CURRICULUM

DIPLOMA

Electronics Engineering

(Three year program-semester system)

Council for Technical Education and Vocational Training

Curriculum Development & Equivalence Division

Sanothimi, Bhaktapur

2008

First Revised, 2014

Second Revised, 2022

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Introduction

Electronics Engineering is one of the prominent and popular disciplines within engineering. Many people in the developed countries, developing countries and under developed countries have given emphasis for the broader application of electronics appliances. This field has been helping the world for the technicological development and it has been creating wage and self-employment opportunities both in public and private sectors. This curriculum is designed with the purpose of producing the middle level technical workforce equipped with knowledge and skills related to the field of electronics engineering so as to meet the demand of such workforce in the country to contribute in the national economic development of Nepal. The knowledge and skills incorporated in this curriculum will be helpful to deliver the individual needs as well national needs in the field of electronics engineering.

Rationale of Revision

Diploma in Electronics Engineering curriculum was developed in 2008 and last revised in 2014. This is the second revision after the implementation of its first revision. The rationales behind its revision are as follows:

- It crossed the 5 years maturity period of its implementation after the 1st revision and similarly the implementing agencies/colleges have requested to revise this curriculum based on their teaching experiences.
- The year-wise re-adjustments of the existing subjects are felt necessary.
- Some new subjects seem to be introduced as per the advancement in technology.
- It is needed to revisit its weightage in both theory and practical marks and contents to make it more practical oriented.
- Industrial Attachment requirement needs to be added.
- The technologies invented in the field of Electronics are necessary to incorporated**.**

Furthermore, technology of Electronics occupation upgraded rapidly and new technology are introduced in the recent year. With the advent in technology trained technicians are needed throughout the world. To cope with the national and international demand, the knowledge and the skills should be updated to make the skills relevant and pertinent to the industry. Hence this curriculum is revised to equip the students as per the changing technology in changing environmental context.

Curriculum title

Diploma in Electronics Engineering (DEX)

Aim

The program aims to produce mid-level technical human resource equipped with knowledge and skills in allied field of study.

Objectives
This curriculum has following objectives:

- To produce the middle level competent technical workforce/human resource (Technical and Supervisory staffs) in electronics engineering.
- To prepare technicians who are able to work in the industrial settings of the country.
- To prepare technical workforce who will demonstrate positive attitude and respect for the profession and socio-cultural values.
- To help meet the demand of technical workforce for the industries of Nepal.
- To reduce the dependence on employing technicians from foreign countries.
- To Create self-employment opportunities.

Group Size
The group size is a maximum 48 students.

Entry Criteria

- SLC pass or SEE or equivalent with minimum C Grade (2.0 Grade Point) in Mathematics and Science and 1.6 Grade Point or equivalent in English and as per the provisions mentioned in the admission guidelines of Office of the Controller of Examinations, CTEVT.
- Pre-diploma in related subject or equivalent with minimum 68.33%.
- Pass entrance examination administered by CTEVT.

Duration
The total duration of this curricular program is three academic years [six semesters]. The program is based on semester system. Moreover, one semester consists of 19.5 academic weeks including evaluation period. Actual teaching learning Hrs. will be not less than 15 weeks in each semester.

Medium of Instruction
The medium of instruction will be in English and/or Nepali.

Pattern of Attendance
Minimum of 90% attendance in each subject is required to appear in the respective final examination.

Teacher (Instructor) and Student Ratio
The ratio between teachers and students must be:

- Overall ratio of teacher and student must be 1:12 (at the institution level)
- 1:48 for theory and tutorial classes
- 1:12 for practical classes
- 1:8 for bench work
- 75 % of the technical teachers should be full timer.

Qualification of Instructional Staff

- The program coordinator should be a master's degree holder in the related subject area.
- The disciplinary subject related teachers should be a bachelor's degree holder in the related subject area.
- The demonstrators should be a bachelor's degree holder or diploma or equivalent with 3 years work experience in the related subject area.
- The foundational subject related teacher (refer to course codes SH and MG) should be master's degree holder in the related subject area.

Instructional Media and Materials

The following instructional media and materials are suggested for the effective instruction and demonstration.

- ***Printed media materials:*** Assignment sheets, case studies, handouts, performance checklists, textbooks etc.
- ***Non-project media materials:*** Displays, models, photographs, flipchart, poster, writing board etc.
- ***Projected media materials****:* Slides, Multimedia Projector.
- ***Audio-visual materials:*** Audiotapes, films, slide-tapes, videodisc, etc.
- ***Computer based instructional materials:*** Computer based training, interactive video etc.
- **Web-Based Instructional Materials** (Online learning)
- **Radio/Television/Telephone**
- **Education-focused social media platform**.

Teaching Learning Methodologies

The methods of teachings for this curricular program will be a combination of several approaches such as; illustrated lecture, tutorial, group discussion, demonstration, simulation, guided practice, fieldwork, block study, industrial practice, report writing, term paper presentation, heuristic and other independent learning exercises.

- **Theory**: Lecture, Group discussion, assignment and group work etc.
- **Practical**: Demonstration, observation and self-practice.
  Internship: Industrial Practice.

Approach of Learning

There will be inductive, deductive and learner-centered approaches of learning.

Examination and Marking Scheme

a. Internal assessment

- There will be an evaluation system for each subject both in theory and practical exposure.
- Each subject will have internal assessment at regular intervals and students will get the feedback about it.
- Weightage of theory and practical marks are mentioned in course structure.
- Continuous assessment format will be developed and applied by the evaluators for evaluating student's performance in the subjects related to the practical experience.

b. Final examination

- Weightage of theory and practical marks are mentioned in course structure.
- Students must pass in all subjects both in theory and practical for certification. If a student becomes unable to succeed in any subject, s/he will appear in the re-examination administered by CTEVT.
- Students will be allowed to appear in the final examination only after completing the internal assessment requirements.

c. Requirement for final practical examination

- Professional of relevant subject instructor must evaluate final practical examinations.
- One evaluator in one setting can evaluate not more than 24 students.
- Practical examination will be administered in actual situation on relevant subject with the provision of at least one internal evaluator from the concerned or affiliating institute led by external evaluator nominated by CTEVT.
- Provision of re-examination will be as per CTEVT policy.

d. Final practicum evaluation will be based on:

- Institutional practicum attendance - 10%
- Logbook/Practicum book maintenance - 10%
- Spot performance (assigned task/practicum performance/identification/arrangement preparation/measurement) - 40%
    - Viva voce :
        - Internal examiner - 20%
        - External examiner - 20%

e. Pass marks:

- The students must secure minimum 40% marks in theory and 50% marks in practical. Moreover, the students must secure minimum pass marks in the internal assessment and in the semester final examination of each subject to pass the subject.

Provision of Back Paper

There will be the provision of back paper but a student must pass all the subjects of all semester within six years from the enrollment date; however, there should be provision of chance exam for final semester students as per CTEVT rules.

Disciplinary and Ethical Requirements

- Intoxication, insubordination or rudeness to peers will result in immediate suspension followed by the review of the disciplinary review committee of the institute.
- Dishonesty in academic or practical activities will result in immediate suspension followed by administrative review, with possible expulsion.
- Illicit drug use, bearing arms in institute, threats or assaults to peers, faculty or staff will result in immediate suspension, followed by administrative review with possible expulsion.

Grading System
The grading system will be as follows:

Grading	Overall marks
• Distinction:	80% and above
• First division:	65% to below 80%
• Second division:	50 % to below 65%
• Pass division:	Pass marks to Below 50%

Certificate Awarded

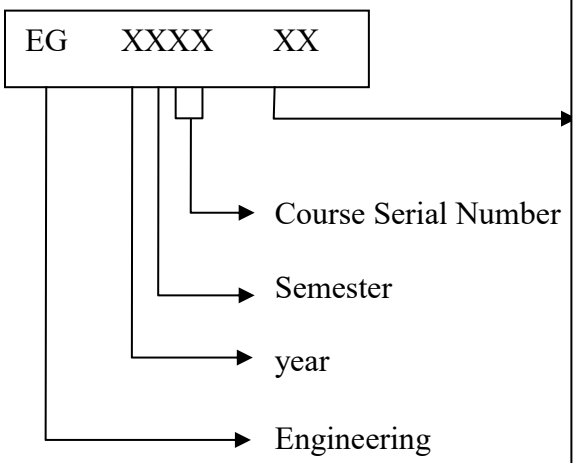
- Students who have passed all the components of all subjects of all 6 semesters are considered to have successfully completed the program.
- Students who have successfully completed the program will be awarded with a degree of "**Diploma in Electronics Engineering**".

Career Path
The graduates will be eligible for the position equivalent to Non-gazetted 1st class/Level 5 (technical) as prescribed by the Public Service Commission of Nepal and other related agencies.

General Attitudes Required
A student should demonstrate following general attitudes for effective and active learning.
Acceptance, Affectionate, Ambitious, Aspiring, Candid, Caring, Change, Cheerful, Considerate, Cooperative, Courageous, Decisive, Determined, Devoted, Embraces, Endurance, Enthusiastic, Expansive, Faith, Flexible, Gloomy, Motivated, Perseverance, Thoughtful, Forgiving, Freedom, Friendly, Focused, Frugal, Generous, Goodwill, Grateful, Hardworking, Honest, Humble, Interested, Involved, Not jealous, Kind, Mature, Open minded, Tolerant, Optimistic, Positive, Practical, Punctual, Realistic, Reliable, Distant, Responsibility, Responsive, Responsible, Self-confident, Self-directed, Self-disciplined, Self-esteem, Self-giving, Self-reliant, Selfless, Sensitive, Serious, Sincere, Social independence, Sympathetic, Accepts others points of view, Thoughtful towards others, Trusting, Unpretentiousness, Unselfish, Willingness and Work-oriented.

Subjects Codes

Each subject is coded with a unique number preceded and followed by certain letters as mentioned in following chart:



Code of Offering Diploma Programmes:

1. AGE: Agricultural Engineering
2. AR: Architecture Engineering
3. AE: Automobile Engineering
4. BM: Biomedical Engineering
5. BM: Biomedical Equipment Engineering
6. CE: Civil Engineering
7. CT: Computer Engineering
8. EE: Electrical Engineering
9. EEX: Electrical & Electronics Engineering
10. EX: Electronics Engineering
11. GE: Geomatics Engineering
12. HE: Hydropower Engineering
13. IT: Information Technology
14. MG: Management
15. ME: Mechanical Engineering
16. MX: Mechatronics Engineering
17. RAE: Refrigeration & Air Conditioning Engineering
18. SH: Science and Humanities

CURRICULUM STRUCTURE
Diploma in Electronics Engineering

YEAR: I **PART: I**

S.N	Code No.	Subjects	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	DISTRIBUTION OF MARKS							
									Theory			Practical				
			L	T	P	Lab			*Asmt Marks	Final Marks	Exam Hours	*Asmt Marks	Final Marks	Exam Hours		
1	EG 1101 SH	Applied Nepali	4				4	4	20	80	3				100	*Continuous assessment
2	EG 1102 SH	Applied English	4				4	4	20	80	3				100	
3	EG 1103 SH	Engineering Mathematics I	4	2			6	4	20	80	3				100	
4	EG 1104 SH	Engineering Physics I	4	2		2	8	5	20	60	3	10	10	2	100	
5	EG 1105 SH	Engineering Chemistry I	4	2		2	8	5	20	60	3	10	10	2	100	
6	EG 1101 AR	Engineering Drawing I	1		4		5	3	0	0		60	40	4	100	
7	EG 1101 CT	Computer Application	2		2		4	3	10	40	1.5	30	20	3	100	
TOTAL			**23**	**6**	**6**	**4**	**39**	**28**							**700**	

YEAR: I **PART: II**

S.N	Code No.	Subjects	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hours	Credit Hours	DISTRIBUTION OF MARKS							
									Theory			Practical				
			L	T	P	Lab			*Assmt Marks	Final Marks	Exam Hours	*Assmt Marks	Final Marks	Exam Hours		
1	EG 1201 SH	Engineering Mathematics II	4	2			6	4	20	80	3				100	*Continuous assessment
2	EG 1202 SH	Engineering Physics II	4	2		2	8	5	20	60	3	10	10	2	100	
3	EG 1203 SH	Engineering Chemistry II	4	2		2	8	5	20	60	3	10	10	2	100	
4	EG 1201 CE	Workshop Practice I	2		6		8	5	0	0		60	40	4	100	
5	EG 1201 AR	Engineering Drawing II	0		4		4	2	0	0		60	40	4	100	
6	EG 1202 CE	Applied Mechanics	3	2		2/2	6	4	20	60	3	20	0		100	
TOTAL			**17**	**8**	**10**	**5**	**40**	**25**							**600**	

Diploma in Electronics Engineering

YEAR: II **PART I**

S.N	Code No.	Subjects	Teaching Scheme						Examination Scheme							Remarks
			Mode				Weekly Hrs	Credit Hrs	DISTRIBUTION OF MARKS						Total Marks	
									Theory			Practical				
			L	T	P	Lab			*Assmt Marks	Final Marks	Time Hrs	*Assmt Marks	Final Marks	Time Hrs		
1	EG 2101 EX	Electronics Devices and Circuit I	4	1	3		8	6	20	80	3	60	40	3	200	*Continuous assessment
3	EG 2102 EX	Computer Programming	3	1	3		7	5	20	80	3	60	40	3	200	
4	EG 2103 EX	Electrical Technology	3	1	3		7	5	20	80	3	60	40	3	200	
2	EG 2104 EX	Digital Electronics I	4		3		7	6	20	80	3	60	40	3	200	
7	EG 2105 EX	Audio & Video Systems			3		3	2				60	40	3	100	
5	EG 2106 EX	Electronic Engineering Materials	3				3	3	20	80					100	
6	EG 2107 EX	Electrical Installation	1		4		5	3				60	40	3	100	
			18	**3**	**19**		**40**	**30**							**1100**	

YEAR: II **PART II**

S.N	Code No.	Subjects	Teaching Scheme						Examination Scheme							Remarks
			Mode				Weekly Hrs	Credit Hrs	DISTRIBUTION OF MARKS						Total Marks	
									Theory			Practical				
			L	T	P	Lab			*Assmt Marks	Final Marks	Time Hrs	*Assmt Marks	Final Marks	Time Hrs		
1	EG 2201 EX	Electronic Devices and Circuit II	4		3		7	6	20	80	3	60	40	3	200	*Continuous assessment
2	EG 2202 EX	Analog Communication System	4		3		7	6	20	80	3	60	40	3	200	
3	EG 2203 EX	Microprocessor and Peripheral Devices	3		3		6	5	20	80	3	60	40	3	200	
4	EG 2204 EX	Digital Electronics II	3		3		6	5	20	80	3	60	40	3	200	
5	EG 2205 EX	Electronic Instruments and Measurement	3		3		6	5	20	80	3	60	40	3	200	
6	EG 2206 EX	Repair and Maintenance of Electronics Appliances I			5		5	3				100	50	3	150	
7	EG 2207 EX	Minor Project			3		3	2				60	40	3	100	
			17		**23**		**40**								**1250**	

Diploma in Electronics Engineering

YEAR: III **PART I**

S.N	Code No.	Subjects	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hrs	Credit Hrs	DISTRIBUTION OF MARKS							
									Theory			Practical				
			L	T	P	Lab			*Assmt Marks	Final Marks	Time Hrs	*Assmt Marks	Final Marks	Time Hrs		
1	EG 3101 EX	Digital Communication System	3		3		6	5	20	80	3	60	40	3	200	*Continuous assessment
2	EG 3102 EX	Computer Network	3		3		6	5	20	80	3	60	40	3	200	
3	EG 3103 EX	Microcontroller and Embedded System	3		3		6	5	20	80	3	60	40	3	200	
4	EG 3104 EX	Optical Fiber Communication	3		3		6	5	20	80	3	60	40	3	200	
5	EG 3105 EX	Power Electronics	3		3		6	5	20	80	3	60	40	3	200	
6	EG 3106 EX	Repair and Maintenance of Electronics Appliances II			4		4	2				60	40	3	100	
7	EG 3107 EX	Industrial Attachment			6		6	3				100	50	4		
			15		**25**		**40**	**30**							**1250**	

YEAR: III **PART II**

S.N	Code No.	Subjects	Teaching Scheme						Examination Scheme						Total Marks	Remarks
			Mode				Weekly Hrs	Credit Hrs	DISTRIBUTION OF MARKS							
									Theory			Practical				
			L	T	P	Lab			*Assmt Marks	Final Marks	Time Hrs	*Assmt Marks	Final Marks	Time Hrs		
1	EG 3201 EX	Wireless and Mobile Communication	4		3		7	6	20	80	3	60	40	3	200	*Continuous assessment
2	EG 3202 EX	Programmable Logic Controller (PLC)	3		3		6	5	20	80	3	60	40	3	200	
3	EG 3203 EX	Medical Electronics	3		3		6	5	20	80	3	60	40	3	200	
4	EG 3204 EX	Major Project			9		9	5				120	80	8	200	
5	EG 3201 MG	Entrepreneurship Development	3		2		5	4	20	60	3	10	10	2	100	
6		Elective: One of the following	4		3		7	6	20	80	3	60	40		200	
	EG 3205 EX.1	a. Microwave and Radar Engineering														
	EG 3205 EX.2	b. Renewable Energy Technology														
	EG 3205 EX.3	c. Imaging Technology Equipment														
	EG 3205 EX.4	d. Electric Vehicle Technology														
			17		**23**		**40**	**31**							**1100**	

L=Lecture, T=Tutorial, P=Practical

First Year (First and Second Semester)

[See Separate Curriculum]
First Year Engineering All
(Year I Part I and Year I Part II)

Second Year

Part I & II

(Third and Fourth Semester)

Third Semester
Year II Part I

Subjects:

1	EG 2101 EX	Electronics Devices and Circuit I
3	EG 2102 EX	Computer Programming
4	EG 2103 EX	Electrical Technology
2	EG 2104 EX	Digital Electronics I
7	EG 2105 EX	Audio & Video Systems
5	EG 2106 EX	Electronic Engineering Materials
6	EG 2107 EX	Electrical Installation

Electronics Devices and Circuits I

EG 2101 EX

Total: 7 hours/week

Year: II **Lecture: 4 hours/week**

Part: I **Tutorial: 1 hours/week**

Practical: 3 hours/week

Lab: hours/week

Course Description:

This course deals with various types of electronic devices and circuits required for the electronic works**.**

Course Objectives:

On completion of this course the students will be able to:

1. Identify and explain the working principles of various semiconductor devices, relate their characteristics and applications.
2. Explain the characteristics of CB, CE and CC configuration circuits.
3. Identify and explain the working of transistors in various configurations;

Course Contents:

Unit 1. Semi conductor physics: 7 hrs

1.1. Review of basic atomic structure and energy levels.
1.2. Concept of insulators, conductors and semi- conductors.
1.3. Atomic structure of Ge and Si, covalent bonds concept of intrinsic and extrinsic semi- conductor.
1.4. P and N impurities, Doping of impurity.
1.5. P and N type semiconductors and their conductivity.
1.6. Effect of temperature on conductivity of intrinsic semi conductor.
1.7. Energy level diagram of conductors, insulators and semi conductors.
1.8. Minority and majority carriers.

Unit 2. Semi conductor diode: 10 hrs

2.1 PN junction diode, mechanism of current flow in PN junction, Drift and diffusion current, depletion layer, forward and reverse biased PN junction, potential barrier, and concept of junction capacitance in forward and reverse bias condition.
2.2 V-I characteristics, static and dynamic resistance and their calculation from diode characteristics.
2.3 Types of diodes, their brief characteristics and applications.
2.4 Diode as half wave, full wave and bridge rectifier (PIV), rectification efficiencies and ripple factor calculations).
2.5 Filters: shunt capacitor filter, series inductor filter and LC filter.
2.6 Zener and avalanche breakdown.

Unit 3. Introduction to Bipolar Junction transistor: 10 hrs

3.1 Concept of bipolar junction transistor, structure, PNP and NPN transistor, their symbols and mechanism of current flow.
3.2 Current relations in transistor, concept of leakage current.
3.3 CB, CE, CC configuration of the transistor.
3.4 Input and output characteristics in CB and CE configurations, input and output dynamic resistance in CB and CE configurations, Current amplification factors.
3.5 Comparison of CB CE and CC Configurations.
3.6 Transistors as an amplifier in CE Configurations, d.c load line and calculation of current gain, voltage gain using d.c load line.

Unit 4. Transistor biasing Circuits: 6 hrs

4.1. Concept of transistor biasing and selection of operating point.
4.2. Different types of operating point, need for stabilization of operating point.

Unit 5. Single stage transistor amplifier: 10 hrs

5.1. Single stage transistor amplifier circuit, a.c load line and its use in calculation of currents and voltage gain of a single stage amplifier circuit.
5.2. Explanation of phase reversal of output voltage with respect to input voltage.
5.3. h- Parameters and their significance.
5.4. Calculation of current gain, voltage gain, input impedance and output impedance using h-parameter.

Unit 6. Field Effect Transistors 8 hrs

6.1. Construction.
6.2. Operation and characteristics of FET.
6.3. Operation and characteristics of MOSFET in depletion and Enhancement mode.
6.4. CMOS- advantages and applications.
6.5. Comparison of JFET, MOSFET and BJT.
6.6. FET amplifier circuit and its working principle. (No Derivation)

Unit 7. Special Semiconductor Devices 9 hrs

7.1. LED and LCD, charactersitcs and applications.
7.2. Photo transistor and Photo cell, characteristics and applications.
7.3. Optocoupler and isolator brief introduction.
7.4. Hall Effect Devices brief introduction and application.
7.5. Solid state relays, their principle and application.

Practical /Laboratory: 45 hrs

1. Familiarization with operation of following instruments: Multi-meter, CRO, Signal generator, Regulated Power Supply by taking readings of relevant electrical quantities.
2. Plot V-I characteristics for PN junction diode.
3. Plot V-I characteristics of Zenor diode.

4. Plot the waveform of following rectifier circuit
    a. Half wave rectifier
    b. Full wave rectifier
    c. Bridge rectifier
    d. Shunt capacitor filter
    e. Series inductor filter f. Filter
5. Transistor as a switch.
6. Plot input and output characteristics and calculate parameters of transistors in CE configuration.
7. Plot input and output characteristics and calculate of parameters of transistors in CB configuration.
8. Plot V-I characteristics of FET amplifier.
9. Measure the Q-Point and note the variation of Q-Point.
a. By increasing the base resistance in fixed bias circuit.
b. By changing out of bias resistance in potential divider circuit.
10. Measure the Voltage Gain, input, output impedance in single state CE amplifier circuit.

References:

1. Basic Electronics and Linear Circuit by NN Bhargava and Kulshreshta, Tata McGraw Hill, New Delhi.
2. Principles of Electrical and Electronics Engineering by VK Mehta; S Chand and Co., New Delhi

Marks Specification for final examination:

Unit	Content	Course Hours	Marks
1	Semi conductor physics	7	9
2	Semi conductor diode	10	14
3	Introduction to Bipolar transistor	10	14
4	Transistor biasing Circuits	6	8
5	Single stage transistor amplifier	10	14
6	Field effect Transistors	8	10
7	Special Semiconductor Devices	9	11
	Total	**60**	**80**

Note: There might be minor deviation on the above specified marks.

Digital Electronics I

EG 2104 EX

Total :7 hours/week

Year :II **Lecture :4 hours/week**

Part :I **Tutorial :hours/week**

Practica :3 hours/week

Course description:

This course deals on the basic concepts of digital electronics. It also imparts knowledge on number systems, logic gates, various codes, parities, Boolean algebra, mux and demux, filp-flop, counters and shift registers.

Course Objectives:

After completing this course the students will be able to

1. Design methods for combinational logic circuit.
2. Verify truth tables of basic gates and universal gates.
3. Design concept of sequential logic circuits.
4. Design problem based /predefined logic based circuits.

Course Contents:

Unit 1: Introduction **2 hrs**

1.1 Define digital and analog signals and systems; differentiate between analog and digital signals.

1.2 Need of digitization and applications of digital systems.

Unit 2: Number Systems **9 hrs**

2.1 Decimal, binary, octal and hexadecimal number systems

2.2 Conversion of number from one number system to another including decimal points.

2.3 Binary addition, subtraction, multiplication and division, 1's and 2's complement method of subtraction.

2.4 BCD code numbers and their limitations, addition of BCD coded numbers, conversion of BCD to decimal and vice-versa.

2.5 Excess-3 code, gray code, binary to gray and gray to binary conversion.

2.6 Concept of parity, single and double parity, error detection and correction using parity.

Unit 3: Logic Gates **4 hrs**

3.1 Logic gates, positive and negative logic, pulse waveform, definition, symbols, truth tables, operation of NOT, OR, AND, NAND, NOR, EX-OR and EX-NOR gates.

3.2 Realization of NAND and NOR as universal logic gates.

Unit 4: Logic Simplification **8 hrs**

4.1. Rules and laws of Boolean algebra, logic expression, De Morgan's theorems and their proof.

4.2. Sum of products form (minterm), Product of sum form (maxterms), simplification of Boolean expressions with the help of Rules and laws of Boolean algebra.

4.3. Karnaugh mapping techniques up to 4 variables and their applications for simplification of Boolean expression.

Unit 5: Arithmetic Circuits **3 hrs**

5.1. Half adder, full adder circuits and their operation.

5.2. Block diagram and operation of Parallel binary adder (2-bit and 4-bit).

Unit 6: Multiplexer/Demultiplexer **4 hrs**

6.1. Basic functions, symbols and logic diagrams of 4-inputs and 8-inputs multiplexers.

6.2. Function/utility of 16 and 32 inputs multiplexers.

6.3. Realization of Boolean expression using multiplexer/demultiplexers.

Unit 7: Decoders, Display Devices and Associated Circuits **4 hrs**

7.1. Basic Binary decoder, 4-line to 16-line decoder circuit.

7.2. BCD to decimal decoder, BCD to 7-segment decoder/driver, LED/LCD display.

Unit 8: Encoders and Comparators **4 hrs**

8.1. Encoder, decimal to BCD encoder, decimal to BCD priority encoder, keyboard encoder.

8.2. Magnitude comparators, symbols and logic diagrams of 2-bit and 4-bit comparators.

Unit 9: Latches and Flip-Flops **6 hrs**

9.1. Latch, SR-latch, D-latch, Flip-flop, difference between latch and flip-flop.

9.2. S-R, D flip-flop their operation using waveform and truth tables, race around condition.

9.3. JK flip-flop, master slave and their operation using waveform and truth tables.

9.4. T flip-flops.

Unit 10: Counters **8 hrs**

10.1. Asynchronous counter, 4-bit Asynchronous counter, Asynchronous decade counter.

10.2. Synchronous counter, 4-bit synchronous binary counter, synchronous decade counter.

10.3. Up/down Asynchronous counters, divide by N counter MOD-3, MOD-5, MOD-7, MOD-12 counters.

10.4. Ring counter, cascaded counter, counter applications.

Unit 11: Shift Registers **8 hrs**

11.1. Shift registers functions, serial-in-serial out, serial-in-parallel-out, parallel-in-serial-out, parallel-in-parallel out.

11.2. Universal shift register, shift register counter and applications of shift registers.

Practical /Laboratory: **45 hrs**

1. Study of logic breadboard with verification of truth table for AND, OR, NOT, NAND, EX-OR, NOR gate.
2. Verification of NAND and NOR gate as universal gates.
3. Construction of half-adder and full adder circuits using EX-OR and NAND gate and verification of their operation.
4. Verify the operation of
    a) Multiplexer using an IC.
    b) De-multiplexer using an IC.
5. Verify the operation of
    a) BCD to decimal decoder using an IC.
    b) BCD to 7 segment decoder using an IC.
6. Verify operation of SR, JK, D-flip-flop master slave JK filp-flop using IC.
7. Verify operation of SISO, PISO, SIPO, PIPO shift register (universal shift register).
8. Study of ring counter, Up/down counter.
9. Construct and verify the operation of an asynchronous binary decade counter using JK flip-flop.
10. Verification of truth tables and study the operation of tristate buffer IC 74126 or similar IC and construction of 4/8 bit bi-directional bus by using an IC.
11. Testing of digital ICs using IC tester.

References:

1. Digital Electronics and Applications by Malvino Leach, Tata McGral Hill, New Delhi
2. Digital Logic Designs by Morris Mano, Prentice Hall of India, New Delhi
3. Digital Fundamentals by Thomas Floyds, Universal Book Stall
4. Digital Electronics by RP Jain, Tata McGraw Hill, New Delhi
5. Digital Electronics by KS Jamwal, Dhanpat Rai & Co., New Delhi
6. Digital Electronics by Rajiv Sapra, Ishan Publication, Ambala
7. Digital Electronics by BR Gupta, Dhanpat Rai & Co., New Delhi
8. Digital Systems: Principles and Applications by RJ Tocci, Prentice Hall of India, New Delhi
9. Digital Electronics by Rajaraman V., Prentice Hall of India, New Delhi

Marks Specification for final examination

Unit	Content	Course Hours	Marks
1	Introduction	2	3
2	Number Systems	9	12
3	Logic Gates	4	5
4	Logic Simplification	8	11
5	Arithmetic Circuits	3	4
6	Multiplexer/Demultiplexer	4	5
7	Decoders, Display Devices and Associated Circuits	4	5
8	Encoders and Comparators	4	5
9	Latches and Flip-Flops	6	8
10	Counters	8	11
11	Shift Registers	8	11
	Total	**60**	**80**

***Note**: **There might be minor deviation on the above specified marks**.*

Computer Programming
EG 2102 EX

Total: 7 hours/week
Year: II **Lecture: 3 hours/week**
Part: I **Tutorial: 1 hours/week**
Practical: 3 hours/week

Course description:

This course deals with the fundamentals of computer Programming. The student will learn the effective use of the C programming language syntax to develop special programs, and provide I/O control for special applications.

Course Objectives:

After completing this course the student will be able to:

1. Discuss the basic skills needed in programming.
2. Write, compile, debug and run a program in C.
3. Discuss the data types in C.
4. Use the functions in C.
5. Use different control structures.
6. Use Arrays, Strings and Pointers in their programs.
7. Use input/output statements in a program.
8. Read/write/search in a file through a C program.

Course Contents:

Unit 1. Introduction to Computer Program **5 hrs**

1.1 Program and Programming languages.
1.2 Types of Programming languages.
- Low level languages (Machine language and assembly language).
- High level languages.

1.3 Problem Solving Using Computer.
- Problem Analysis.
- Algorithm Development and Flowcharts.
- Coding
- Compilation and Execution
- Debugging and Testing
- Program Documentation

1.4 Different Programming Techniques
- Procedural Programming
- Modular Programming
- Object Oriented Programming

Unit 2. Introduction to C **5 hrs**

2.1 Basic structure of a C program
2.2 Character set, Keywords, Identifiers, Rules for naming identifiers
2.3 Constants, Variables, Data Types
2.4 Enumerated Data Types
2.5 Expressions, Statements and Comments
2.6 Concepts of Header files and Preprocessors

Unit 3. Input and Output **2 hrs**

3.1 Formatted I/O
3.2 Character I/O
3.3 Programming Using I/O

Unit 4. Flow Control Instructions **5 hrs**

4.1 Decision Control Instructions

- If
- If-else
- Else-if ladder
- Nested if-else

4.2 Switch statement

4.3 Loop Control Instructions

- For Loop
- While Loop
- Do While Loop
- Nesting of loops

Unit 5. Array **5 hrs**

5.1 Introduction to Array
5.2 Array Declaration
5.3 Array Initialization
5.4 Accessing individual elements of an array
5.5 Two Dimensional Arrays
5.6 Accessing the elements of a two dimensional array
5.7 Passing an array element to a function
5.8 Rules of using an array

Unit 6. Functions **5 hrs**

6.1 Need for user-defined functions
6.2 Components of Function

- Function definition, function declaration and function call
- Local variables of a function
- Parameters or Arguments to a function
- Return Values
- Prototype of a function

6.3 Rules of using a function
6.4 Recursive function
6.5 Preprocessor directives: Macro expansion and file inclusion

Unit 7. Pointers **5 hrs**

7.1 Introduction to pointer
7.2 Declaring a Pointer variable
7.3 Initializing a pointer variable
7.4 Using a Pointer Variable
7.5 Pointer Arithmetic
7.6 Use of pointers
- As function arguments (By reference)
- Pointers and array
- Passing an entire array to a function
- Functions returning a Pointer Variable

Unit 8. Strings **4 hrs**

8.1 Introduction to strings
8.2 String I/O
8.3 String Manipulation Functions

Unit 9. Structures and Unions **4 hrs**

9.1 Declaring and Accessing Structure
9.2 Various uses of Structures
9.3 Unions

Unit 10. File Handling **4 hrs**

10.1 File Pointer
10.2 Opening and closing data files
10.3 Input/output with data files
10.4 Formatted/unformatted data files

Unit 11. Example applications of computer Program **1 hr**

11.1 Various Applications of computer Program
- Applications in Banking
- Library Management System
- Graphics/Gaming

Practical /Laboratory: **45 hrs**

1. Programming exercise on executing and editing a C Programs.
2. Programming exercise on defining variables and assigning values to variables.
3. Programming exercise on arithmetic and relation operators.
4. Programming exercise on arithmetic expressions and their evaluation.
5. Programming exercise on reading and writing a character.
6. Programming exercise on formatting input printf and formatting output using scan.
7. Programming exercise on IF, IF-ELSE, ELSE-IF statements.
8. Programming exercise on SWITCH statement.
9. Programming exercise on WHILE, DO-WHILE statement.
10. Programming exercise on FOR statement and nested loops.
11. Programming exercise on one dimensional arrays.
12. Programming exercise on two dimensional arrays.
13. Programming exercise on functions.
14. Programming exercise on pointers.
15. Demonstration of application of computer programs.
16. Students should submit and present a mini project in C Programing.

References:

1. Brian W .Keringhan and Dennis M .Ritchie, “The C Programming Language ”PHI
2. V .Rajaraman, “Computer Programming in C ”PHI
3. Byron S. Gottfried, “Programming with C ”McGraw Hill
4. Stephen G .Kochan “Programming in C", CBS Publishers and distributors
5. Kelly and Pohl, “A book on C ”, Benjamin/Cummings
6. E Balagurusamy, “Programming in ANSI C”

Evaluation Scheme

Unit wise Marks division for Final Exam

Unit	Content	Course Hours	Marks
1	Introduction to Computer Program	5	9
2	Introduction to C	5	9
3	Input and Output	2	3
4	Flow Control Instructions	5	9
5	Array	5	9
6	Functions	5	9
7	Pointers	5	9
8	Strings	4	7
9	Structures and Unions	4	7
10	File Handling	4	7
11	Example applications of computer Program	1	2
	Total	**45**	**80**

*Some minor change may arise in marks distribution.

*One question of 8 marks should be asked as optional.

Electrical Technology
EG 2103 EX

Total: 7 hours /week
Year: II **Lecture: 3 hours/week**
Part: I **Tutorial: 1 hours/week**
Practical: 3 hours/week

Course Description:

This course deals two different streams of engineering as general concepts in electrical engineering and major electrical respectively. The first unit deals with the general concepts of electrical engineering. Second unit describes major circuit laws for solving different types of electric circuits. Third unit describes basic electrical energy storing components and their behaviour. Third unit deals with ac system, R, L and C combination in circuit and behavior of these circuit elements for ac excitation**.** Last three chapters are concerned with basic construction, operating principles and types of electrical machines, transformer, motor and generators.

Course Objectives:

After completing this course the students will be able to:

1. Explain the basic concept of electric current and voltage, series and parallel circuits.
2. Identify the basics network theorems and their uses.
3. Identify AC quantities and active and reactive power, single phase and three phase system.
4. Conceptualize the basic principles of different types of electrical machines.

Course contents:

Unit: 1 Introduction **6 hrs**

1.1. Electric charge and current
1.2. Potential difference and electromotive force
1.3. Resistance and its variation with temperature
1.4. Direct and alternating current
1.5. Series and parallel circuits
1.6. Ohm's law and its limitation
1.7. Voltage and current sources, Independent and dependent sources
1.8. Electric power and Energy
1.9. Cells/Battery**:** Dry cell, Lead-Acid Cell, Mercury Cell, Ni-Cd, Li-ion
1.10. Series and parallel connection of cells

Unit 2: DC Circuit Analysis **8 hrs**

2.1. Kirchhoff's current and voltage laws
2.2. Mesh current method of circuit analysis

2.3. Node voltage method of circuit analysis
2.4. Superposition theorem
2.5. Thevenin's theorem
2.6. Nortorn's theorem
2.7. Maximum power transfer theorem

Unit 3: Circuit Elements **6 hrs**

3.1. Inductor and Inductance
3.2. Series and Parallel connection of Inductor
3.3. Capacitor and Capacitance
3.4. Series and Parallel connection of Capacitors
3.5. Charging and Discharging of Capacitors
3.6. Energy stored in Capacitor and Inductor

Unit 4: AC Circuit Analysis **8 hrs**

4.1 Generation of sinusoidal emf in single phase and three phase, phase sequence
4.2 Phase difference, Instantaneous value, peak value, average value and RMS value
4.3 Phase relations in R, L and C Circuit
4.4 AC excitation in R, RL, RC, RLC and power calculations
4.5 Resonance in series and parallel RLC
4.6 AC power distribution, requirement of three phase over single phase system
4.7 Star-Delta connection of three phase loads and sources, line and phase quantities between voltage and current

Unit 5: Transformers **5 hrs**

5.1 Construction and working principle, emf equation of transformer
5.2 Step up and step down transformers, power and distribution transformer
5.3 Auto transformer and its use
5.4 Losses and efficiency of transformers, Eddy and hysteresis losses

Unit 6: DC Generators/Motors **6 hrs**

6.1 Construction and working principles of DC machines
6.2 Emf equation and importance of back emf
6.3 ypes of DC motors and their speed control

Unit 7: AC Generators/Motors **6 hrs**

7.1 Construction, working principle and characteristics of three phase induction motor
7.2 Induction machine as generator
7.3 Construction, working principle and characteristics of three phase synchronous generators
7.4 Synchronous motor construction and working principle
7.5 Single phase induction motors, capacitor start motor, shaded pole motors, pulse and hysteresis motors

Practical /Laboratory: **45 hrs**

1. Verification of Ohm's Law
2. Verification of KCL and KVL
3. Verification of maximum power transfer theorem
4. Verification of superposition theorem
5. Charging /discharging of capacitor, time constant
6. Resonance in RLC series and parallel
7. Polarity and turn ratio testing of transformer
8. Speed control of DC motors

Tutorial: **15 hrs**

Assist students for conceptual & critical problem solving

1. Ohm's law, resistor series and parallel connection and temperature effect on resistor, series and parallel connection of cells, internal resistance, emf, voltage drop and losses 3 hrs
2. Numerical related to DC circuit analysis**:** mesh, Thevenin's, Nodal, Norton's, Maximum power transfer theorem, superposition theorem**.** 4 hrs
3. Capacitor and inductor series and parallel connection, charging/discharging of capacitors 2 hrs
4. AC circuit analysis**:** RL,RC,RLC circuit numerical, voltage current,impedance,power, power factor ,single and three phase power calculation,line and phase quantities,star-delta 3 hrs
5. Emf equation of transformers, turn ratio, losses and efficiency 1 hr
6. DC motors and generators basic equations 1 hr
7. AC motor and generator basic equations 1 hr

References:

1 B.L Theraja and A.K. Theraja, S Chand and Company Ltd.A textbook of Electrical Technology
2 Fundamentals of Electrical Engineering by J. B. Gupta
3 Principles of Electrical Engineering by Vincent Del Toro
4 Foundations of Electrical Engineering by R.J. Cogdell
5 Basic Electrical Engineering by A.E. Fitzgerald

Marks Specification for final examination:

Unit	Content	Course Hours	Marks
1	Introduction	6	11
2	DC Circuit Analysis	8	14
3	Circuit Elements	6	11
4	AC Circuit Analysis	8	14
5	Transformers	5	8
6	DC Generators/Motors	6	11
7	AC Generators/Motors	6	11
	Total	**45**	**80**

Note: There might be minor deviation on the above specified marks.

Electronics Engineering Materials
EG 2106 EX

Total :3 hours/week
Year :II **Lecture :3 hours/week**
Part :I **Tutorial :hours/week**
Practical :hours/week

Course Description:

This course deals with materials and their classification and components related to electronics engineering. It also imparts the identification, characteristics, specifications, merits, limitations, and applications of electronic components and materials.

Course Objectives:

After completing this course student will able to:
1. Identify and explain the different materials, their poperties and applications.
2. Identify and explain different types of electronics components.

Course Contents:

Unit 1: Materials **22 hrs**

1.1 Classification of materials 3hrs
- Conducting, semi-conducting and insulating materials through a brief reference to their atomic structure.

1.2 Conducting Materials 6hrs
- Resistors and factors affecting resistivity such as temperature, alloying and mechanical stressing.
- Classification of conducting materials into low resistivity and high resistivity materials.

1.3 Insulating Materials 6hrs
- Important relevant characteristics (electrical, mechanical and thermal)
- Applications of the following material: Mica, Glass, Copper, Sliver, PVC, Silicon, Rubber, Bakelite, Cotton, Ceramic, Polyester, Polythene and Varnish.

1.4 Magnetic Materials 7hrs
- Different Magnetic materials; (Dia, Para, Ferro) and their properties.
- Ferro magnetism, Domains, permeability, Hysteresis loop.
- Soft and hard magnetic materials, their examples and typical applications.

Unit 2: Components **23 hrs**

2.1 Capacitors 5 hrs
- Concept of capacitance and capacitors, units of capacitance, types of capacitors, constructional details and testing specifications
- Capacity of parallel plate capacitors, spherical capacitors, cylindrical capacitor.
- Energy stored in a capacitor.

- Concept of di-electric and its effects on capacitance, di-electric constant, break down voltage.
- Series and parallel combination of capacitor. Simple numerical problems of capacitor.

2.2 Resistors: 3 hrs

- Carbon film, metal film, carbon composition, wire wound and variable types (presets and potentio-meters)

2.3 Transformer, inductors and RF coils: 3 hrs

- Methods of manufacture, testing, Need of shielding, application and trouble shooting

2.4 Surface Mounted Devices (SMDs): 3 hrs

- Constructional detail and specifications.

2.5 Connectors, Relays, switches and cables: 3 hrs

- Different types of connectors, relays, switches and cables, their symbols, construction and characteristics.

2.6 Semi Conductors and Integrated Circuits 6 hrs

- Basic characteristics of Semiconductor materials, testing of diodes, transistors, FETs and SCRs.
- Various processes used in IC manufacturing. Hybrid IC technology.
- Introduction to Superconductivity and piezoelectric transducer elements

References:

1. Electronic Components and Materials by Grover and Jamwal; Dhanpat Rai and Sons, New Delhi
2. Basic Electronics and Linear Circuits by NN Bhargava and Kulshreshta; Tata McGraw Hill, New Delhi
3. Electronic components and Materials by SM Dhir, Tata McGraw Hill, New Delhi
4. Electrical and Electronic Engineering Materials by SK Bhattacharya, Khanna Publishers, New Delhi
5. Electronic Engineering Materials by ML Gupta, Dhanpat Rai and Sons; New Delhi.

Marks Specification for final examination:

Unit	Content	Course Hours	Marks
1	**Materials**		
1.1	Classification of materials	3	5
1.2	Conducting Materials	6	11
1.3	Insulating Materials	6	11
1.4	Magnetic Materials	7	13
2	**Components**		
2.1	Capacitors	5	9
2.2	Resistors	3	5
2.3	Transformer, inductors and RF coils	3	5
2.4	Surface Mounted Devices **(**SMDs**)**	3	5
2.5	Connectors, Relays, switches and cables	3	5
2.6	Semi Conductors and Integrated Circuits	6	11
Total		**45**	**80**

Note: There might be minor deviation on the above specified marks.

Electrical Installation

EG 2107 EX

Total :5 hours/week

Year :II **Lecture :1 hours/week**

Part :I **Practical :4 hours/week**

Course Description:

This course deals with identification, selection of cable for lighting circuit from supply intake to light and power as well as pump motors and connection procedures of these equipment and accessories.

Course Objectives:

After completing this course student will able to:

1. Identify and proper use of wiring accessories and fittings.
2. Apply wiring regulation and reduce electrical risks
3. Select and use proper size of cable, fittings and accessories
4. Interpret electrical layout, wiring and schematic diagrams.
5. Install, inspect, test single phase wiring circuit.

Course Contents:

In all the units mentioned below, the related theory has to be covered in the laboratory before performing the practical exercises.

Unit 1. Electrical safety **1 hr**

- 1.1 Single phase supply voltage
- 1.2 Insulation resistance
- 1.3 Electrical shock

Unit 2. Cable, wires **1 hr**

- 2.1 Sizes
- 2.2 Materials type
- 2.3 Current carrying capacity, cable selection

Unit 3. Tools and equipment **1 hr**

- 3.1 Identification and selection of electrical tools
- 3.2 Proper handling, use and care.

Unit 4. Single phase service intake system, main cable **1 hr**

- 4.1 Main switch
- 4.2 Kilowatt hour meter
- 4.3 Distribution board
- 4.4 Light load -power load.

Unit 5. Wiring accessories and fixtures **1 hr**

5.1 Different types of switch
5.2 Light and power sockets
5.3 Lamp fittings
5.4 Distribution board
5.5 Junction boxes

Unit 6 .Protective devices **1 hr**

6.1 Fuses, MCB, MCCB
6.2 Types, rating and use
6.3 Earthing system
6.4 Earthing procedure
6.5 Selection and importance

Unit 7. Wiring regulation **1 hr**

7.1 Insulation resistace
7.2 Earth resistance
7.3 Light and power circuits

Unit 8. Study of alternate switch connection by different method **1 hr**

8.1 Gate
8.2 Compound and street light point with different controls

Unit 9. Connection method of stair case corridor **1 hr**

Unit 10. Flourescent tube **1 hr**

10.1 Choke, Electronic Choke
10.2 Starter
10.3 Capacitor
10.4 Connection and working principle

Unit 11. Distribution board **1 hr**

11.1 Incomer
11.2 Busbar out going
11.3 Type and size of DB'S .

Unit 12. Generator **1 hr**

12.1 Connection of Generator and UPS
12.2 Inverter back up system and its application in house wiring fully or partly 1hrs

Unit 13. Single phase capacitor motor centrifugal switch running capacitor, starting capacitor and its use **1 hr**

Unit 14. Earthing **1 hr**

14.1 Earth plate

14.2 Rod
14.3 Earth
14.4 Electrode
14.5 Salt
14.6 Charcoal watering

Unit 15. Testing installation **1 hr**

15.1 Polarity, continuity test
15.2 Insulation test
15.3 Earth resistance test
15.4 Earth continuity test of phase and neutral wire

Practical /Laboratory: **60 hrs**

1. Stripping of stranded wire, flexible wire, unarmoured and armoured single and multicore cables splicing, forming, soldering, straight and eyelet forming and cable shoe fitting
2. Connect 3 pin 13 or 15 amp plug and 3 pin 13 or 15 amp socket across the 3 core 2.5mm^2 flexible cable
3. Connect 2 pin plug and a pendenent holder across twin flexible cable 1.5 mm^2
4. Check continuity of wires and test extension cord and table lamp connection
5. Installation of call bell controlled from single station
6. Installation of one light control by one single pole switch using PVC batten -read circuit diagram and install as per lay out diagram
7. Installation of two lamps conrol by one simple switch using PVC batten, once in series connection then in parallel connection – observe the difference.
8. Installation of two lamps control by two gang simple switch and a light socket.
9. Installation of one lamp controlled by, two station using alternate switch, two-way connection
10. Installation of two-way lighting using second method
11. Installation of two lamps using alternate and intermediate switches
12. Installation of one tube light control by one switch and one power socket.
13. Installation of 6 ways DB and assembling of DPMCB, SP MCBS and Energy meter.
14. Identify, test and install manual change over system.
15. Installation of single phase pump motor using double pole switch prime the pump and test run.
16. Demonstrate the procedure of earthing
17. Use insulation tester, earth resistance tester, ohmmeter to carryout the test of new installation and prepare test certificate.

References:

1 Electrical wiring fundamental –Folay
2 Electrical installation and workshop practice - F.G. Thomson
3 Electrical installation – estimating and costing- J.B. Gupta

Marks Specification for final examination:

Unit	Content	Course Hours	Marks
1	Electrical safety	1	2
2	Cable,	1	3
3	Tools and equipment	1	2
4	Single phase service intake system main cable	1	3
5	Wiring accessories and fixtures	1	2
6	Protective devices	1	3
7	Wiring regulation	1	2
8	Study of alternate	1	3
9	Connection method	1	2
10	Flourescent tube	1	3
11	Distribution board	1	3
12	Generator	1	3
13	Single phase capacitor motor	1	3
14	Earthing	1	3
15	Testing installation	1	3
	Total	**15**	**40**

Note: There might be minor deviation on the above specified marks.

Audio & Video Systems
EG 2105 EX

Total :3 hours/week
Year :II **Lecture :hours/week**
Part :I **Tutorial :hours/week**
Practical :3 hours/week

Course description:

This subject deals with the study of various audio and video systems and troubleshoots those. This course caters the requirements of practical knowledge for disassembly, fault findings and repair of various sections of television system which will help students to pursue career in this field.

Course Objectives:

On completion of this course, the students will be able to

1. Describe the basic of sound fundamental process.
2. Design and construct the audio-amplifier with various controls
3. Explain comprehensive of television systems.
4. Explain the analysis and synthesis of TV pictures, Composite Video Signal, Receiver Picture Tubes and Television Camera Tubes and the principles of Monochrome Television Transmitter and Receiver systems
5. Describe advanced topics in Television systems and Video Engineering
6. Evaluate and solve fault of different section in television receiver

Course Contents:

Students should be provided the following theoretical knowledge in the laboratory itself, while conducting the practical.

Unit 1. Characteristic of Sound:

Nature of Sound, pressure and Intensity of Sound Waves, Sensitivity of Human-Ear for Sound, Loudness and Phon, Frequency of Sound Waves, Intervals, Octaves and Harmonics, Pitch, resonance effect in sound systems.

Unit 2. Audio Devices and Applications:

Microphone Sensitivity, Nature of Response and Directional Characteristics, Measurement Microphones, Various Types of Microphones, Various Types of Loudspeakers, Characteristic Impedance of Loud Speakers, PA Systems & Installations.

Unit 3. Optical Recording:

Types of Optical Recording of Sound, Methods of Optical Recording of Sound on film, Reproduction of Sound from Films, Compact Disc, Optical Recording on Disc, Playback Process, Comparison of Compact and Conventional Discs principle of disc recording, principle of Disc reproduction, block diagram of disc recording system, block diagram of disc reproduction system, production of disc records on mass scale, coarse-grooves and micro-grooves, construction of cutter stylus, playback needles, cartridges or pick-up units, Equalizations in disc recording/playback systems.

Unit 4. Audio Amplifier:

Types of Audio Amplifiers, Audio Amplifier VS RF amplifier, characteristics of Audio Amplifiers, voltage amplifier, power amplifier, push-pull power amplifier, complementary symmetry push-pull amplifier, negative feedback in amplifiers, controls in Audio amplifiers, special types of tone controls.

Unit 5. Introduction to Television & television pictures:

Picture transmission, television transmitter, television receiver, synchronization, receiver controls, geometric form and Aspect ratio, image continuity, number of scanning lines, interlaced scanning, picture resolution, brightness gradation and colour characteristics.

Unit 6. Television Cameras and picture tubes:

Camera tube types, vidicon camera tube, silicon diode array vidicon, camera optics, monochrome TV camera, colour cameras, camera control equipment, monochrome picture tube, electrostatic focusing, beam deflection, picture tube screen, raster centering adjustments, picture tube characteristics and control, picture tube specifications, colour picture tubes.

Unit 7. Composite video signal and colour signal-generation and encoding:

Video signal dimensions, Horizontal sync composition, Vertical sync details, Function of vertical pulse train, Scanning sequence details, Perception of brightness and colour, Additive and subtractive colour mixing, Video signals for colours, Luminance signal (Y), Compatibility, Colour-difference signals, encoding of colour difference signals, Formation of chrominance signal, PAL Encoder.

Unit 8. Television Signal Transmission & Propagation:

Picture Signal transmission, Positive and negative modulation, Vestigial sideband transmission, Standard channel Bandwidth, Television transmitter, TV Signal propagation, Interference suffered by TV channels. TV broadcast channels for terrestrial transmission.

Unit 9. Television Receiver:

RF Tuner, IF Subsystem, Video amplifier, Sound section, Sync separation and processing, Deflection circuits, Scanning Currents in the yoke, DC Power supplies. Electronic tuners, IF Subsystem, Y Signal channel, Chroma decoder, Separation of U and V colour phasors, Synchronous demodulators, Sub carrier generation and control, Matrixing for drive Circuits.

Unit 10. Advances in TV Technology:

HDTV, Display Technologies (CRT, LCD, Plasma, LED, Projection), Video Interfaces (Composite, Component, S-Video, DV, HDMI, DVI).

Unit 11. Television Systems and Standards:

NTSC Colour System, PAL Colour System, French B&W and Colour TV System, Television Standard. Introduction to CCTV.

Practical /Laboratory: **45 hrs**

1. To study block diagram and circuit diagram of colour TV.
2. To Analyze and perform the circuit description of RF–Section (Tuner section) and IF subsystem section and their functions.
3. To Analyze and perform detailed circuit description of video and chroma section and its function.
4. To Analyze and perform detailed circuit description of vertical oscillator.
5. To Analyze and perform detailed circuit description of horizontal oscillator.
6. To Analyze and perform detailed circuit description of sound section.
7 To Analyze and perform detailed circuit description of SMPS section.
8. To design Public Addressing System (PAS) and its components.
9. To Analyze generation of pattern using pattern generator device
10. To observe and Analyze Frequency Response of microphones
11. To observe and Analyze Frequency Response of loudspeakers
12. Use of Audio Metering Tools like DB Meter.
13. Installation & troubleshooting of DTH system.

References:

1. Bali & Bali, “Audio Video Systems Principles Practices and Troubleshooting”, Khanna Publishing Company.
2. Audio Engineering, Know it all series, Newnes Press, ISBN 978-1-85617-526-5
3. R.R. Gulati , “Modern Television Practice”
4. R.G. Gupta,” Audio Video Systems” Tata McGraw-Hill Technical Education.
5. John Watkinson, Guide To Compression Snell & Wilcox Inc Publication

Forth Semester
Year II Part II

Subjects:

1	EG 2201 EX	Electronic Devices and Circuit II
2	EG 2202 EX	Analog Communication System
3	EG 2203 EX	Microprocessor and Peripheral Devices
4	EG 2204 EX	Digital Electronics II
5	EG 2205 EX	Electronic Instruments and Measurement
6	EG 2206 EX	Repair and Maintenance of Consumer Appliances I
7	EG 2207 EX	Minor Project

Electronics Device and Circuit II
EG 2201 EX

Total: 7 hours/week
Year: II **Lecture: 4 hours/week**
Part: II **Tutorial: hours/week**
Practical: 3 hours/week
Lab: hours/week

Course Description:

This course deals with various electronic devices and circuits, mainly with use of transistors in analog circuits like power amplifier, multistage amplifier, oscillators, wave shaping circuits and in multivibrators etc. It also gives information about timer, operational amplifier, voltage regulator, ICs and their applications for effective functioning in the field of electronic service industry.

Course Objectives:

On completion of this course the students will be able to:

1 Explain operation and function of large and small signal amplifiers with applications.
2 Design simple power supplies and amplifiers and test related circuits.
3 Explain operation and function of various types of oscillators and tuned amplifiers and their applications.

Course Contents:

Unit 1: Multistage Amplifiers **6 hrs**

1.1 Need for multistage amplifier
1.2 Gain of multistage amplifier
1.3 Different types of multistage amplifier like RC coupled, transformer coupled, direct coupled, and their frequency response and bandwidth

Unit 2: Large Signal Amplifier **8 hrs**

2.1 Difference between voltage and power amplifiers
2.2 Importance of impedance matching in amplifiers
2.3 Class A, Class B, Class AB, and Class C amplifiers
2.4 Single ended power amplifiers, push-pull amplifier, and complementary symmetry push-pull amplifier

Unit3: Feedback in Amplifiers **8 hrs**

3.1 Basic principles and types of feedback
3.2 Derivation of expression for gain of an amplifier employing feedback
3.3 Effect of feedback (negative) on gain, stability, distortion and bandwidth of an amplifier
3.4 RC coupled amplifier with emitter bypass capacitor
3.5 Emitter follower amplifier and its applications

Unit 4: Sinusoidal Oscillators **9 hrs**

4.1. Use of positive feedback
4.2. Barkhausen criterion for oscillations
4.3. Different oscillator circuits; tuned collector, Hartley, Colpitts, phase shift, Wien's bridge and crystal oscillator. Their working principles and simple numerical problems
4.4. Series and parallel resonant circuits and bandwidth of resonant circuits
4.5. Single and double tuned voltage amplifiers and their frequency response characteristics

Unit 5: Wave Shaping Circuits **5 hrs**

5.1. General idea about different wave shapers
5.2. RC and RL integrating and differentiating circuits with their applications
5.3. Diode clipping and clamping circuits and simple numerical problem on the circuits

Unit 6: Multivibrator Circuits **8 hrs**

6.1. Working principle of transistor as switch
6.2. Concept of multi-vibrator: astable, monostable, and bistable and their applications
6.3. Block diagram of IC555 and its working
6.4. IC555 as monostable and astable multi-vibrator

Unit 7: Operational Amplifiers **12 hrs**

7.1. Characteristics of an ideal operational amplifier and its block diagram
7.2. Definition of differential voltage gain, CMMR, PSRR, slew rate and input offset current
7.3. Operational amplifier as an inverter, scale changer, adder, subtractor, differentiator, and integrator (no derivation)
7.4. Concept of Schmitt trigger circuit and sample and hold circuit using operational amplifier and their application

Unit 8: Regulated DC Power Supplies **4 hrs**

8.1. Concept of DC power supply. Line and load regulation
8.2. Concept of fixed voltage, IC regulators (like 7805, 7905), and variable voltage regulator like (IC 723)
8.3. Idea of SMPS

Practical /Laboratory: **45 hrs**

1. Plot the frequency response of two stage RC coupled amplifier and calculate the bandwidth and compare it with single stage amplifier
2. To measure the gain of push-pull amplifier at 1KHz
3. To measure the voltage, gain of emitter follower circuit and plot its frequency response
4. Plot the frequency response curve of Hartley and Colpitts Oscillator
5. Plot the frequency response curve of phase shift and Wein bridge Oscillator
6. To observe the output waveforms of series and shunt clipping circuits
7. To observe the output for clamping circuits

8. To observe the output waveform of a Bistable multivibrator
9. Use of IC 555 as monostable multivibrator and observe the output for different values of RC
10. Use of IC 555 as astable multivibrator and observe the output at different duty cycles
11. To use IC 741 (op-amplifier) as
    a. Inverter
    b. Adder
    c. Subtractor
    d. Integrator
12. To realize positive and negative fixed voltage AC power supply using three terminal voltage regulator IC (7805, 7812, 7905)

References:

1. Basic Electronics and Linear Circuits by NN Bhargava, Tata McGraw Hills, New Delhi
2. Electronics Principles by Malvino, Tata McGraw Hills, New Delhi
3. Electronic Devices and Circuits by Millman and Halkias, McGraw Hills, New Delhi
4. Basic Electronics by Grob, Tata McGraw Hills, New Delhi
5. Art of Electronics by Horowitz
6. Electronic Principles by Sahdev, Dhanpat Rai and Sons, New Delhi.
7. Electronic Circuit Theory by Boylstead
8. Electronic Devices and Circuits by BL Theraja, S Chand and Co Ltd. New Delhi
9. Operational Amplifiers and Linear Integrated Circuits by Ramakant A. Gaykwad
10. Electronics Devices and Circuits by Rama Reddy, Narosa Publishing House Pvt. Ltd., New Delhi
11. Electronics Devices and Circuits-II by Naresh Gupta, Jyotesh Malhotra and Harish C. Saini, Eagle Prakashan, Jalandhar

Marks Specification for final examination:

Unit	Content	Course Hours	Marks
1	Multistage Amplifiers	6	8
2	Large Signal Amplifier	8	11
3	Feedback in Amplifiers	8	11
4	Sinusoidal Oscillators	9	12
5	Wave Shaping Circuits	5	7
6	Multivibration Circuits	8	11
7	Operational Amplifiers	12	15
8	Regulated DC Power Supplies	4	5
	Total	**60**	**80**

Note: There might be minor deviation on the above specified marks.

Analog Communication System
EG 2202 EX

Total: 7 hours/week

Year: II **Lecture: 4 hours/week**

Part: II **Tutorial: hours/week**

Practical: 3 hours/week

Course description:

Electronic Communication plays vital role in our lives. Development of communication Technology has increased its application in allied field of electronics including Telephony, telegraphy, satellite, Mobile, RADAR, industrial controls, online application like internet banking, ATM machine, Wireless network, optical communication, Mobile communication system.

Analog communication is a foundation for all advanced subjects in communication engineering. This subject will focus on the operation of analog transmission and reception techniques. This subject also deals with pulse modulation and their different types. Study of Elements of Electronics, Electronic Devices and Circuits is prerequisite for Analog communication subject.

Course Objectives:

After completing this course the students will be able to

1. Describe different electronic communication systems.
2. Explain concept of modulation and demodulation of AM / FM.
3. Explain basic operation and characteristics of Radio transmitters and receivers.
4. Explain the concept of radio wave propagation.
5. Explain basic principles, characteristics and applications of various types of antennas used in communication systems

Course Contents:

Unit 1. Basics of Electronic Communication **6 hrs**

1.1 The importance of electronic communication.
1.2 Definition: Analog signal, Digital signal, Baseband signal
1.3 The elements of basic electronic communication system (Draw block diagram and explain each block.)
1.4 Noise in communication system and types
1.5 Types of electronic communication. Simplex, Duplex- full /half.
1.6 The electromagnetic spectrum.
1.7 Concept of transmission bandwidth.

Unit 2. Modulation Techniques **24 hrs**

2.1 Basics of Modulation
- Need for modulation
- Types: AM, FM, PM. Definition, waveforms

2.2 Amplitude Modulation

- Modulation index-definition, its effect on modulated signal, simple numerical.
- Mathematical representation of amplitude modulated wave & its meaning., concepts of side band (SSB, DSB & VSB)
- Bandwidth requirements
- Block diagram of High & Low level AM transmitter and its operation
- Representation of AM signal in time & frequency domain
- Circuit and operation of AM modulators using BJT/FET

2.3 Frequency modulation

- Deviation ratio, maximum deviation ratio, mathematical representation of FM & its meaning
- Representation of FM signal in time domain & frequency domain
- Bandwidth requirements
- Concept of Pre-emphasis & De-emphasis
- Generation of FM (Block diagram and its working): Reactance modulator, varactor diode modulator, Armstrong

2.4 Pulse Modulation Techniques.

- Need of Pulse Modulation
- PAM, PWM, PPM- Block diagram, waveforms, advantages & disadvantages & their comparison.
- Generation of PAM transistorized circuit, Generation of PWM, PPM using IC 555.

Unit 3. Radio Receivers: 20 hrs

3.1. Block diagram and working principle of superheterodyne AM receiver. Function of each block and typical waveforms at input and output of each block

3.2. SSB communication receiver: Block diagram, operation, characteristics

3.3. Performance characteristics of radio receiver: sensitivity, selectivity, S/N ratio, image rejection ratio and their measurement procedure

3.4. Selection criteria for intermediate frequency (IF)

3.5. Block diagram of an FM receiver, function of each block and waveforms at input and output of each blocks.

3.6. Need for limiting and de-emphasis in FM reception

3.7. Demodulation of AM signal.

- Diode detector, practical diode detector.
- Need of AGC & its types – simple, delayed.

3.8. FM detector Types:

- Balanced slope detector
- Phase Discriminator
- Ratio detector.
- PLL as FM demodulator.

Unit 4. Antennas: **5 hrs**

4. 1. Physical concept of radiation of electromagnetic energy from a dipole. Concept of polarization of EM Waves.
4. 2. Definition and physical concepts of the terms used with antennas: point source, gain, directivity, radiation pattern
4. 3. Types of antennas-brief description, characteristics and typical applications of folded dipole, medium wave (mast) antenna, Yagi-Uda and ferrite rod antenna (used in transistor receivers)
4. 4. Description of horn antenna and dish antenna, their applications
    - Definition and type

Unit 5. Wave Propagation: **5 hrs**

5. 1. Basic idea about different modes of wave propagation and typical areas of application. Ground (Surface) wave propagation and its characteristics
5. 2. Space wave communication: Line of sight propagation
5. 3. Sky wave propagation: Ionosphere and its layers. Explanation of terms: virtual height, critical frequency, skip distance, maximum usable frequency

Practical /Laboratory: **45 hrs**

1. Observe and draw the waveform of AM and calculate modulation index of AM.
2. Observe and draw input / output waveforms of AM detector.
3. Observe and draw the waveform of FM and calculate modulation index of FM.
4. Observe the waveforms at various points in AM receiver.
5. Generate PAM and observe the waveforms of PAM.
6. Generate PWM, PPM and observe the waveforms of PWM, PPM using IC's.
7. To plot the radiation pattern of a directional and omni directional antenna
8. To plot radiation pattern of a horn antenna.
9. To plot the variation of field strength of a radiated wave, with distance from a transmitting antenna

NOTE:

Visits to appropriate sites of AM/FM Radio stations should be made with a view to understand their working. A comprehensive report must be prepared by all students on these visits, especially indicating the dates and locations of their visits.

References:

1. Electronic Communication Systems, by G. Kennedy and B. Davis, Tata McGraw-Hill, New Delhi
2. Electronic Communications, by D**.** Roddy & J. Coolen
3. Communication system by A.K. Gautam S.K. Kataria Sons, Delhi
4. Communication Systems, by Sanjay Sharma, -S.K. Kataria and sons
5. An Introduction to analog and digital communications, by Simon Haykin. John Wiley and Sons.
6. Radio Engineering by G.K. Mittal, Khanna Publishers, New Delhi
7. Electronics Communication by KS Jamwal, DhanpatRai& Sons, New Delhi
8. Optical fiber Communication by John M Senior, Prentice Hall of India, New Delhi
9. Handbook of Experiments in Electronics and Communication Engineering by S. Poornachandra Rao, and B Sasikala, Vikas Publishing House Pvt. Ltd, Jangpura, New Delhi
10. Latest Publications on the subject.

Marks Specification for final examination:

Unit	Content	Course Hours	Marks
1	Basics of Electronic Communication	6	8
2	Modulation Techniques	24	32
3	Radio Receivers:	20	26
4	Antennas:	5	7
5	Wave Propagation	5	7
	Total	**60**	**80**

Note: There might be minor deviation on the above specified marks.

Microprocessors and Peripheral Devices
EG 2203 EX

Total: 6 hours/week
Year: II **Lecture: 3 hours/week**
Part: II **Tutorial: hours/week**
Practical: 3 hours/week

Course description:
This course deals with fundamentals of microprocessor, basic low level microprocessor programming, interfacing and introduction to basic programmable devices.

Course Objectives:
After completing this course the students will be able to
1. Explain the working principle of microprocessor
2. Describe the process of writing and executing low level language
3. Interface devices with a computer
4. Describe about the peripheral devices that can be used with 8085 microprocessors.

Course Contents:

Unit 1. Introduction to Microprocessor **5 hrs**
- 1.1. Introduction to Microprocessor, microcomputer, microcontroller.
- 1.2. History of Microprocessor
- 1.3. Stored Program Concept and Von Neumann Architecture
- 1.4. Block diagram of a typical microprocessor & microcontroller and their difference.
- 1.5. General architecture of a microcomputer system showing control buses

Unit 2. Microprocessor architecture and the instruction set **8 hrs**
- 2.1 Internal architecture of 8085 microprocessor
- 2.2 Pin details of 8085 and related signals
- 2.3 Instruction and data formats
- 2.4 Instruction classifications
- 2.5 8085 Instruction set with examples
- 2.6 Addressing modes in 8085 with examples.

Unit 3. Assembly language programming for 8085 **8 hrs**
- 3.1. Introduction to assembly language and assemblers
- 3.2. Simple assembly language programs
- 3.3. Programs using loops, counters, delays
- 3.4. Table processing
- 3.5. Subroutine and stack
- 3.6. Code conversion ASCII/BCD/Binary

Unit4. Interfacing I/O and memory devices **8 hrs**
- 4.1. 8085 machine cycles and bus timing

- Fetch and execute cycles
- Memory read/write machine cycle
- I/O read/write machine cycle

4.2. Address Decoding
- Unique and non-unique address decoding
- Address decoding for I/O and memory devices

4.3. Interfacing I/O devices
- Interfacing Input Devices
- Interfacing Output Devices
- Address decoding using block decoders
- Interfacing Memory-mapped I/O

4.4. Memory Interfacing
- Memory structure and its requirement
- RAM and ROM chips
- Address decoding using NAND and block decoders

4.5. Direct memory access

Unit 5. 8085 Interrupt processing **6 hrs**

5.1. Programmed I/O
5.2. Interrupt Driven I/O
5.3. The 8085 Interrupt
5.4. 8085 Vectored Interrupts
5.5. Restart and software instructions

Unit 6. Introduction to Peripheral Devices **6 hrs**

6.1. 8255 Programmable Peripheral Interface
6.2. 8254(8253) Programmable Interval Timer
6.3. 8259 Programmable Interrupt Controller
6.4. 8251 USART

Unit 7. Advanced Microprocessors **4 hrs**

7.1. Architecture of 8086 microprocessors
7.2. Addressing modes and programming features
7.3. Comparison with 8085 microprocessor

Practical /Laboratory: **45 hrs**

The practical exercise shall cover the low level program from simple programs for data transfer to complex programs for table processing

1. Basics of microcomputer system through the 8085 microprocessor trainer kit
2. Programs that use data transfer instructions
3. Programs that use arithmetic instructions
4. Programs that use logical instructions
5. Programs with conditional and unconditional branching
6. Programs with conditional and unconditional subroutine call and stack
7. Programs involving loops and counters

8. Programs that involves masking and checking numbers
9. Programs to manipulate table of numbers
10. Program for BCD and ASCII manipulation
11. Programs to perform multiplication and division
12. Programs to read and write from the port

References:

1. Amesh S. Gaonkar, "8085 Microprocessor programming and interfacing", New Age
2. John Uffenbeck, "The 8080, 8085 & Z-80 Programming, Interfacing and Troubleshooting", PHI
3. Albert Paul Malvino, Jerald A. Brown, "Digital Computer Electronics", McGraw- Hill
Add more books

Marks Specification for final examination:

Unit	Content	Course Hours	Marks
1	Introduction to Microprocessor	5	9
2	Microprocessor architecture and the instruction set	8	14
3	Assembly language programming for 8085	8	14
4	Interfacing I/O and memory devices	8	14
5	8085 Interrupt processing	6	11
6	Introduction to Peripheral Devices	6	11
7	Advanced Microprocessors	4	7
	Total	**45**	**80**

Note: There might be minor deviation on the above specified marks.

Digital Electronics II
EG 2204 EX

Total: 6 hours/week
Year: II **Lecture: 3 hours/week**
Part: II **Tutorial: hours/week**
Practical: 3 hours/week

Course description:

This course deals with the study, design and application of digital devices that are based on various logic families.

Course Objectives:

After completing this course the students will be able to
1. Explain various logic families,
2. Design different logic concept and circuits.

Course Contents:

Unit 1: Logic Families **8 hrs**

1.1 Logic family classification. TTL, ECL, MOS, CMOS. Types of integration SSI, MSI, LSI, VLSI, ULSI
1.2 Characteristics of TTL and CMOS and the comparison. Propagation delay. Speed, noise margin. Logic levels, power dissipation, fan-in, fan-out, power supply requirements
1.3 Open collector and totem pole output circuits, operation of a standard TTL and CMOS (NAND, NOR gates)
1.4 CMOS to TTL interfacing and TTL to CMOS interfacing, LAMP/LED interfacting
1.5 Introduction to tri-state devices tri-state buffer and invertor circuits. Examples of unidirectional and bi-directional bus with tri-state interfacing.

Unit 2: Analog to Digital (A/D) and Digital to Analog (D/A) Converters **8 hrs**

2.1 D/A Converters: Performance characteristics of D/A converters, binary weighted resister network and R2R ladder network methods of D/A converters and applications
2.2 A/D Converters: Performance characteristics of A/D converters, single slope, dual slope, successive approximation and parallel A/D converters

Unit 3: Memories **10 hrs**

3.1 Memory organization, classification of semiconductor memories, ROM, PROM, DROM, EPROM, EEPROM, RAM,
3.2 Expansion of memory.
3.3 Introduction to CCD memories, content addressable memory
3.4 Programmable logic devices, PROM as PLD, programmable logic array (PLA) programmable array logic (PAL),
3.5 Field Programmable Gate Array (FPGA) and its general architecture
3.6 Familiarization with common ICs.

Unit 4: Combinational Circuits **7 hrs**

4.1. Minimization of Boolean expressions using
- K-map method,
- tabular method of function minimization,
- Quine McCluskey method

Unit 5: Sequential Circuits **8 hrs**

5.1. Essential components of sequential circuit,
5.2. Synchronous and asynchronous sequential circuits,
5.3. Classification of sequential circuits (Melay and Moore Machine),
5.4. Design of counters using J-K and R-S flip-flops.

Unit 6: Arithmetic and Logic Unit **4 hrs**

6.1. Basic idea about arithmetic logic unit with respect to IC 74181 and applications
6.2. Implementation of binary multiplication, division, subtraction and addition

Practical /Laboratory: **45 hrs**

1. Verify the operation of D/A converter
2. Verify the operation of A/D converter
3. Verify the writing and reading operation of RAM IC
4. Design J-K Flip-flop counter and verify its truth table
5. Familiarity with the use of EPROM programs and UV index
6. Exercise on programming of EPROM
7. Using PLA design and implement a combinational circuit like full adder
8. Design and implement full adder and full subtractor
9. Verify the logical operation, arithmetic operation of binary numbers using IC741981
10. Design of combination circuit using ROM

References:

1. Digital Systems and Applications by RJ Tocci, Prentice Hall of India, New Delhi
2. Digital Electronics by RP Jain, Tata McGraw Hill, New Delhi
3. Digital Electronics by KS Jamwal, Dhanpat Rai & Co., New Delhi
4. Digital Logic Designs by Morris Mano, Prentice Hall of India, New Delhi
5. Digital Designs by CJ Roth, Jaico Publication
6. Digital Designs by Z Kohavi
7. Digital Electronics by Terry LM Bartlet
8. Digital Electronics by Rajaraman V, Prentice Hall of India, New Delhi
9. Digital Fundamentals by Malvino and Leachy, Tata McGraw Hill Publishers, New Delhi
10. Digital Systems by Sanjay K Bose, Wiley Eastern (P) Ltd., New Delhi

Marks Specification for final examination:

Unit	Content	Course Hours	Marks
1	Logic Families	8	14
2	A/D and D/A Converters	8	14
3	Memories	10	18
4	Combinational Circuits	7	13
5	Sequential Circuits	8	14
6	Arithmetic and Logic Unit	4	7
	Total	**45**	**80**

Note: There might be minor deviation on the above specified marks.

Electronic Instruments and Measurement
EG 2205 EX

Total: 6 hours/week
Year: II **Lecture: 3 hours/week**
Part: II **Tutorial: hours/week**
Practical: 3 hours/week

Course description:

This course deals with fundamentals of measurement and instrumentation, measurements of signal and Calibration, Errors, Signal conditioning and data acquisition system.

Course Objective

After completing this course, the students will be able to:

1. To provide knowledge of measurements.
2. To gain the knowledge of working principles and operation of different instruments.
3. To handle wide variety of instruments while testing, trouble shooting, and calibration.

Course content

Unit 1: Basics of Measurements **5 hrs**

1.1 Measurement, method of measurement, types of instruments
1.2 Specifications of instruments: Accuracy, precision, sensitivity, resolution, range, errors in measurement, sources of errors, limiting errors and loading effect
1.3 Requirements, importance and applications of standards and calibration

Unit 2: Multimeter **6 hrs**

2.1 Principles of measurement of DC voltage, DC current, AC voltage, AC current
2.2 Moving coil and moving iron type instruments (voltmeter and Ammeter)
2.3 Block diagram of multimeter and measurement of voltage, current and resistance using multimeter
2.4 Specifications of multimeter and their applications
2.5 Limitations with regard to frequency and input impedance

Unit 3: Electronic Voltmeter **3 hrs**

3.1 Advantages over conventional multimeter for volt measurement with respect to input impedance and sensitivity,
3.2 Principles of voltage, current and resistance measurement (block diagram only),
3.3 Specifications of electronic voltmeter

Unit 4: AC Milli Voltmeter **4 hrs**

4.1. Types of AC milli voltmeters and their block diagram with description,
4.2. Typical specifications and their significance

Unit 5: Cathode Ray Oscilloscope **6 hrs**

5.1. Construction and working of different blocks used in CRT,
5.2. Time base operation and need for blanking during flyback, synchronization,
5.3. Block diagram description of a basic CRO and triggered sweep oscilloscope, front panel controls,
5.4. Specifications of CRO and their explanation,
5.5. Measurement of current, voltage, frequency, Time period and phase using CRO, CRO probes,
5.6. Digital storage oscilloscope: block diagram and working principle

Unit 6: Signal Generators and Analysis Instruments **5 hrs**

6.1. Explanation of block diagram of AF sine and square wave generator and RF generators with their specifications
6.2. Pulse generator, function generator, Distortion factor meter; wave analyzer

Unit 7: Impedance Bridges and Q Meters **6 hrs**

7.1. Wheat stone bridge
7.2. AC bridges: Maxwell's induction bridge, Hay's bridge and Schering Bridge
7.3. Block diagram and working principle of Q meter and its specifications.

Unit 8: Digital Instruments **6 hrs**

8.1. Comparison of analog and digital instruments,
8.2. Working principle of ramp and integration type digital voltmeter,
8.3. Block diagram and working of a digital multimeter,
8.4. Measurement of time interval, time period and frequency using universal counter/ frequency counter,
8.5. Brief working principle of logic probe, logic pulser, logic analyzer.

Unit 9: Measurement of Power **4 hrs**

9.1. Measurement of power using voltmeter & ammeter
9.2. Wattmeter (dynamo type) Brief operation and application
9.3. Energy meter (Kwh meter) Operation & application

Practical /Laboratory: **45 hrs**

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance
2. To observe the limitations of a multimeter for measuring high frequency voltage
3. Measurement of voltage, frequency and time period using CRO
4. Measurement of rise time and fall time using CRO
5. Measurement of Q of a coil and its dependence on frequency
6. Measurement of voltage, frequency, time and phase using DSO
7. Use of logic pulser and logic probe

References:

1. Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai andSons, New Delhi
2. Electronics Instrumentation by Cooper, Prentice Hall of India, New Delhi
3. Electronics Test and Instrumentation by Rajiv Sapra, Ishan Publications, Ambala
4. Electronics Instrumentation by JB Gupta, Satya Prakashan, New Delhi

Marks Specification for final examination:

Unit	Content	Course Hours	Marks
1	Basics of Measurements	5	9
2	Multimeter	6	11
3	Electronic Voltmeter	3	5
4	AC Milli Voltmeter	4	7
5	Cathode Ray Oscilloscope	6	11
6	Signal Generators and Analysis Instruments	5	9
7	Impedance Bridges and Q Meters	6	11
8	Digital Instruments	6	11
9	Measurement of Power	4	6
	Total	**45**	**80**

Note: There might be minor deviation on the above specified marks.

Repair and Maintenance of Electronic Appliances-I

EG 2206 EX

Total: 5 hour /week

Year: II **Lecture: hours/week**

Part: II **Tutorial: hours/week**

Practical: 5 hours/week

Course description

This course deals with the procedures of testing, repairing and maintenance of essential domestic electrical and electronic appliances.

Course objectives

On completion of this course the students will be able to:

1. Test and identify the fault of consumer appliance
2. Troubleshoot the faulty parts/section
3. Repair and Replace the faulty part in consumer appliances
4. Reform and supervise repair work
5. Prepare circuit diagram of consumer appliances

Course Contents ***75 hrs***

Unit 1. Introduction to maintenance principles **3 hrs**

1.1 Overview of safety measures to be adopted during maintenance.
1.2 Preventive and corrective maintenance
1.3 Introduction to fault diagnosis techniques, using basic flow chart

Unit 2. Power Supply **10 hrs**

2.1 Testing of active components
2.2 Practice soldering and de-soldering techniques
2.3 Assemble and test– half wave, full wave & bridge rectifier circuits with and without filter.
2.4 Identify the different types of fixed positive and negative regulator ICs (78/79 series)
2.5 Identify the pins
2.6 Construct a fixed voltage regulator using 78xx/79xx series ICs
2.7 Construct a variable voltage regulator using LM 723.
2.8 Observe the output voltage of different IC regulators by varying the input voltage

Unit 3. UPS/Inverter **8 hrs**

3.1 Installation of UPS and Inverters
3.2 Maintenance of batteries

3.3 Dismantle the UPS and identify the major parts
- Testing of major components
- Testing of power modules
- Charging, discharging and testing of batteries.

Unit 4. Battery- charger 6 hrs

4.1. Transformer, electronic circuit, rectifiers-filter control, float and boost charge in indicator.

4.2. Continuity test, leakage test, disassembling and assembling procedure and final test

Unit 5. Voltage stabilizer 8 hrs

5.1. Safety precautions and demonstration of principle of operation

5.2. Consideration when troubleshooting

5.3. Transformer, electronic components, DC circuit, continuity of components and body leakage

Unit 6. Rice Cooker 6 hrs

6.1. Thermal fuse, magnetic switch, bi-metallic thermostatic switch ON/OFF switch indicator, cooking element and warmer element

6.2. Visual inspection, disassembling and assembling procedure and final test

Unit 7. Grinder, Mixture and Dryer 8 hrs

7.1. Armature winding, field winding, capacitor suppression, limit switch, carbon brush, holders and carbon heating element

7.2. Visual inspection, continuity test, body leakage test, disassembling and assembling procedure and final test

Unit 8. Washing machine 13 hrs

8.1 Installation of front load washing machine

8.2 Installation of top load washing machine

8.3 Identify the internal and external parts of semi-auto washing machine

8.4 Identify the internal and external parts of fully automatic washing machine

8.5 Operate semi–automatic washing machine

8.6 Operate fully automatic washing machine

8.7 Rectify the fault leading to not working of control panel switches.

8.8 Rectify the fault leading to not working of pulsator / agitator.

8.9 Rectify the fault leading to spin drier not working.

8.10 Rectify the fault leading to one side rotation of motor.

8.11 Rectify the fault leading to water inlet

Unit 9. Microwave Oven 13 hrs

9.1 Identify the internal and external parts of microwave oven.

9.2 Identify the different touch pad controls their functions.

9.3 Testing of high voltage diode.

9.4 Identify the HV capacitor and discharge it.

9.5 Rectify the fault leading to fuse blows off when cooking is initiated.
9.6 Rectify the fault leading to not responding of touch switches. (front panel)
9.7 Rectify the fault leading to dead set.
9.8 Rectify the fault leading to long cooking time.
9.9 Precautions – importance of interlocking switch in performing maintenance

References:

1. Troubleshooting and Repairing Major Appliances, 3 editions by Eric Kleinert
2. Electrical motor Repair - Robert Rosenberg
3. Handbook of Repair and Maintenance of Domestic Electronics by Shashi Bhushan Sinha
4. The Complete Guide to the Maintenance and Repair of Domestic Electrical by Graham Dixon
5. Troubleshooting Repairing Consumer Electronics Without a Schematic by Homer L. Davidson
6. Consumer Electronics Troubleshooting and Repair Handbook by Homer L. Davidson
7. Troubleshooting Electronic Equipment by R. Khandpur
8. The complete microwave oven service handbook operation, maintenance, troubleshooting, and repair by J. Carlton Gallawa
9. Manufacturer's catalogue and repair manual

Minor Project
EG 2207 EX

Total: 3 hour /week
Year : II **Lecture: hours/week**
Part :II **Tutorial: hours/week**
Lab: 3 hours/week

Course description:

This course deals with mini projects for diploma course in Electronics Engineering. The students will carry out a small scale project to develop hands-on experience of working in a project. During the course, the student will also develop small but practical usable device and apply effectively. The students will learn working as a team, basic collaboration and project management skills. The student will also learn about formulating project documentations as well.

Course Objective:

After completing the project, students will be able to

1. Select a project
2. Analyze and design the project work
3. Implement the project
4. Document the project
5. Provide the PowerPoint presentation.

Course Content: ***45 hrs***

Following minor project list is built using a variety of sensors, microcontrollers, motors, buzzers and other electronics component to cover a wide scale of electronics and electrical domains. Fabrication and testing of the following mini projects can be done:

1. Single Stage Amplifier
2. Full wave rectifier using Pi Filter
3. Two Stage R-C coupled Amplifier
4. Clipping and clamper circuit.
5. Porch light using LED & SCR.
6. Clap Switch
7. Water Level Indicator.
8. Temperature indicator.
9. Lamp Dimmer.
10. Seven segment display
11. Fabricate distribution board consisting of 2 or 3 electrical points.
12. Fully automated emergency light
13. Home or Office automation
14. Mini project on renewable energy- Solar, Wind or hybrid
15. Application using microcontrollers/Programmable Logic Controllers
16. Project in the field of electronics/embedded system/networking/computer installation
17. Home Security System Project
18. Battery Charger Circuit Using SCR

19. Air Flow Detector Circuit
20. Water Level Alarm Circuit
21. Low Cost Fire Alarm Circuit
22. Single Chip FM Radio Circuit
23. Light Activated Switch Circuit
24. Water Level Controller using Micro Controller - AT89S51
25. Digital Voltmeter using 8051 Microcontroller – AT89S51

Beside these listed projects, some other mini project can also be prepared with the consultation of faculty member according to the local needs/ availabilities**.**

Note*:* A group of four to six students to be formed assemble the project model and should submit a report consisting of circuit diagram, brief detail of used component and total cost of the project. Report should not be exceeding of 10-15 pages

For each project a project supervisor is assigned by the department to assist the students in case of problem during the project development.

References:

1. Monthly Magazine**:** Electronics for You, Chip etc**.**
2. Electronics Project Books
3. Electrical Projects Books

Fifth Semester
Year III Part I

Subjects:

1	EG 3101 EX	Digital Communication System
2	EG 3102 EX	Computer Network
3	EG 3103 EX	Microcontroller and Embedded System
4	EG 3104 EX	Optical Fiber Communication
5	EG 3105 EX	Power Electronics
6	EG 3106 EX	Repair and Maintenance of Electronics Appliances II
7	EG 3107 EX	Industrial Attachment

Digital Communication Systems
EG 3101 EX

Total: 6 hours/week
Year: III **Lecture: 3 hours/week**
Part: I **Tutorial: hours/week**
Practical: 3 hours/week

Course Description:
Communication technologies have undergone radical changes, especially due to convergence of computers and communication. No industry is untouched by the digital communication. This course will enable the diploma engineers to apply facts. Concepts and working principles of Digital communication for the troubleshooting and maintenance of digital communication system. This course is intended to develop the skills to diagnose and rectify the errors occur in Digital communication system. The concepts and principles of digital communication will also lay the foundation to understand the various modern communication systems.

Course Objectives:
On completion of this course the students will be able to:
1. Explain the fundamentals of digital data communication systems
2. Analyse various error detection and correction codes in digital communication systems
3. Use various pulse code modulation techniques
4. Maintain systems based on digital modulation techniques.
5. Multiplex and demultiplex digital signals.
6. Maintain spread spectrum based systems.

Course Contents:

Unit 1. Introduction to Digital Communication **5 hrs**
- 1.1 Analog and digital carrier modulation/demodulation principles
- 1.2 Analog and digital communication systems
- 1.2 Advantages & applications of digital communication systems
- 1.3 Signals and Systems definition and types.

Unit 2. Baseband Digital Communication: **14 hrs**
- 2.1 Pulse Modulation Techniques
- 2.2 Pulse Amplitude Modulation (Natural sampling, Flat-Top PAM)
- 2.3 Pulse Code Modulation (Sampling, Quantization, Encoding, Practical circuits, Bandwidth considerations, Signalling rate, Companding laws)
- 2.4 Digital Signalling
  - Binary & Multi-level signalling
  - Line codes (waveforms of Unipolar RZ, NRZ, Polar RZ, NRZ, Waveforms of Manchester & Differential Manchester line codes)
  - Spectral Efficiency,
  - Eye pattern
- 2.5 Inter Symbol Interference (definition, mitigation measures)

2.6 Differential PCM and Delta Modulation.
2.7 Principles of Time Division Multiplexing (T1/E1 TDM PCM Hierarchy)

Unit 3. Digital Carrier Modulation principles and techniques: 13 hrs

3.1 Block diagram, working and waveforms of Amplitude, Frequency and Phase shift keying (ASK, FSK, PSK) transmitter & receiver, Block diagram of Quadrature Amplitude Modulation (QAM) and Differential PSK transmitter & receiver.
3.2 Comparison of digital modulation techniques (No mathematical approach)
3.3 Bandwidth and power efficiency of various digital carrier modulation techniques
3.4 Carrier recovery (Block diagram of Squaring loop, Costas loop) and clock recovery techniques.
3.5 Error probability and bit error rate

Unit 4. Introduction to Coding Theory: 13 hrs

4.1. Introduction to Information theory (Amount of information, Entropy, Information Rate) and Shannon Hartley's channel capacity theorem
4.2. Effect of channel noise and interference on the performance of digital communication system
4.3. Source and channel coding Theories:
- Shannon-Fano and Huffman coding (Including Numerical to generate codes, Find Entropy, Average length and Efficiency)
- Hamming distance and Hamming weight calculations
- Introduction to Block and Convolution Codes.

4.4. Error detection and correction algorithms

Practical /Laboratory: **45 hrs**

1. Test the performance of natural and flat top sampling circuit.
2. Test the sample and hold circuit for various sampling frequencies to check the sampling theorem.
3. Test the performance of the Pulse Code modulator/ demodulator circuit.
4. Test the performance of the Amplitude Shift Keying (ASK) modulator/ demodulator circuits.
5. Test the performance of the Frequency Shift Keying (FSK) modulator/ demodulator circuits.
6. Test the performance of the Phase Shift Keying (PSK) modulator/ demodulator circuits.
7. Test the line encoder circuit for various line encoding Formats
8. Test the performance for Time division multiplexing circuit.
9. Test the performance for Frequency division multiplexing (FDM) circuit.

References:

1. An Introduction to analog and digital communications, by Simon Haykin., John Wiley and Sons.
2. Digital and Analogue communication systems, by Leon Couch II, Pearson Education, 2001
3. Advanced Electronic Communication Systems, Wayne Tomasi, Prentice Hall India, 2004
4. Communication Systems, by Sanjay Sharma, S.K. Kataria and sons

Marks Specification for final examination:

Unit	Content	Course Hours	Marks
1	Introduction to Digital Communication	5	9
2	Baseband Digital Communicati	14	25
3	Digital Carrier Modulation principles and techniques:	13	23
4	Introduction to Coding Theory:	13	23
	Total	**45**	**80**

Note: There might be minor deviation on the above specified marks.

Computer Networks
EG 3102 EX

Year: III **Total: 6 hour /week**
Part: I **Lecture: 3 Hours/Week**
Practical: 3 Hours/Week

Course Description:

This course deals with fundamentals of computer network, its architecture, its standards, protocols and security issues used in computer network.

Course Objectives:

After completing this course, the students will be able to:
1. Introduce the architecture of computer network
2. Explain various hardware devices and software used in computer networks
3. Setup small home/office network
4. Make secure computer network

Unit 1: Introduction to computer networks **5 hrs**
- 1.1 Introductory concept of computer network
- 1.2 Features of computer network
- 1.3 Classification of computer network
- 1.4 Introduction of networking
- 1.5 Concept of internet
- 1.6 Application and challenging issues of computer network

Unit 2: Network Architecture **5 hrs**
- 2.1 Network types: [LAN, MAN, WAN, CAN, SAN, PAN]
- 2.2 OSI Reference model
- 2.3 TCP/IP Reference model
- 2.4 Network protocols, interfaces, services

Unit 3: Hardware and Software for Computer Network **6 hrs**
- 3.1 Concept of hardware and software for networking
- 3.2 Network devices: [Repeater, Hub, NIC, Bridge, Switch, Router, Gateway]
- 3.3 Client- server and peer to peer model
- 3.4 Connection versus connectionless services

Unit 4: LAN architecture and standards **3 hrs**
- 4.1 Introduction to LAN standards and architecture
- 4.2 Media access control
- 4.3 MAC address
- 4.4 CSMA/CD
- 4.5 Token ring, Token bus
- 4.6 IEEE 802.3, 802.4, 802.5
- 4.7 Introduction to wireless LAN, Bluetooth, Wi-Fi, Wi-Max

Unit 5: Physical layer and data layer **7 hrs**

5.1 Introduction to physical layer
5.2 Line coding formats
5.3 Channel bandwidth
5.4 Propagation and transmission time
5.5 Introduction to data link layer and its issues
5.6 Flow and error control issues at data link layer
5.7 Data link layer protocols [HDLC, PPP]

Unit 6: Network Layer **7 hrs**

6.1 Internetworking
6.2 Addressing issues, IP address
6.3 Different classes
6.4 Private and Public address
6.5 Subnet mask and Subnetting (with numericals)
6.6 Classless addressing
6.7 Routing type and its necessity
6.8 Introduction to IPv4, IPv6 and its necessity

Unit 7: Transport and Application Layer **7 hrs**

7.1 Transport layer issues [Congestion control, Flow control, Quality of service]
7.2 Transport layer protocols [TCP, UDP]
7.3 Application layer and its function
7.4 Electronic mail: SMTP, File transfer: FTP
7.5 Protocols [DHCP, DNS, HTTP, WWW]

Unit 8: Computer Network Security **5 hrs**

8.1 Security concept [Confidentiality, Integrity and Availability], Digital signature
8.2 Cryptography and key management
8.3 Firewalls
8.4 Virtual private network,
8.5 Wireless security threads and mitigation

Practical /Laboratory: **45 hrs**

1. Installation of network interface card and various network devices like hub, switch, router.
2. Prepare different types of Network cables and practically implements cross-wired cable and straight through cable using clamping tool.
3. Perform Installation and configuration of workstation PC
4. To setup peer-to-peer networking.
5. To install and configure server for client server networking.
6. Familiarization with basic network commands: Observing IP address and MAC address, Setting IP address and default gateway in PC, Verifying network layer connectivity
7. Dynamic routing (e.g. RIP) and default route
8. Configure HTTP, FTP, DHCP server.
9. Configuration of DNS and e-mail server
10. Design of local area network (LAN, MAN, WAN)
11. Case Study: Organizational visit to study existing network system and submit the report.

***References:*:**

1. “Computer Networks”, A. S. Tanenbaum
2. “Data Communications and Networking”, Behrouz A. Forouzan
3. "Data communication and computer Network", Dr. Sanjay Sharma, S. kkataria & sons-latest edition

Unit wise Marks division for Final Exam

Unit	Content	Course Hours	Marks
1	Introduction to computer networks	5	9
2	Network Architecture	5	9
3	Hardware and Software for Computer Network	6	11
4	LAN architecture and standards	3	6
5	Physical layer and data layer	7	12
6	Network Layer	7	12
7	Transport and Application Layer	7	12
8	Computer Network Security	5	9
9	Case Study		
	Total	**45**	**80**

*Some minor change may arise in marks distribution.
*One question of 8 marks should be asked as optional.

Microcontrollers and Embedded System

EG 3103 EX

Total: 6 hours/week

Year: III **Lecture: 3 hours/week**

Part: I **Tutorial: hours/week**

Practical: 3 hours/week

Course Description:

The study of microcontrollers in terms of architecture, software and interfacing techniques leads to the understanding of working of microcontrollers and applications of microcontroller in electronic industries. Microcontroller is the heart of the programmable devices. Embedded systems and Micro-controllers have also assumed a great significance in the electronic and consumer goods industry and are a very vital field. Students of electronics and related engineering branches often use microcontroller to introduce programmable control in their projects, automation and fault finding in industry. The subject aims expose students to the embedded systems besides giving them adequate knowledge of micro controllers.

Course Objectives:

After completion of the subject, the learner should be able to:

1. Explain the working of microcontrollers
2. Describe the Instruction set and programming related to microcontrollers
3. Describe embedded system
4. Explain embedded operating systems
5. Program PIC microcontroller and AVR microcontroller
6. Interface sensors with microcontroller

Course Contents:

Unit 1. Microcontroller series (MCS) **10 hrs**

1.1 Difference between microprocessor and Microcontroller
1.2 Architecture of 8051 Microcontroller
1.3 Pin details
1.4 I/O Port structure
1.5 Memory Organization
1.6 Special Function Registers (SFRs)
1.7 External Memory

Unit 2. Instruction Set for Microcontroller Programming **12 hrs**

2.1 Instruction Set of 8051
2.2 Addressing Modes,
2.3 Types of Instructions
2.4 Timer operation
2.5 Serial Port operation
2.6 Interrupts

Unit 3. Introduction to Embedded System **9 hrs**

3.1 Embedded system overview
3.2 Difference between general Purpose Computers and embedded systems.

3.3 History of embedded systems
3.4 Embedded system architecture
3.5 Functional structure of embedded system
3.6 Real-time operating system
3.7 Factors affecting embedded systems
3.8 Applications of embedded systems
3.9 Embedded systems characteristics and features

Unit 4. Embedded Processor Architecture **6 hrs**

4.1 RISC and CISC Architecture and their difference
4.2 Introduction of PIC and AVR microcontroller, block diagram, function of each block.
4.3 Difference between PIC & AVR Microcontroller.

Unit 5. Programming concepts of microcontrollers. **4 hrs**

5.1 Basic introduction of Software used in microcontrollers.
5.2 Methods to transfer C or ASM code in microcontrollers.

Unit 6. Input/output interface **4 hrs**

6.1 Interfacing Sensors, 7-segement display, LCD, LED and relay

Practical /Laboratory: **45 hrs**

1. Familiarization with Micro-Controller Kit and its different sections
2. Programming to interface switches and LEDs
3. Programming and interface of Seven Segment and LCD.
4. Programming for A/D converter, result on LCD.
5. Programming for D/A converter, result on LCD.
6. Programming for serial data transmission from PC to Kit or Vice versa.
7. Design PIC based Security System
8. Design AVR based Temperature indicator cum controller.
9. Case Study: Prepare and submit case study report of any one embedded system.

References:

1. Fundamentals of Microprocessor and Microcontroller by B. Ram, Dhanpat Rai Publications.
2. Microcotroller and Embedded Systems using Assembly and C by Muhammad Ali Mazidi, RolinMckinlay, Janice GilispieMazidi: Pearson
3. PIC Microcontroller and Embedded Systems: Using assembly and C by Muhammad Ali Mazidi, RolinMckinlay, Danny Causey; Pearson
4. Microcotroller and Embedded Systems using Assembly and C by Muhammad Ali Mazidi, RolinMckinlay, Janice GilispieMazidi, Pearson
5. Embedded Systems - Architecture, Programming, Design, by Kamal, R. Tata McGraw Hill, New Delhi

Marks Specification for final examination:

Unit	Content	Course Hours	Marks
1	. Microcontroller series (MCS)	10	18
2	Instruction Set for Microcontroller Programming	12	21
3	Introduction to Embedded System	9	16
4	Embedded Processor Architecture	6	11
5	Programming concepts of microcontrollers.	4	7
6	Input/output interface	4	7
	Total	**45**	**80**

Note: There might be minor deviation on the above specified marks.

Optical Fiber Communication

EG 3104 EX

Total :6 hours/week
Year :III **Lecture :3 hours/week**
Part :1 **Tutorial :hours/week**
Practical :3 hours/week

Course description :

This course deals with the principles of optical fiber communication system .

Course Objectives :

After completing this course the students will be able to

1. Explain basic optical communication systems .
2. Understand principles of optical fiber communication system

Course contents :

Unit 1 Introduction **6 hrs**

1.1 Historical perspective, basic communication systems, optical frequency range .
1.2 Application of fiber optic communication
1.3 Electromagnetic spectrum used,
1.4 Advantages and disadvantages of optical communication .
1.5 Principle of light penetration, reflection, critical angle .

Unit 2 Optical Fibers and Cables **7 hrs**

2.1 Fiber types and its construction,
2.2 Multimode and monomode fibers,
2.3 Step index and graded index fibers,
2.4 Acceptance angle

Unit 3 Losses in optical fiber cable : **7 hrs**

3.1 Absorption Losses, Scattering Losses, Radiation losses, Compelling losses, bending loses .
3.2 Dispersion types and its effect on data rate
- Material dispersion
- Wave guide dispersion
- Modal dispersion
- Total dispersion

Unit 4 .Light sources and Detectors **14 hrs**

4.1 Characteristics of light source used in optical communication,
4.2 Principle of operation of LED,
4.3 Different type of LED structures used and their brief description,
4.4 LED driving circuitry, Injection Laser diode, principle of operation,
4.5 Different injection laser diodes,

4.6 Comparison of LED and ILD, non-semiconductor laser .
4.7 Characteristics of photo detectors used in optical communication;
4.8 PIN diode and avalanche photo diode) APD), their brief description

Unit 5 Connectors, Splicing and coupling **6 hrs**

5.1 Fiber alignment and joint losses
5.2 Splicing, types of splices, types of connectors used
5.3 Couplers, three and four port coupler, star coupler
5.4 Fiber optic switch

Unit 6 Optical Fiber System **5 hrs**

6.1 Optical transmitter circuit
6.2 Optical receiver circuit
6.3 Optical power budgeting,
6.4 Multiplexing methods used
6.5 Modulation methods used

Practical /Laboratory: ***45 hrs***

1. Setting up of fiber analog link
2. Setting up to optic digital link
3. Measurement of various losses in optical fibers
4. To observe and measure the splice or connector loss
5. To measure and calculate numerical aperture of optical fiber
6. To observe characteristics of optical source
7. To observe characteristics of optical detector
8. To observe the radiation pattern of LED
9. To Connect a fiber with connector at both ends
10. Introduction to various components and tools used in optical fiber communication

References:

1. Optical fiber Communication by John M Senior, Prentice Hall of India, New Delhi
2. Optical fiber Communication by J .Gower, Prentice Hall of India, New Delhi
3. Optical fiber Communication by „ Gerd Keiser, McGraw Hill International Editions
4. Optical Communications -Components and Systems by JH Franz and VK Jain, Narosa Publishing House, New Delhi
5. Optical fiber Communication Systems by GP Agrawal, John Wiley & Sons, New Delhi
6. Optical fiber Communication and its Applications by S C Gupta, Prentice Hall of India, New Delhi

Marks Specification for final examination:

Unit	Content	Course Hours	Marks
1	Introduction	6	11
2	Optical Fibers and Cables	7	12
3	Losses in optical fiber cable	7	12
4	Light sources and Detectors	14	25
5	Connectors, Splicing and coupling	6	11
6	Optical Fiber System	5	9
	Total	**45**	**80**

Note: There might be minor deviation on the above specified marks.

Power Electronics
EG 3105 EX

Total: 6 hours /week
Year: III **Lecture: 3 hours/week**
Part: I **Practical: 3 hours/week**

Course Description:

This course covers solid-state elements of industrial control including Triacs, SCRs and triggering devices, industrial applications of electronics and other control devices. Concept of AC-DC conversion and frequency control are briefly discussed in this course along with its applications.

Course Objectives:

After completing this course the student will be able to:

1. Explain the importance of power electronic equipment used in process control Industry.
2. Explain the principle of industrial control.
3. Explore electronic devices used in industrial control.
4. Explore industrial controls from a systems approach

Course contents:

Unit: 1 Power Electronics Devices **10 hrs**

1.1 Power diode – Construction, Characteristic and ratings
1.2 Power Transistor - Construction, Characteristic, use as power switch
1.3 Thyristor – Construction, Characteristics, Turn on mechanism, Turn-on process with gate signal, thyristor firing circuit, thyristor commutation and its type
1.4 GTO - Construction, Characteristics,
1.5 TRIAC – Construction and Characteristics.
1.6 MOSFET - Construction and Characteristics.
1.7 IGBT - Construction and Characteristics.
1.8 Basic idea about the selection of Heat sink for thyristors.
1.9 Application such as light intensity control, speed control of universal motors, fan regulator, battery charger

Unit 2: Controlled Rectifiers **10 hrs**

2.1 Single phase half wave controlled rectifier with load (R, R-L), calculation of rms value, average value, ripple factor, efficiency
2.2 Single phase full wave controlled rectifier (R, R-L) calculation of rms value, average value, ripple factor, efficiency
2.3 Single phase full wave centre tap rectifier
2.4 Fully controlled full wave bridge rectifier.
2.5 Filtering: C, L and LC filters

Unit 3. DC Chopper **2 hrs**

3.1 Step down chopper – Circuit diagram, operation, constant and variable chopping frequency operation.

3.2 Step up chopper – Circuit diagram and operation.

Unit 4. Inverter and Cyclo-Converter **12 hrs**

4.1 Single phase square wave inverter – Circuit diagram, operating principle, rms value of output voltage, operation with resistive load.

4.2 Three-phase bridge inverter with six-step output voltage waveform – Circuit diagram, operating principle, rms value of output voltage, operation with resistive load.

4.3 Application of inverter in speed control of induction motor and synchronous motor.

4.4 Introduction, types & basic working principle of cyclo converters & their applications.

4.5 Introduction, types & basic working principle of AC voltage controller & their applications.

Unit 5: Thyristorised Control of Electric drives **8 hrs**

5.1 DC drive control: Half wave drives, Full wave drives, Chopper drives (Speed control of DC motor using choppers)

5.2 AC drive control: Phase control, Constant V/F operation, Cyclo converter/Inverter drives.

Unit 6: Uninterrupted Power supplies **3 hrs**

6.1 UPS, on-line, off line & its specification

6.2 Basic concept of SMPS

Practical /Laboratory: **45 hrs**

1. Characteristics of Power diode
2. Characteristics of Thyristor
3. Efficiency of half wave rectifier, observation of output voltage waveform with and without capacitor filter
4. Efficiency of full wave rectifier, observation of output voltage waveforms with and without capacitor filter
5. Speed control of DC motor using Chopper, observation of output voltage waveforms with resistive load
6. Fabrication of single phase AC voltage controller, observation of output voltage waveforms with resistive load
7. Single Phase Square wave inverter with resistive load

***References:*:**

1. Power Electronics by P.C. Sen Tata Mc Graw Hill. New Delhi
2. Power Electronics by P.S. Bhimbhra, Khanna Publishers, New Delhi
3. Power Electronics by M.S. Berde, Khanna Publishers, New Delhi.
4. Power Electronics by MH Rashid
5. Industrial Electronics and Control by SK Bhattacharya and S. Chatterji, New Age Publications. New Delhi

Marks Specification for final evaluation:

Unit	Content	Course Hours	Total marks
1	Power Electronics Devices	10	18
2	Controlled Rectifiers	10	18
3	DC Chopper	2	4
4	Inverter and Cyclo-Converter	12	21
5	Thyristorised Control of Electric drives	8	14
6	Uninterrupted Power supplies	3	5
	Total	**45**	**80**

Note: There might be minor deviation on the above specified marks

Repair and Maintenance of Electronics Appliances-II

EG 3106 EX

Total: 4 hours/week

Year: III **Lecture: hours/week**

Part: I **Tutorial: hours/week**

Practical: 4 hours/week

Course Description:

The PC Compatible Microcomputer family and mobile phones are rapidly moving forward in power & capabilities. This Course introduces students regarding tools, and equipments of system and also upgrades & repairs the system. This course caters the requirements of practical knowledge for repair and maintenance of computer/laptop and mobile phones, which will help students to pursue their career in this field.

Course Objectives:

After completion of the subject, the learner should be able to:

1. Demonstrate the basic hardware of computer/laptop and mobile phones.
2. Demonstrate different components of motherboard and processing unit
3. Apply various techniques of interfacing and Use serial/ parallel port.
4. Demonstrate working of various power supplies.
5. Identify systems hardware, I/O devices & related faults.
6. Discuss mobile handset features and types.
7. Use of various tools required for mobile phone repairing.
8. Test and identify faults in various electronic components and replace them.
9. Testing Integrated Circuit Packages (ICs) On Mobile Phone PCBs.
10. Flashing software into mobile phones.

Course Contents:

Unit 1. Mobile Handset Repair & Maintenance **30 hrs**

1.1 Reading & writing skills, Communication skills, Time management skills, Team skills, Safety & Security.

1.2 Introduction to mobile phones, Generations of mobile phones, FHSS networks, GSM, Spread spectrum, CDMA, TDMA & Basic electronics components.

1.3 Handset Specific operating systems, Handset features & applications, working principle of mobile handset & Components used in mobile handsets.

1.4 Tools & equipment used for repairing & maintenance of mobile handsets, types of power supply & batteries, boosting a battery, Troubleshooting basics.

1.5 Network problems, Power failure (dead), Mobile phone hardware troubleshooting (water damage, hanging, charging & keypad problems), Handsets assembly& disassembly, Soldering & desoldering and use SMD rework station.

1.6 BGA IC's, Basics of Computer, Installation of software, Flashing, PC based diagnostic tools, mobile sets formatting, use of secret codes.

1.7 Mobile softwares, Data cable, Card reader, Mobile display, Remove/replace Component & Mobile phone hardware troubleshooting (Troubleshooting through circuit diagram, transmission, transmitter filter, microphone, reception, Antenna, RF power amplifier, local oscillator, Audio IC, speaker, charge and other Circuitry).

Unit 2. Assembly and Maintenance of Computers 30 hrs

2.1 Assembly and Installation of Peripheral Devices: Installation of Power Supply; Attach Components to Motherboard: CPU, Heat Sink, Fan, Thermal component, RAM; Installation of Motherboard in Case; Installation of Internal Devices: Hard disk drive(HDD**)**, Solid State Drive (SSD), Optical drives **(**CD and DVD); Installation of Adapter Cards: NIC, Wireless, Video cards; Connection of Internal cables; BIOS set-up.

2.2 Introduction of Laptop; Types of Laptop: Traditional, Subnotebook & Notebook; Disassembly of laptop & study hardware used in Laptop; Devices used in Laptop: Display, CPU, Graphical processing unit, Memory, Internal storage, Input, I/O Ports, Expansion Cards, Battery and Power supply

2.3 Upgradation and Security System: Introduction about Security; Classification of Security Threats: Hackers, Malware and User Error; Introduction to virus and Antiviruses; How to secure your Computer; Security for Wireless Networking; How to secure DATA; Updating Microsoft Software and Installation of antivirus softwares.

References:

1. Computer Installation and Servicing, D. Balasubramanian, Tata McGraw Hill
2. The complete PC upgrade and Maintenance, Mark Minasi, BPB Publication, The complete PC upgrade and Maintenance
3. Troubleshooting, Maintaining and Repairing PCs, Stephen J Bigelow, Tata McGraw Hill Publication, Troubleshooting Maintaining and Repairing PCs
4. Upgrading and repairing laptops, Scott Mueller, QUE Publication,
5. Upgrading and repairing laptops "Hardware and Software of Personnel Computers" By Bose S. K.; Wiley Eastern Ltd. New Delhi.
6. The Laptop Repair Workbook: An Introduction to Troubleshooting and Repairing Laptop Computers by Morris Rosenthal
7. Laptop Repair Complete Guide; Including Motherboard Component Level Repair by Garry Romaneo.
8. The Ultimate Laptop Repairing Course by Rahaman K A
9. Mobile Phones and Tablets Repairs: A Complete Guide for Beginners and Professionals by Chukky Oparandu.
10. Smartphone Troubleshooting Repair by Mr Victor Emeka.
11. Magazines for mobile phone repair and maintenance.

Industrial Attachment
EG 3107 EX

Total: 6 hours/week
Year: III **Lecture: hours/week**
Part: I **Tutorial: hours/week**
Practical: 6 hours/week

Course Description:
The aim of the polytechnic education is to create a pool of skill based manpower to support shop floor and field operations as a middle level link between technicians and engineers. Diploma pass out plays an important role in managing shop-floor operations Therefore, it is necessary to the diploma pass out to get acquainted with the actual shop floor operations in the industry. This course has been designed to give actual working environment exposure to the diploma students.

Course Objectives:
After completion of the subject, the learner should be able to:
1. Adhere industrial safety practices
2. Work in industrial working environment.
3. Carry out survey related to industrial processes.
4. Identify industrial problems for industrial Project Course
5. Prepare industrial training report based on work experience
6. Present report

Course Contents:

Unit 1. Industrial Visits **18 hrs**

Visit any one industries related to program. Small scale, medium scale, large scale and perform task given in following point 2 to 5.

Unit 2. Safety Practices **4 hrs**

Adhere Industrial Safety Practices
- Talk to safety officer
- Record the safety practices to be followed in industry.
- Record Don'ts and Do's.
- Follow all instructions.

Unit 3. Survey **10 hrs**

Perform Industrial Process Survey
- Collect information regarding various processes carried out in an industry by discussing the allotted supervisor/officer
- Note down findings
- Prepare brief report

Unit 4. Working Experiences **28 hrs**

Work in industrial working environment
- Follow instructions of supervisor
- Observe industrial processes
- Record daily work done in diary

Unit 5. Problem Identification **10 hrs**

Identify industrial problems

- Discuss with the supervisor and workers
- Identify the problem in any of the industrial process/system
- Record your findings

Unit 6. Report Writing (After Completion of Training) **20 hrs**

6.1 Prepare industrial training report in standard format, which includes following.

- Title Page which includes: Title, Purpose of submission, Institute logo, Students Name, Industry Name, Department and Institute Name
- Certificates: Student declaration, Certificate from industry
- Acknowledgement
- Text
    - Introduction to Industry
    - Safety Practices in Industry
    - Industrial Process
    - Working Experience
    - Results
    - Summary/Conclusion.
    - References

6.2 Use Latex for preparing report.

6.3 Perform plagiarism check from free internet site.

- Submit report of plagiarism check to the allotted teacher with industrial training report.

7. Presentation (After Completion of Training) **8 hrs**

- Prepare power point presentation
- Present before panel of teachers.

NOTE: College/ Institute must facilitate students to select the industry & pursue Industrial visit. Visit must be done in the industries related to electronics, communication, electrical or IT engineering field.

Sixth Semester
Year III Part II

Subjects:

1	EG 3201 EX		Wireless and Mobile Communication
2	EG 3202 EX		Programmable Logic Controller
3	EG 3203 EX		Medical Electronics
4	EG 3204 EX		Major Project
5	EG 3201 MG		Entrepreneurship Development
6	Elective : One of the following		
	EG 3205 EX.1	a.	Microwave and Radar Engineering
	EG 3205 EX.2	b.	Renewable Energy Technology
	EG 3205 EX.3	c.	Imaging Technology Equipment
	EG 3205 EX.4	d.	Electric Vehicle Technology

Wireless and Mobile Communication
EG 3201 EX

Total: 7 hours/week
Year: III **Lecture: 4 hours/week**
Part: II **Tutorial: hours/week**
Practical: 3 hours/week

Course description:

This course deals with wireless and mobile communication technology that is complex but is spreading at a very fast rate. This course teaches the students about the principle and functioning of wireless/mobile system/equipment to keep themselves abreast of this latest application of communication.

Course Objectives:

After completing this course the students will be able to

1 Explain basic principles of wireless communications.
2 Explain basic concept of cellular communication system.
3 Explain basic principles, characteristics and applications of mobile communication system.
4 Explain basic principles, characteristics and applications of CDMA and GSM system.

Course contents:

Unit 1. Wireless Communication **10 hrs**

1.1 Introduction
1.2 Advantages of wireless communication
1.3 Electromagnetic waves.
1.4 Frequency Spectrum used.
1.5 Paging system.
1.6 Cordless Telephone System.
1.7 Cellular Telephone System
1.8 Comparison of above wireless communication systems.
1.9 Propagation considerations
- Range
- Atmospheric Effect
- Geographic Effect
- Fading
- Doppler Effect

Unit 2. Cellular Concept **14 hrs**

2.1 Cell area and Hexagonal Cell geometry
2.2 Capacity of cell

2.3 Concept of Frequency Reuse & Handover.
2.4 Interference: Co-channel and Adjacent channel
2.5 Methods of reducing Interference
2.6 Improving coverage and capacity in cellular system
- Cell Splitting.
- Sectoring
- Segmentation

Unit 3. Multiple Access Techniques for Wireless Communication 16 hrs

3.1 Introduction to Multiple Access.
3.2 Frequency Division Multiple Access (FDMA)
3.3 Time Division Multiple Access (TDMA)
3.4 Code Division Multiple Access (CDMA)
3.5 Spread Spectrum Multiple Access (SSMA)
3.6 Frequency Hopping Spread Spectrum (FHSS).
3.7 Distinction between TDMA FDD and TDMA TDD
3.8 Comparison of FDMA/TDMA/CDMA

Unit 4. Mobile Communication Systems 20 hrs

4.1 Basic Introduction of AMPS
4.2 Introduction to 1G, 2G, 3G, 4G, and 5G
4.3 Introduction of Global Systems for Mobile Communication (GSM**)**: Specifications, architecture and advantages
4.4 Introduction of CDMA System, comparison of CDMA and GSM Systems.
4.5 Introduction to GPRS and EDGE
4.6 Introduction to Architecture and Features of UMTS
4.7 Concept of HSPA (High Speed Packet Access)
4.8 Features and Architecture of LTE (Long Term Evolution), Concept of Vo-LTE **(**Voice Over Long Term Evolution)
4.9 Brief description of SIM, IMEI, Wi-Max and Bluetooth technology
4.10 Introduction to GPS (Global Position System) and its working principle.

Practical /Laboratory: **45 hrs**

Demonstrate the features, specification and working of cellular mobile

1. Measurement of signal strength at various points from a transmitting antenna
2. Observing call processing of GSM trainer kit.
3. Imparting industrial visit to any two of the following: Telecom Industry, Television Broadcast station and ISP industry to understand real time applications, including report submission.

References:

1. Wireless Communications (Principles and Practice), by Thedore S**.** Rappapoirt.
2. Introduction to Wireless and Mobile Systems, by Dharma Prakash Agarwal, Qing-An zeng.
3. Wireless Communications and Networking, by William Stallings.
4. Mobile and Personal Communication Systems and Services, by Raj Pandya, Prentice Hall of India, New Delhi
5. Mobile Communication by John Schiller, Prentice Hall of India, New Delhi
6. Wireless Communications by Pahalwan, Pearson Publishers.

Marks Specification for final examination:

Unit	Content	Course Hours	Total marks
1	Wireless Communication	10	13
2	Cellular Concept	14	18
3	Multiple Access Techniques for Wireless Communication	16	21
4	Mobile Communication Systems	20	28
	Total	**60**	**80**

Note: There might be minor deviation on the above specified marks.

Programmable Logic Controller (PLC)

EG 3202 EX

Total: 6 hour /week
Year: III **Lecture: 3 hours/week**
Part: II **Tutorial: hours/week**
Lab: 3 hours/week

Course description

This course is designed to provide fundamental concepts of PLC, Ladder programming using functions of PLC and its applications and simulations.

Course objectives

On completion of this course, the students will be able to:

1. Interpret the structure of a PLC, and its various components
2. Design a PLC system, component, or process to meet a set of specifications.
3. Explain the role of PLCs in safety critical systems.
4. Illustrate a PLC simulation software package.
5. Utilize software package to solve problems on a wide-range of PLC problems.

Course Contents

Unit 1: Introduction to Programmable Logic Controllers **5 hrs**

1.1 Definition, history of electric, electronic and PLC control
1.2 PLCs versus Other Types of Controls, advantage and disadvantage
1.3 Architecture Detail of PLC and Control System Components, principle of operation
1.4 PLC Product Application Ranges
1.5 Ladder Diagrams and the PLC
1.6 PLC Circuits and Logic Contact Symbol

Unit 2: PLC instructions set **4 hrs**

2.1 Configuring the PLC Memory—I/O Addressing
2.2 PLC Instructions for Discrete Inputs/Outputs
2.3 PLC Operation-Scan Time, Watch Dog Timer

Unit 3: PLC Logic, Timer, Counter Functions **6 hrs**

3.1 Introduction to PLC programming
3.2 Programming Logic Gate Functions and its basic applications
3.3 Retentive timers, Nonreactive timers and timer applications
3.4 Basic counter functions, Counter applications

Unit 4: PLC Math Functions **4 hrs**

4.1 Addition, Subtraction, Multiplication, Division

4.2 Square root, Scaling, Absolute value, X to the power of Y
4.3 Natural Logarithm, Base 10 logarithm-4, Sine, Cosine, Tangent

Unit 5: PLC Logic Functions **5 hrs**

5.1 Bit functions
5.2 Shift and rotate functions
5.3 PLC Compare, Jump, and MCR Functions
5.4 PLC Subroutine Functions
5.5 PLC Sequencer Function
5.6 PLC interrupt functions

Unit 6: Ladder diagram programming **7 hrs**

6.1 Types of programming languages for PLC
6.2 Programming based on Basic instructions, timer counter, sequencer to comparison instruction using ladder diagrams

Unit 7: **Applications of PLC** **6 hrs**

7.1 Process controls like Car parking, traffic light control, Door bell operation
7.2 Assembly process like Bottling plant control, sorting of objects for packaging

Unit 8: **Automation and data analysis** **8 hrs**

8.1 Industrial Automation and instrumentation system
8.2 Introduction to SCADA and DCS
8.3 Human Machine Interface
8.4 Serial networks **(**RS-232, RS-485**)**
8.5 TCP/IP networks

Practical /Laboratory: **45 hrs**

Perform the following tasks:

1. Execute program for logic function and make any application using logic functions of PLC **(**For example water level control, sensor operated light control, alarms)
2. Execute program for timer, counter, move, math, 7 segment display, encoder, decoder and other required functions and make any application**. (**For example traffic light, tank filling, motor, stepper motor control, security systems**)**
3. Execute program for bit, shift, rotate, jump, subroutine, sequencer function and make any application**. (**For example moving display, simple industrial, home automation**)**

References:

1. M. Rabiee, Programmable Logic Controllers: Hardware and Programming, Good heart-Willcox, 2002.
2. M. Rabiee, Programmable Logic Controllers: Hardware and Programming Laboratory Manual, Goodheart-Willcox, 2002.
3. Programmable Controllers (Theory and Implementation) By L. A. Bryan and E. A. Bryan
4. Programmable-Logic-Controllers-Fourth Edition, Author: W. Bolton
5. Programmable Logic Controllers: An Emphasis on Design and application, Author: Kelvin T. Ericson
6. Programmable Logic Controller by Frank Petruzella

Marks Specification for final examination:

Unit	Content	Course Hours	Total marks
1	Introduction to Programmable Controllers	4	7
2	PLC instructions set	4	7
3	PLC Logic, Timer, Counter Functions	6	11
4	PLC Math Functions	4	7
5	PLC Logic Functions	5	9
6	Ladder diagram programming	7	12
7	Applications of PLC	7	12
8	Automation and data analysis	8	15
	Total	**45**	**80**

Note: There might be minor deviation on the above specified marks

Medical Electronics

EG 3203 EX

Total: 6 hours/week

Year: III **Lecture: 3 hours/week**

Part: II **Tutorial: hours/week**

Practical: 3 hours/week

Course description:

This course deals with the fundamentals of anatomy and physiology and medical electronic equipment and their applications in biomedical field. Students will understand basic principles of transducer and physiological transducers and other medical instruments.

Course Objectives:

After completing this course the student will be able to:

1. Familiarize with anatomy and physiology.
2. Explain the operating principles of various types of transducer for using in the biomedical field.
3. Describe the blood pressure and sound measurements
4. Explain the basic principles of different instruments used in medical science.

Course Contents:

Unit 1: Anatomy and physiology **6 hrs**

- 1.1 Elementary ideas of cell structure
- 1.2 Heart and circulatory system.
- 1.3 Central nervous system
- 1.4 Muscle action
- 1.5 Respiratory system
- 1.6 Body temperature and reproduction system

Unit 2: Overview of Medical Electronics Equipment **4 hrs**

- 2.1 Classification
- 2.2 Application and specifications of diagnostic, therapeutic and clinical laboratory equipment, method of operation of these instruments

Unit 3: Electrodes **5 hrs**

- 3.1 Bioelectric signals,
- 3.2 Bio electrodes, Electrode, Electrode tissue interface,
- 3.3 Contact Impedance,
- 3.4 Types of Electrodes, Electrodes used for ECG, EEG

Unit 4: Transducers **5 hrs**

- 4.1 Typical signals from physiological parameters,
- 4.2 Pressure transducer,
- 4.3 Flow transducer, temperature transducer, pulse sensor, respiration sensor

Unit 5: Bio Medical Recorders **10 hrs**

5.1 Block diagram description and application of following instruments

- ECG Machine
- EEG Machine
- EMG Machine

Unit 6: Patient Monitoring Systems **10 hrs**

6.1 Heart and Pulse rate measurement

6.2 Respiration rate measurement

- Blood pressure measurement
- Principle of defibrillator and pacemaker

Unit 7: Safety Aspects of Medical Instruments **5 hrs**

7. 1 Gross current shock
7. 2 Micro current shock
7. 3 Special design from safety consideration
7. 4 Safety standards.

Practical /Laboratory: **45 hrs**

1. Observation of human anatomy and physiology with respect to medical electronics.
2. Demonstration of different types of electrode used in medical electronics
3. Demonstration of different types of transducers used in medical electronics
4. Check the specifications of an ECG Recorder and its operation.
5. Check the specifications of an EEG Recorder and its operation
6. Operation of Pacemaker, defibrillators
7. Implement Heart Rate Meter.

References:

1. Handbook of biomedical Instrumentation by RS Khandpur
2. Biomedical Instrumentation by Cromwell,
3. Modern Electronics Equipment by RS Khandpur, TMH, New Delhi
4. Introduction to Biomedical Electronics by Edward J. Perkstein; Howard B.J., USA

Marks Specification for final examination:

Unit	Content	Course Hours	Total marks
1	Anatomy and physiology	6	11
2	Overview of Medical Electronics Equipment	4	6
3	Electrodes	5	9
4	Transducers	5	9
5	Bio Medical Recorders	10	18
6	Patient Monitoring Systems	10	18
7	Safety Aspects of Medical Instruments	5	9
	Total	**45**	**80**

Note: There might be minor deviation on the above specified marks.

Major Project
EG 3204 EX

Total: 9 hour /week

Year: III **Lecture: hours/week**

Part: II **Tutorial: hours/week**

Lab: 9 hours/week

Course description:

This project work will enhance the knowledge gained by the students in the three years study. Students will use their knowledge to design and implement a complete project work in the various field of electronics and communication; for example: microwave communication, industrial electronics & PLC, embedded system & microcontroller, robotics, mechatronics, medical electronics, agriculture based electronics and other electronic engineering fields.

Course Objective:

After completing the project, students will be able to

1. Select a project
2. Analyze and design the project work
3. Implement the project
4. Documenting the project
5. Familiarize with the gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.

Course Content:

The project work involves the following

1. Selection of relevant topics
2. Selection of design criteria
3. Necessary calculations
4. Selection of the components
5. Project proposal writing
6. Project proposal submission
7. Assembling of the device
8. Testing and result finding
9. Report writing
10. Submitting the report and the assembled device/prototype
11. Viva voice (in the presence of external examiner)
12. For each project a project supervisor is assigned by the department to assist the students in case of problem during the project development.

Evaluation procedure of the project work

Out of the 200 marks assigned for the project work, the evaluation is carried as follows

- Proposal/Report Writing: 30%
- Result/Product: 50%
- Presentation/Viva: 20%

Entrepreneurship Development
EG 3201 MG

Year: III **Total: 5 Hrs. /week**
Semester: II **Lecture: 3 Hrs./week**
Tutorial: Hr./week
Practical: 2 Hrs./week
Lab: Hrs./week

Course Description:
This course is designed to provide the knowledge and skills on formulating business plan and managing small business. The entire course deals with assessing, acquiring, and developing entrepreneurial attitude; skills and tools that are necessary to start and run a small enterprise.

Course Objectives:
After completion of this course students will be able to:
1. Understand the concept of business and entrepreneurship;
2. Explore entrepreneurial competencies;
3. Analyze business ideas and viability;
4. Learn to formulate business plan with its integral components and
5. Manage small business.

Course Contents:

Theory

Unit 1: Introduction to Business & Entrepreneurship: [9 Hrs.]
a. Overview of entrepreneur and entrepreneurship
b. Wage employment, self- employment and business
c. Synopsis of types and forms of enterprises
d. Attitudes, characteristics & skills required to be an entrepreneur
e. Myths about entrepreneurs
f. Overview of MSMEs (Micro, Small and Medium Enterprises) in Nepal

Unit 2: Exploring and Developing Entrepreneurial Competencies: [9 Hrs.]
a. Assessing individual entrepreneurial inclination
b. Assessment of decision-making attitudes
c. Risk taking behavior and risk minimization
d. Creativity and innovation in business
e. Enterprise management competencies

Unit 3: Business identification and Selection: [4 Hrs.]
a. Sources and method of finding business idea(s)
b. Selection of viable business ideas
c. Legal provisions for MSMEs in Nepal

Unit 4: Business plan Formulation: **[18 Hrs.]**

a. Needs and importance of business plan
b. Marketing plan
    - Description of product or service
    - Targeted market and customers
    - Location of business establishment
    - Estimation of market demand
    - Competitors analysis
    - Estimation of market share
    - Measures for business promotion
c. Business operation plan
    - Process of product or service creation
    - Required fix assets
    - Level of capacity utilization
    - Depreciation & amortization
    - Estimation office overhead and utilities
d. Organizational and human resource plan
    - Legal status of business
    - Management structure
    - Required human resource and cost
    - Roles and responsibility of staff
e. Financial plan
    - Working capital estimation
    - Pre-operating expenses
    - Source of investment and financial costs
    - Per unit cost of service or product
    - Unit price and profit/loss estimation of first year
f. Business plan appraisal
    - Return on investment
    - Breakeven analysis
    - Risk factors

Unit 5: Small Business Management: **[5 Hrs.]**

a. Concept of small business management
b. Market and marketing mix
c. Basic account keeping

Practical

Unit 1: Overview of Business & Entrepreneurship [2 Hrs.]

1. Collect business information through interaction with successful entrepreneur

Unit 2: Exploring and Developing Entrepreneurial Competencies [2 Hrs.]

1. Generate innovative business ideas

Unit 3: Product or service Identification and Selection [2 Hrs.]

1. Analyze business ideas using SWOT method

Unit 4: Business Plan Formulation [22 Hrs.]

1. Prepare marketing plan
2. Prepare operation plan
3. Prepare organizational and human resource plan
4. Prepare financial plan
5. Appraise business plan
6. Prepare action plan for business startup

Unit 5: Small Business Management [2 Hrs.]

1. Prepare receipt and payment account
2. Perform costing and pricing of product and service

Microwave and Radar Engineering
EG 3205 EX.1 (Elective)

Total: 7 hours/week
Year: III **Lecture: 4 hours/week**
Part: II **Tutorial: hours/week**
Practical: 3 hours/week

Course description:

This subject includes an exposure to microwaves engineering, radar systems, fiber optics and satellite communication. In microwaves industry, job opportunities are available in the area of assembly, production, installation, repair and maintenance of microwave transmitters and receivers. The knowledge of radar systems allows opportunities with civil and defense organizations dealing with aircraft and shipping. Fiber optics is the latest thrust area in communication with vast opportunities in the private sector.

Course Objectives:

On completion of this course, the students will be able to

1. Familiarize with microwave devices and components.
2. Explain the working of microwave communication systems.
3. Explain about the Radar systems and VSAT.

Course Contents:

Unit 1: Introduction to Microwaves **3 hrs**

1.1 Introduction to microwaves and its applications, Classification on the basis of its frequency bands (HF, VHF, UHF, L, S, C, X, KU, KA, K, Q, U)

Unit 2: Microwave Devices **12 hrs**

2.1 Basic concepts of thermionic emission and vacuum tubes,

2.2 Effects of interelectrode capacitance, Lead Inductance and Transit time on the high frequency performance of conventional vacuum tubes and steps to extend their high frequency operations.

2.3 Construction, characteristics, operating principles and typical applications of the following devices (No derivation and mathematical treatment)

- Multi cavity klystron
- Reflex klystron
- Multi-cavity magnetron
- Traveling wave tube
- Gunn diode and
- IMPATT Diode

Unit 3: Waveguides **6 hrs**

3.1 Rectangular and circular waveguides and their applications.

3.2 Modes of waveguide

3.3 Propagation constant of a rectangular waveguide, Cut-off wavelength, guide wavelength and their relationship with free space wavelength (no mathematical derivation).
3.4 Impossibility of TEM mode in a waveguide.

Unit 4: Microwave Components **11 hrs**

4.1. Constructional features & Characteristics and application of tees, bends, matched termination, twists, detector, mount, slotted section, directional coupler, fixed and variable attenuator, isolator, circulator and duplex, coaxial to waveguide adapter

Unit 5: Microwave antennas **4 hrs**

5.1. Structure characteristics and typical applications of Horn and Dish antennas

Unit 6: Microwave Communication systems **8 hrs**

6.1. Block diagram and working principles of microwave communication link.
6.2. Troposcatter Communication: Troposphere and its properties, Tropospheric duct formation and propagation, troposcatter propagation.

Unit 7: Radar Systems **12 hrs**

7. 1 Introduction to radar, its various applications, radar range equation (no derivation) and its applications.
7. 2 Block diagram and operating principles of basic pulse radar. Concepts of ambiguous range, radar area of cross-section and its dependence on frequency.
7. 3 Block diagram and operating principles of CW (Doppler) and FMCW radars, and their applications.
7. 4 Block diagram and operating principles of MTI radar.
7. 5 Radar displays- PPI

Unit 8: Introduction to VSAT **4 hrs**

8.1 Transponders.
8.2 Concept of Multiple access techniques.
8.3 VSAT and its features**.**

Practical /Laboratory: **45 hrs**

1. To measure electronics and mechanical tuning range of a reflex klystron
2. To measure VSWR of a given load.
3. To measure the Klystron frequency by slotted section method
4. To measure the directivity and coupling of a directional coupler.
5. To plot radiation pattern of a horn antenna in horizontal and vertical planes.
6. To verify the properties of magic tee.
7. To carry out installation of a dish antenna.

References:

1. Microwave Devices and Components by S.Y**.** Lio, Prentice Hall of India, New Delhi
2. Electronics Communication by Roddy and Coolen
3. Electronics Communication System by KS Jamwal, Dhanpat Rai & Sons, Delhi
4. Radar Engg by Skolynik

NOTE:
Visit to the appropriate sites of microwave industries, radar installations and communication stations should be made to understand their working. A comprehensive report must be prepared and presented by the students on their visits, especially indicating the dates and locations of their visits.

Marks Specification for final examination:

Unit	Content	Course Hours	Total marks
1	Introduction to Microwaves	3	4
2	Microwave Devices	12	16
3	Waveguides	6	8
4	Microwave Components	11	15
5	Microwave Antennas	4	5
6	Microwave Communication systems	8	11
7	Radar Systems	12	16
8	Introduction to VSAT	4	5
	Total	**60**	**80**

Note: There might be minor deviation on the above specified marks.

Renewable Energy Technology

EG 3205 EX.2 (Elective)

Total :7 hour /week

Year :III **Lecture :4 hours/week**

Part :II **Tutorial :hours/week**

Practical :3 hours/week

Course Description :

This course deals with fundamentals of different renewable energy resources and their role in sustainable development .

Course Objectives :

After completing this course, the students will be able to :

1. Identify the different renewable energy resources and their importance .
2. Describe about basic principles behind renewable energy sources like hydro, solar, wind and biomas .
3. Compare the prospects of renewable energy resources

Course contents :

Unit 1: Introduction **8 hrs**

1.1 World energy scenario

1.2 Energy crisis

1.3 Renewable energy resources

- Solar energy
- Hydro electricity
- Biomass
- Wind energy
- Geothermal energy
- Tidal energy
- Wave energy

Unit 2: Solar Energy **18 hrs**

2.1 Solar radiation

- Electromagnetic spectrum
- Prediction of solar radiation

2.2 Solar thermal energy

- Concentrating collectors
- Flat plate collectors
- Domestic hot water system
- Solar dryer
- Solar distillation
- Solar ponds
- Swimming pool heating

2.3 Solar-electricity

- Fundamental principle of photovoltaic conversion
- Types of photovoltaic cells)mono-crystalline, poly-crystalline, thin film or amorphous cells
- Solar module, energy storage battery, charge controller
- Solar home system and solar water pumping

Unit 3: Hydro-electricity **16 hrs**

3.1 Potential and current scenario of hydropower in Nepal
3.2 Water head, flow and power from water
3.3 Types of hydropower plants Large hydro, medium hydro, small hydro, micro hydro, peltric set
3.3 Micro-hydro power
3.4 Feasibility study and evaluation of potential of hydro power
3.5 Demand survey and calculation of micro-hydro size
3.6 Hydraulic structures
3.7 Electromechanical equipments

- Turbine
- Generator
- Governer
- Automatic voltage regulator
- Electronic load controller
- Ancillary equipments

Unit 4: Biomass **10 hrs**

4.1 Biomass as a fuel

- Direct combustion
- Gasification
- Pyrolysis
- Anaerobic digestion –Biogas

4.2 Role of biogas in Nepal
4.3 Components of Biogas system

- Biogas constituents
- Biodigester
- Biogas inputs(feeds)
- Digestion
- Slurry
- Use of Biogas)cooking, lighting

Unit 5: Wind Energy **8 hrs**

5.1 Power from the winds
5.2 Wind turbines

- Horizontal axis turbines
- Vertical axis turbines

5.3 Electricity generation from wind turbines

5.4 Wind farm

Practical /Laboratory: **45 hrs**

1 .Measurement of solar radiation

2. Sizing and load calculation for solar Home System (load, solar panel, charge controller, battery, inverter calculation)

3. Installation of solar PV home system.

4 .Demonstrate the operation of solar heaters, solar ovens, solar dryers

Site visit and report submission in any one of the following

1. Observation of hydropower systems.
2. Observation of Biogas system
3. Observation of wind turbine, induction generator and generation controller

***References:*:**

1. Renewable Energy, Power for a sustainable future by Godfrey Boyle, Oxford University Press .
2. John W .Twidell and Anthony D .Weir, Renewable Energy Resources, English Language Book Society, ISBN 0419144706, Edition 1986
3. Philip G .Hill, Power Generation, Resources, Hazarch Technology and Costs, MIT Press, 1977
4. Thumann, Fundamentals of Energy Engineering, Fairmount Press, Prentice Hall Inc., 1984
5. A.W .Culp, Principles of Energy Conversion
6. G.D. Rai, Non-Conventional Energy Sources, Khanna Publisher, New Delhi, India

Marks Specification for final examination:

Unit	Content	Course Hours	Total marks
1	Introduction	8	11
2	Solar Energy	18	24
3	Hydro-electricity	16	21
4	Biomass	10	13
5	Wind Energy	8	11
	Total	**60**	**80**

Note: There might be minor deviation on the above specified marks.

Imaging Technology Equipment
EG 3205 EX.3 (Elective)

Total: 7 hour /week

Year: III **Lecture: 4 hours/week**
Part: II **Tutorial: hours/week**
Lab: 3 hours/week

Course description:

This course deals with basics of medical imaging systems, blood pressure & sound, measurement of how & volume of blood and respiratory systems, chemical biosensors, clinical laboratory instrumentation, therapeutic and prosthetic devices.

Course Objective

After completing this course, the students will be able to:
1. Explain the image capturing and bio-medical equipments.

Course Content

Unit 1. Medical Imaging System: **9 hrs**
- 1.1 Information content of an image,
- 1.2 Modulation transfer function,
- 1.3 Noise-equivalent bandwidth,
- 1.4 Photography,
- 1.5 Television system,
- 1.6 Radiography,
- 1.7 Computed radiography,
- 1.8 computed tomography,
- 1.9 Magnetic resonance imagining,
- 1.10 Nuclear medicine,
- 1.11 Single-photon emission computed tomography,
- 1.12 Positron emission tomography,
- 1.13 Ultrasonography.

Unit 2. Blood Pressure and Sound: **10 hrs**
- 2.1 Direct measurement,
- 2.2 Harmonic analysis of blood-pressure waveforms,
- 2.3 Dynamic properties of pressure-measurement system,
- 2.4 Measurement of system response,
- 2.5 Effects of system parameters on response,
- 2.6 Bandwidth requirements for measuring blood pressure,
- 2.7 Typical pressure-waveform distortion,
- 2.8 Systems for measuring venous pressure,
- 2.9 Heart sounds,
- 2.10 Phonocardiography,
- 2.11 Cardiac catheterization,

2.12 Effects of potential and kinetic energy on pressure measurements,
2.13 Indirect measurements of blood pressure,
2.14 Tonometry.

Unit 3. Measurement of Flow and Volume of blood **9 hrs**

3.1 Indicator-dilution method that uses continuous infusion,
3.2 Indicator-dilution method that uses rapid injection,
3.3 Electromagnetic flowmeters,
3.4 Thermal-convection velocity sensors,
3.5 Chamber plethysmography,
3.6 Electric-impedance plethysmography,
3.7 Photoplethysmography.

Unit 4. Measurement of Respiratory System: **8 hrs**

4.1 Modeling the respiratory system
4.2 Measurement of pressure
4.3 Measurement of gas-flow rate
4.4 Lung volume
4.5 Respiratory plethysmography
4.6 Tests of respiratory mechanics
4.7 Measurement of gas concentration
4.8 Tests of gas transport

Unit 5. Chemical Biosensors: **8 hrs**

5.1 Blood-gas and acid-base physiology,
5.2 Electrochemical sensors,
5.3 Chemical fibrosensors,
5.4 Ion-selective field-effect transistor (ISFET),
5.5 Immunologically sensitive field-effect transistor (IMFET),
5.6 Noninvasive blood-gas monitoring,
5.7 Blood-glucose sensors.

Unit 6. Clinical Laboratory Instrumentation: **6 hrs**

6.1 Spectrophotometry,
6.2 Automated chemical analyzers,
6.3 Principles of Chromatography,
6.4 Principle of Electrophoresis,
6.5 Introduction of Hematology and principle of measurement of blood element

Unit 7. Therapeutic and Prosthetic Devices: **10 hrs**

7.1 Cardiac pacemakers and other electric stimulation,
7.2 Defibrillators and cardioverters,
7.3 Mechanical cardiovasculator orthotic and prosthetic devices,
7.4 Hemodialysis: block diagram and operation
7.5 Lithotripsy,
7.6 Ventilators,
7.7 Infant Incubators,

7.8 Drug infusion pump: block diagram and operation
7.9 Electro surgical unit: block diagram and operation
7.10 Therapeutic applications of the laser.

Practical /Laboratory: **45 hrs**

1. Conduct experiment for indirect measurement of Blood pressure using both digital blood pressure measurement device and sphygmomanometer.
2. Conduct an experiment to measure flow of liquid using electromagnetic flowmeter.
3. Conduct an experiment to measure Arterial Oxygen Saturation using pulse oximeter.
4. Operation and Observation Ultrasound machine.
5. Operation and Observation of electro-surgical device.
6. Operation and Observation of spectrophotometer.
7. Conduct visit to medical equipment centers to observe the installation and working of any two of the following devices:
    - MRI
    - Computed Tomography Device
    - Automated Chemical Analyzer
    - Pacemaker
    - Ventilator.
        - Prepare the report.

References:

1. John G. Webster, "*Medical Instrumentation, Application and Design,*" John Wiley & Sons (Asia) Pte Ltd, 2003.
2. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, "*Biomedical Instrumentation and Measurements*", Prentice-Hall of India Private Limited, 2001.
3. Joseph J. Carr, John M. Brown, "*Introduction to Biomedical Equipment Technology*", Pearson Education, 2003.
4. R S Khandpur, "*Handbook of Biomedical Instrumentation*", Tata McGraw-Hill Publishing Company Limited, New Delhi, 1994.

Marks Specification for final examination:

Unit	Content	Course Hours	Total marks
1	Medical Imaging System	9	12
2	Blood Pressure and Sound**:**	10	13
3	Measurement of Flow and Volume of blood	9	12
4	Measurement of Respiratory System**:**	8	11
5	Chemical Biosensors**:**	8	11
6	Clinical Laboratory Instrumentation	6	8
7	Therapeutic and Prosthetic Devices**:**	10	13
	Total	**60**	**80**

Note: There might be minor deviation on the above specified marks.

Electric Vehicle Technology
EG 3205 EX.4 (Elective)

Total: 7 hours /week
Year: III **Lecture: 4 hours/week**
Part: II **Lab: 3 hours/week**

Course Description:

This course deals three basic streams of electrical vehicle technology. First chapter introduces basic concept, components and structure, needs and scopes and global scenario of electrical vehicle technology**.** Second chapter gives basic ideas about battery and source system, charging station configuration, major components used. It also gives knowledge about different types of battery and their comparative knowledge, their selection criteria, IEC guidelines and so on**.** Third chapter gives basic idea about different types of electrical motors and drive control system.

Course Objectives:

After completing this course, the student will be able to:

1. Explain Need and scope of EV technology
2. Explain Working principle and basic architecture of electric vehicles.
3. Explain Construction, characteristics and selection criteria of various types of battery system.
4. Explain Charging station, SLD, size and rating calculation
5. Explain Working principle, construction, sizing and comparison of various types of DC and AC motors that are used in EV technology

Course contents:

Unit 1: Introduction of Electric Vehicles **10 hrs**

1.1 Electric vehicle Architecture
1.2 Needs of EV and their types; pure EV, Hybrid EV, Fuel Cell EV, Gridable Hybrid EV
1.3 Major components of electric vehicle
1.4 Global scenario of Electric Vehicles
1.5 Mandatory Safety precautions while handling Electric Vehicle.
1.6 Comparison of EV with Internal Combustion Engine

Unit 2: Battery **10 hrs**

2.1 Working principle and construction of batteries: zinc chloride, lead acid, Li-ion, Ni-Cd
2.2 Tools for checking the battery Capacity in Ahr, Kwhr, Battery Charging methods and circuits.
2.3 Battery Parameters and Comparisons, Capacity Rate, Lifetime and Sizing of batteries

Unit 3: Charging Systems **15 hrs**

3.1 Basic Requirements for Charging System, Components of charging station, Type of charging station, Selection and Sizing of charging station, Single line diagram of charging station

3.2 Charger Architectures, IEC Guidelines and Technologies: (SAE J1772, VDE-AR-E 2623-2-2, CHAdeMo) ,Combined Charging System (CCS)

3.3 Average and RMS Currents in the Rectifier, Switch and Diode, Power Semiconductors for Charging

3.4 Battery Management Systems: Background, Typical Structure of BMS, Future Generation in BMS

Unit 4: Electric Drives **19 hrs**

4.1 Brushed DC Motor: Operation of the basic DC motor, Types of motors, Torque speed characteristics, Speed control, Motor losses and efficiency, Braking and regenerative braking

4.2 Brush-less Motors: Brush-less DC motor, PMDC, hub-motor, Switched reluctance motors, induction motor: Construction, working principle, Torque speed characteristics, Speed control, Motor losses and efficiency, Braking and regenerative braking

4.3 Selection and sizing of Motor, Mechanical and Electrical connection of motor

Unit 5: Motor Controller **6 hrs**

5.1 Voltage Controller: Step-down or 'buck' regulators, Step-up or 'boost' switching regulator Single-phase inverters, Three-phase inverters

Practical /Laboratory: **45 hrs**

1. Design the layout of electric vehicle showing various components used in an EV
2. Study a Solar based electric vehicle and mention the rating and function of each component used in Solar based EV.
3. Study a Battery based electric vehicle and mention the rating and function of each component used in BEV.
4. Basic structure, components and SLD of charging station
5. Charging circuit design, charging and discharging of different types of DC battery
6. To study the control of DC-DC converter (chopper) fed DC motor.
7. To study the operation of single phase PWM inverter.
8. To study speed control of 3-phase induction motor using V/F control method

References:

1. K. T. Chau, Wiley-IEEE Press, Electric Vehicle Machines and Drives: Design, Analysis and Application
2. John G. Hayes and G. Abas Goodarzi, Wiley Publication, Electric Power-train: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles,
3. James Larminie, John Wiley & Sons Ltd.Electric Vehicle Technology Explained,
4. Mehrdad Ehsani, Yimin Gao, Stefano Longo and Kambiz M. Ebrahimi, CRC Press, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles
5. By Gopal K. Dubey, Narosa Publishing House, Fundamentals of Electrical Drive

Marks Specification for final evaluation:

Unit	Content	Course Hours	Total marks
1	Introduction of Electric Vehicles	10	13
2	Battery	10	13
3	Charging Systems	15	20
4	Electric Drives	19	26
5	Motor Controller	6	8
	Total	**60**	**80**

Note: There might be minor deviation on the above-specified marks

Experts Involved in Curriculum Revision, 2022

SN	Name	Designation	Organiztion
1	Er Sudhip Adhikari	Principal	Manmohan Memorial Polytechnic, Mornag
2	Er Sarbesh Chaudhary	Lecturer	Manmohan Memorial Polytechnic, Mornag
3	Er Lochan Raj Neupane	Asst. Lecturer	Manmohan Memorial Polytechnic, Mornag
4	Er Rajan ku Chaudhary	Asst. Lecturer	Manmohan Memorial Polytechnic, Mornag
5	Er Prabheker Chaudhary	Asst. Lecturer	Manmohan Memorial Polytechnic, Mornag
6	Er Dinesh Mahalo	Asst. Lecturer	Manmohan Memorial Polytechnic, Mornag
7	Er Binod Ghimire	Asst. Lecturer	Manmohan Memorial Polytechnic, Mornag
8	Er Gopal Sapkota	Asst. Lecturer	Manmohan Memorial Polytechnic, Mornag
9	Er Ram ku Yadav	Asst. Lecturer	Manmohan Memorial Polytechnic, Mornag
10	Er Kamleshwar Thakur	Asst. Lecturer	Manmohan Memorial Polytechnic, Mornag
11	ErYubraj Chaudhary	Asst. Lecturer	Manmohan Memorial Polytechnic, Mornag
12	Er Ashok ku Chaudhary	Asst. Lecturer	Manmohan Memorial Polytechnic, Mornag
13	Er Suraj Goshae	Asst. Lecturer	Manmohan Memorial Polytechnic, Mornag