds to V_{CE}=12V & I_C=2mA. Construct the circuit and find R_B if V_{CC}=24V & R_C=5KΩ.
3. What is a MOSFET? What are its types? Explain the construction and working of N channel E-MOSFET .

Detailed Course Contents of ELECTRONIC DEVICES AND CIRCUITS (for BE Computer/ Electrical Third Semester)

Note: Define(SD), Description (D), Derive (Dr), Illustration (I), Explanation (E), Application (A), Experimentation (Ex), Numerical (N)

Detailed Course Contents:

Ch No.	Topic		Subtopic	Depth								Hours	Remarks
				SD	D	DR	I	E	A	EX	N		
1	Semiconductor	1.1	Semiconductor and its types	✓	✓		✓	✓				15	
		1.2	PN junction	✓									
		1.3	VI characteristics of PN junction diode, Effect of temperature on VI characteristics of PN junction diode		✓		✓	✓			✓		
		1.4	Zener diode and Zener diode as a voltage regulator		✓		✓	✓			✓		
		1.5	Schottky diode	✓	✓								
		1.6	Rectifier types, Clippers and clampers	✓	✓	✓	✓	✓			✓		
2	Bipolar junction Transistor	2.1	Introduction and its types	✓	✓		✓	✓				14	
		2.2	BJT Configuration, Input and output characteristics of CB, CE and CC	✓	✓		✓	✓			✓		
		2.3	BJT as an amplifier	✓	✓		✓	✓					
		2.4	BJT as a switch	✓	✓		✓	✓					

		2.5	Types of biasing	✓	✓		✓	✓			✓		
3	Field Effect Transistors	3.1	Junction Field Effect Transistors: Construction, characteristics and Biasing	✓	✓		✓	✓			✓	**8**	
		3.2	Metal Oxide Semiconductor Field Effect Transistor : Construction, characteristics and NMOS(Depletion and Enhancement types)	✓	✓		✓	✓					
4	Operational Amplifier	4.1	Ideal and non-ideal characteristics	✓	✓		✓	✓				**8**	
		4.2	Inverting and non-inverting configuration	✓	✓		✓	✓	✓		✓		
		4.3	Op-amp as adder, subtractor, differentiator, integrator	✓	✓		✓	✓	✓		✓		
Note: Define(SD), Description (D), Derive (Dr), Illustration (I), Explanation (E), Application (A), Experimentation (Ex), Numerical (N)													

Final Examination Scheme:

Chapters	Marks	Remarks
1	**20**	
2	**20**	
3	**10**	
4	**10**	
Total	**60**	

Note: There might be minor deviation in mark distribution.
Mandatory: Marks should be evaluated based on solving steps.

Evaluation Scheme;
Marks Division

Question Type	No. of Questions	Marks	Total Marks
Short	4	2	8
Medium	7	4	28
Long	3	8	24
Total			60

Purbanchal University

Faculty of Engineering, Biratnagar, Nepal

Syllabus

Level: Bachelor

Program: Bachelor in Electrical Engineering

Subject: ELECTRICAL ENGINEERING MATERIAL

Subject Code: BEL----

Year: II **Semester: III**

Teaching Schedule Hours/Week					Examination Schedule						Total Marks
					Final				Internal Assessment		
					Theory		Practical		Theory Marks	Practical Marks	
Credit Hours	L	T	P	Total	Duration	Marks	Duration	Marks	40	-	100
3	3	2	-	5	3 Hrs.	60	-	-			

Note: **L:** Lecture **T:** Tutorial **P:** Practical

Course Objectives: To provide basic knowledge of the electric and magnetic properties of materials used in electrical and electronics engineering

Course Content

1. **Theory of Metal** **[13 hours]**
   Wave Particle duality and De Broglie's Equations, Wave function and Schrodinger's equation, Einstein's Equations, Heisenberg's Uncertainty Principles, Tunneling phenomenon, Energy well model of a metal, Collection of particles, Boltzmann Classical statistics, Fermi-Dirac statistics,
   Free electron model, electron effective mass, energy bands, density of states, Fermi Energy, metal oxide contact, Seebeck effect and thermocouple, Thermionic Emission, Richardson-Dushman Equation, Field Assisted Emission, the Schottky effect

2. **Free Electron Theory of Conduction in Metals** **[4 hours]**
   Thermal velocity of electrons at equilibrium, Drift velocity of electrons in an electric field, Electron mobility, conductivity, resistivity, Diffusion of Electrons, Diffusion co-efficient, Einstein relationship between mobility and diffusion co-efficient

3. **Conduction in Liquids and Gases** **[3 hours]**
   Ionic conduction in liquids; Electrical conduction in gases; Arc discharge and electric breakdown in gases

4. **Insulating and Dielectric Materials** **[7 hours]**
   Definition of Insulating and Dielectric Materials, Classification of insulating material, Characteristic of good insulating materials; Polarisation and dielectric constant, Clausius-Mossotti equation, Polarization mechanisms- ionic, electronic, interfacial and orientational polarization; Dielectric losses, frequency and temperature effect; Dielectric breakdown in solid, liquid and gases; Application of dielectric material; Ferroelectricity; Piezoelectricity

5. **Magnetic Materials and Superconductivity [7 hours]**
   Magnetization of matter, magnetic dipole moment, Atomic magnetic moments, Magnetization Vector M, Magnetising field, Magnetic permeability and Susceptibility; Magnetic material classifications (Diamagnetism, Paramagnetism, Ferromagnetism, Antiferromagnetism, Ferrimagnetism); Hysteresis loop, Hard and soft magnetic materials with examples and uses;Superconductivity, zero resistance and Meissner effect, Type I and Type II superconductors, Critical current density

6. **Semiconducting Materials [7 hours]**
   Intrinsic semiconductors, silicon crystal and energy band diagram, electrons and holes, electrical conduction in semiconductor, Electron and hole concentrations in Intrinsic semiconductor; Extrinsic semiconductors, n-type and p-type semiconductor, compensation doping; Generation and recombination of electrons and holes(Direct recombination and generation, Indirect thermal generation and recombination), concept of lifetime; Diffusion in semiconductor, Einstein relationship.

7. **Semiconductor device fabrication [4 hours]**
   Crystal growing by Czochralski method, Epitaxial growth, photolithography, PN junction fabrication

References:

1. R.A. Colcaser & S. Diehl-Nagle, "Material and Devices for Electrical Engineer and Physicists", MCGraw-Hill,
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, Tata McGraw-Hill, India
4. J. Millman and C.C. Halkias, "Integrated Electronics", Tata McGraw Hill

Chapter Wise Marks Distribution for Final Examination

SN	Chapter	Lecture hour	Marks distribution	Types of Questions			Remarks
				Very Short	Short	Long	
1	Chapter 1	13	18	✓	✓	✓	(1 Very short + 2 short + 1Long)
2	Chapter 2	4	4	✓	✓	-	(2 very short) or (1 short)
3	Chapter 3	3	4	-	✓	-	(2 Very short) or (1 short)
4	Chapter 4	7	10	✓	✓	✓	(1 very short +1 long) or (1 very short + 2 short)
5	Chapter 5	7	10	✓	✓	✓	(1 very short +1 long) or (1 very short + 2 short)
6	Chapter 6	7	10	✓	✓	✓	(1 very short +1 long) or (1 very short + 2 short)
7	Chapter 7	4	4	-	✓		(2 Very short) or (1 short)
	Total	45	60				

Note: All the questions in very short type must be theoretical questions. There shall be 4 very short questions each carrying 2 marks.

In Short type questions there can't be any breakdown and question can be theoretical/derivational/ numerical question. There shall be 7 short questions each carrying 4 marks.

In Long type question there can be some breakdown and questions may be numerical/Derivational/ Theoretical. There shall be 3 long questions each carrying 8 marks.

There shall be marginal marks variations in marks distribution than from the table indicated above.

Purbanchal University
Model question 2023

Program: Bachelor in Electrical Engineering
Semester: III
Subject: BEL---- **Electrical Engineering Material**

FM: 60
PM: 24
Time: 3 hours

Attempt all questions

Group-A : [4×2 = 8]

1. What do you mean by minority carrier suppression?
2. What is Seebeck effect?
3. Define magnetic permeability and write its relation with susceptibility.
4. Enumerate the characteristics of good insulating materials.

Group-B: [7×4 = 28]

5. Find the temperature at which there is 3% probability that a state 0.1 ev above the Fermi level will be occupied by an electron.
6. Derive Einstein relationship between mobility and diffusion coefficient.

7. Explain how electrical conduction takes place in gases.
8. Explain Meissner effect, critical temperature and critical field.

9. Differentiate between ferromagnetism, ferrimagnetism, para-magnetism and anti-ferromagnetism based on magnetization.
10. Explain about Richardson-Dushmann equation.
11. How a single silicon crystal is obtained by Czochralski growth method? Explain.

Group- C: [3×8 = 24]

12. Enumerate the characteristics of good insulating materials. The optical index of refraction and the dielectric constant for glass are 1.45 and 6.5 respectively. Calculate the percentage of electronic polarizability.

13. Explain the significance of work function in metals. Consider an electron in an infinite potential well of size 0.1 nm. What is the ground energy of the electron? What is the energy required to put the electron at the third energy level? How can this energy be provided?

14. Using proper mathematical expression, justify that intrinsic fermi level in semiconductor lies in the middle of the band gap if effective masses of electrons and holes are equal.

Detailed Syllabus of Electrical Engineering Materials

Note: Define (SD), Description(D), Derive (Dr), Illustration(I), Explanation(E), Application(A), Experimental (Ex), Numerical(N)

Ch No.	Topic		Subtopic	Depth								Hour	Remarks
				SD	D	DR	I	E	A	EX	N		
1	**Theory of Metal**	1.1	Wave Particle duality and De Broglie's Equations	✓	✓		✓	✓	✓		✓	1	
		1.2	Wave function and Schrodinger's equation,	✓	✓		✓					2	
		1.3	Einstein's Equations (DR), Heisenberg's Uncertainty Principles	✓	✓	✓	✓	✓	✓		✓	1	
		1.4	Tunneling phenomenon, Energy well model of a metal	✓	✓	✓	✓	✓			✓	3	
		1.5	Collection of particles, Boltzmann Classical statistics, Fermi-Dirac statistics,	✓	✓		✓	✓	✓			2	
		1.6	Free electron model, electron effective mass, energy bands, density of states,	✓	✓			✓				1	
		1.7	Fermi Energy, metal oxide contact, the seeback effect and thermocouple	✓	✓		✓	✓	✓			1	
		1.8	Thermionic Emission, Richardson-Dushman Equation, Field Assisted Emission, the Schottky effect	✓	✓		✓	✓	✓			2	
2.	**Free Electron Theory of Conduction in**	2.1	Thermal velocity of electrons	✓	✓		✓	✓			✓	1	
		2.2	Electron mobility, conductivity, resistivity	✓	✓		✓	✓			✓		

	Metals	2.3	Diffusion of Electrons, Diffusion co-efficient	✓	✓		✓	✓			✓	2	
		2.4	Einstein relationship between mobility and diffusion co-efficient	✓	✓	✓	✓	✓			✓	1	
3.	**Conduction in Liquids and Gases**	3.1	Ionic conduction in liquids	✓	✓		✓	✓				1	
		3.2	Electrical conduction in gases	✓	✓		✓	✓				1	
		3.3	Arc discharge and electric breakdown in gases	✓	✓		✓	✓				1	
4.	**Insulating and Dielectric Materials**	4.1	Definition of Insulating and Dielectric Materials, Classification of insulating material, Characteristic of good insulating materials	✓	✓			✓	✓			1	
		4.2	Polarisation and dielectric constant	✓	✓			✓					
		4.3	Clausius-Mossotti equation	✓	✓	✓		✓	✓		✓	1	
		4.4	Polarization mechanisms- ionic, electronic, interfacial and orientational polarization	✓	✓			✓				1	
		4.5	Dielectric losses, frequency and temperature effect	✓	✓		✓	✓				1	
		4.6	Dielectric breakdown in solid, liquid and gases	✓	✓		✓	✓				1	

		4.7	Application of dielectric material						✓			2	
		4.8	Ferroelectricity; Piezoelectricity	✓	✓				✓				
5.	**Magnetic Materials and Superconductivity**	5.1	Magnetization of matter, magnetic dipole moment, Atomic magnetic moments, Magnetization Vector M, Magnetising field	✓	✓			✓			✓	1	
		5.2	Magnetic permeability and Susceptibility	✓	✓			✓			✓	1	
		5.3	Magnetic material classifications (Diamagnetism, Paramagnetism, Ferromagnetism, Antiferromagnetism, Ferrimagnetism	✓	✓		✓	✓				2	
		5.4	Hysteresis loop, Hard and soft magnetic materials with examples and uses;	✓	✓		✓	✓				1	
		5.5	Superconductivity, zero resistance and Meissner effect, Type I and Type II superconductors, Critical current density	✓	✓		✓	✓				2	
6.	**Semiconducting Materials**	6.1	Intrinsic semiconductors, silicon crystal and energy band diagram, electrons and holes, electrical conduction in semiconductor,	✓	✓		✓	✓				1	
		6.2	Electron and hole concentrations in Intrinsic semiconductor	✓	✓		✓	✓				1	
		6.3	Extrinsic semiconductors, n-type and p-type semiconductor, compensation doping;	✓	✓		✓	✓				1	
		6.4	Generation and recombination of electrons and holes(Direct recombination and generation, Indirect	✓	✓		✓	✓				1	

			thermal generation and recombination), concept of lifetime										
		6.5	Diffusion in semiconductor	✓	✓		✓	✓				1	
		6.6	Einstein relationship	✓	✓	✓	✓	✓				1	
		6.7	Continuity equations for carriers	✓	✓	✓	✓	✓				1	
7.	**Semiconductor device fabrication**	7.1	Crystal growing by Czochralski method	✓	✓		✓	✓	✓			1	
		7.2	Epitaxial growth, photolithography	✓	✓		✓	✓	✓			2	
		7.3	PN junction fabrication	✓	✓		✓	✓	✓			1	

Purbanchal University

Faculty of Engineering, Biratnagar, Nepal

Syllabus

Level: Bachelor

Program: Bachelor in Biomedical/ Electrical/ Electronics Communication & Automation Engineering

Subject: MICROPROCESSOR

Subject Code: BEC----

Year: II **Semester: III**

Teaching Schedule Hours/Week					Examination Schedule						Total Marks
					Final				Internal Assessment		
					Theory		Practical		Theory Marks	Practical Marks	
Credit Hours	L	T	P	Total	Duration	Marks	Duration	Marks	40	50	150
3	3	1	3	7	3 Hrs.	60	-	-			

Note: **L:** Lecture **T:** Tutorial **P:** Practical

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 to microprocessor **(4 hours)**

1.1 Evolution of microprocessor
1.2 Microcomputer System with bus organization
1.3 Comparison among CPU, microprocessor and microcontroller
1.4 Application of microprocessors

2. Intel 8085 Microprocessor **(12 hours)**

2.1 Internal Architecture
2.2 Pin diagram and pin function
2.3 Addressing modes
2.4 Instruction Set
2.5 Instruction and machine cycle
2.6 Timing diagram for opcode fetch, memory read and write and I/O read and write
2.7 Assembly language programs of 8085, macro assembler, assembler directives and subroutine
2.8 Time delay and counter design

3. Intel 8086 Microprocessor (12 hours)

3.1 Internal Architecture
3.2 Memory segmentation
3.3 Addressing modes
3.4 Instruction Set
3.5 Fetch-execution overlap
3.6 Assembly language programs of 8086

4. Memory Interface (3 hours)

4.1 SRAM and ROM interface requirements
4.2 Address Decoding
4.3 Memory Interfacing with 8085

5. Input/output Interfaces: (9 hours)

5.1 Serial communication
5.2 Parallel communication
5.3 Programmable Peripheral Interface 8255: block diagram and mode of initialization
5.1 RS-232C standard
5.2 Programmable Communication Interface 8251: block diagram

6. Interrupt: (5 hours)

6.1 Basic Interrupt processing
6.2 Types of interrupt
6.3 Interrupt priority: polled and chained interrupt
6.4 DMA: block diagram and Timing diagram

Laboratory

1. Familiarization with 8085 microprocessor trainer kit and simulator
2. Data transfer instructions
3. Arithmetic and logical instructions
4. Subroutine and branching instructions
5. Stack operations
6. Timers and delay
7. Code conversion
8. Familiarization with assembly language program, assembling and macro assembler (MASM)
9. Operations related to data transfer, arithmetic and logical instruction in 8086
10. Operation related to case conversion (Upper case to lower case and vice-versa)

References:

1. Ramesh S. Gaonkar, ”Microprocessor – Architecture, Programming & Applications with the 8085”, Penram International Publisher, 5th Ed., 2006
2. Douglas V. Hall, “Microprocessors & Interfacing: Programming & Hardware”, 2nd Ed., Tata McGraw Hill, 2006
3. Ghosh, P. K., Sridhar P. R.,"*0000 to 8085: Introduction to Microprocessors for Engineers and Scientists*", Second Edition, Prentice Hall of India Private Limited, 1997.
4. " Lance, A. Leventhal., "*Introduction to Microprocessors: Software, Hardware, and Programming*”, Eastern Economy Edition, Prentice Hall of India Private Limited, 1995.
5. Malvino, A. P., "*An Introduction to Microcomputers*", Prentice Hall of India Private Limited, 1995.

Detailed Syllabus of **Microprocessor:**

Note: Define(SD), Description (D), Derive (Dr), Illustration (I), Explanation (E), Application (A), Experimentation (Ex), Numerical (N)

Detailed Course Contents:

Ch No.	Topic		Subtopic	Depth								Hour	Remarks
				SD	D	DR	I	E	A	EX	N		
1	Introduction	1.1	Evolution of microprocessor		✓							4	
		1.2	Microcomputer System with bus organization				✓	✓					
		1.3	Comparison among CPU, microprocessor and microcontroller				✓	✓					
		1.4	Application of microprocessors						✓				
2	Intel 8085 Microprocessor	2.1	Internal Architecture				✓	✓				12	
		2.2	Pin diagram and pin function				✓	✓					
		2.3	Addressing modes				✓	✓					
		2.4	Instruction Set				✓	✓					

		2.5	Instruction and machine cycle				✓	✓					
		2.6	Timing diagram for opcode fetch, memory read and write and I/O read and write		✓		✓	✓					
		2.7	Assembly language programs of 8085, macro assembler, assembler directives and subroutine				✓	✓					
		2.8	Time delay and counter design				✓	✓					
3	Intel 8086 Microprocessor	3.1	Internal Architecture				✓	✓				**12**	
		3.2	Memory segmentation		✓								
		3.3	Addressing modes		✓		✓	✓					
		3.4	Instruction Set		✓		✓	✓					
		3.5	Fetch-execution overlap		✓		✓	✓					
		3.6	Assembly language programs of 8086				✓	✓					
4	Memory Interface	4.1	SRAM and ROM interface requirements				✓	✓				**3**	
		4.2	Address Decoding				✓	✓					
		4.3	Memory Interfacing with 8085				✓	✓					

5	Input/output Interfaces	5.1	Serial communication		✓		✓	✓				**9**	
		5.2	Parallel communication		✓		✓	✓					
		5.3	Programmable Peripheral Interface 8255: block diagram and mode of initialization				✓	✓					
		5.4	RS-232C standard		✓		✓	✓					
		5.5	Programmable Communication Interface 8251: block diagram				✓	✓					
6	Interrupt	6.1	Basic Interrupt processing		✓							**5**	
		6.2	Types of interrupt		✓		✓	✓					
		6.3	Interrupt priority: polled and chained interrupt		✓		✓	✓					
		6.4	DMA: block diagram and Timing diagram				✓	✓					
Note: Define(SD), Description (D), Derive (Dr), Illustration (I), Explanation (E), Application (A), Experimentation (Ex), Numerical (N)													

Laboratory

1. Familiarization with 8085 microprocessor trainer kit and simulator
2. Data transfer instructions
3. Arithmetic and logical instructions
4. Subroutine and branching instructions
5. Stack operations
6. Timers and delay
7. Code conversion
8. Familiarization with assembly language program, assembling and macro assembler (MASM)

9. Operations related to data transfer, arithmetic and logical instruction in 8086
10. Operation related to case conversion (Upper case to lower case and vice-versa)

References:

1. Ramesh S. Gaonkar, "Microprocessor – Architecture, Programming & Applications with the 8085", Penram International Publisher, 5th Ed., 2006
2. Douglas V. Hall, "Microprocessors & Interfacing: Programming & Hardware", 2nd Ed., Tata McGraw Hill, 2006
3. Ghosh, P. K., Sridhar P. R.,"*0000 to 8085: Introduction to Microprocessors for Engineers and Scientists*", Second Edition, Prentice Hall of India Private Limited, 1997.
4. " Lance, A. Leventhal., "*Introduction to Microprocessors: Software, Hardware, and Programming*", Eastern Economy Edition, Prentice Hall of India Private Limited, 1995.
5. Malvino, A. P., "*An Introduction to Microcomputers*", Prentice Hall of India Private Limited, 1995.

Final Examination Scheme:

Chapters	Marks	Remarks
1	4	
2	18	
3	14	
4	4	
5	12	
6	8	
Total	60	

Note: There might be minor deviation in mark distribution.
Mandatory: Marks should be evaluated based on solving steps.

Evaluation Scheme;
Marks Division

Question Type	No. of Questions	Marks	Total Marks
Short	4	2	8
Medium	7	4	28
Long	3	8	24
Total			60

Purbanchal University
Model question 2023

Program: Bachelor in Biomedical/ Electrical/ Electronics Communication & Automation Engineering
Semester: III
Subject: BEC---- Microprocessor

FM: 60
PM: 24
Time: 3 hours

Attempt all questions.

Group A [2X4=8]

1. "Microprocessor is commonly known as CPU", justify the statement. Also if the microprocessor is of 8 bits, what does it specify? [2]
2. What are the general characteristics of microprocessor? Explain in brief. [2]
3. What is I/0 interface? Why it is needed? [2]
4. Differentiate between Register based and accumulator based microprocessor. [2}

Group B [4X7=28]

1. What do you mean by flag register in 8085A microprocessor? Explain in brief with example. [1+3]
2. Draw a timing diagram for the instruction MVI M, 11H such that the instruction is in the location BFFFH and the op-code as 67H. [4]
3. WAP in 8085 for 10ms of delay. [4]
4. What is addressing modes? Also explain any six addressing modes of 8086 microprocessor in brief. [1+3]

5. Interface a 4KB ROM and two 8KB RAM memory chip with 8085 microprocessor. Also illustrate the address range of the chip. [4]
6. What happen when microprocessor is interrupted? Classify the interrupt on the basis of priority. [1+3]
7. Differentiate between maskable and non-maskable interrupt. [4]

Group C [8X3=24]

1. WAP in 8085 to provide the given on/off time to three traffic lights (Green, Yellow and Red) and two pedestrian signs (WALK and DON'T WALK). The signal lights and signs are turned on/off by the data bits of an output port as shown below.

S.N	Lights	Data Bits	On Time
1	Green	D0	15seconds
2	Yellow	D2	5 seconds
3	Red	D4	20 seconds
4	WALK	D6	15 seconds
5	DON'T WALK	D7	25 seconds

The traffic and pedestrian flow are in the same direction, the pedestrian should cross the road when the green light is on. [8]

OR

Write a program in 8086 that will display the string "electronics in purbanchal university".Also display each word in next line in uppercase. [8]

2. Write a block diagram of 8255 PPI. Also explain the function of each block in brief along with control word. [8]

3. Draw the internal architecture of 8086 microprocessor. Explain about its two units along with general registers and PSW. [8]

OR

Write a program in 8086 that will display the string “ExerCise”. Also count the number of vowels and store it at variable count. [8]