PUNJAB BOARD OF TECHNICAL EDUCATION

21-A, Kashmir Block Allama Iqbal Town, Lahore

www.pbte.edu.pk R&D Section Tel # 042-99260273

SAY NO TO CORRUPTION

No PBTE/R&D/2024/624 Dated:- 26-08-25

NOTIFICATION

In pursuance of NAVTTC Notification No. DG(SS&C)/DAE/2024 dated 25-07-2025, it is notified that the following old courses of DAE (3 years) have been repealed and replaced with revised courses in respective fields of technology as detailed below:

i- Diploma of Associate Engineer in Mechanical Technology (Power) with specialization in Auto & Farm Machinery (3 Years).
ii- Diploma of Associate Engineer in Architecture Technology (3 Years).
iii- Diploma of Associate Engineer in Food Processing and Preservation Technology (3 Years).
iv- Diploma of Associate Engineer in Electronics Technology (3 Years).
v- Diploma of Associate Engineer in Telecommunication Technology (3 Years).

The implementation of said revised technologies shall be effective on the students who shall be registered from academic session 2025-26 and onward. Punjab Board of Technical Education, Lahore shall conduct the examinations of the said revised technologies w.e.f. 1st Annual Examination 2026 and onwards accordingly. However, the candidates enrolled in the previous versions of the aforesaid DAE technologies will avail the prescribed chances under the old curricula. Soft copy of the revised curricula of the aforesaid technologies may be downloaded from the website of PBTE i.e. www.pbte.edu.pk/textbooks.html

SECRETARY

CC To

1- PA to Chairperson, PBTE, Lahore.
2- PA to DG Academics, TEVTA, Lahore.
3- PA to DG Operations, TEVTA, Lahore.
4- PA to Secretary, PBTE, Lahore.
5- PA to Controller of Examinations, PBTE, Lahore.
6- The Principals concerned.
7- Deputy Controller of Examinations (Conduct), PBTE, Lahore.
8- Deputy Controller of Examinations (Secrecy), PBTE, Lahore.
9- System Analyst, PBTE Lahore.
10- Assistant Controller of Examinations (Technical), PBTE, Lahore.
11- Assistant Controller of Examinations (Secrecy), PBTE, Lahore.
12- Assistant Controller of Examinations (P&P-I), PBTE, Lahore.
13- Assistant Controller of Examinations (P&P- II), PBTE, Lahore.
14- Web Administrator, PBTE Lahore to upload on Board Website.
15- In-Charge P&S Section, PBTE, Lahore.
16- In-Charge Operation Wing, PBTE Lahore.

D.A.E. Electronics Curriculum

(Revised-May, 2025)

DAE ELECTRONICS TECHNOLOGY
SCHEME OF STUDIES, Revised, March-2025

1ST Year

Sr. No	Code	Name of Subject	Credit Hours		
			T	P	C
1.	GEN-111	Islamiat & Pak Studies	1	0	1
2.	TTQ-111 / Civic-111	Tarjumat-ul-Quran / Civics	1	0	1
3.	Eng-112	English	2	0	2
4.	Math-123	Applied Mathematics-I	3	0	3
5.	Phy-122	Applied Physics	1	3	2
6.	Ch-132	Applied Chemistry	1	3	2
7.	**Comp-182**	ICT Fundamentals	1	3	2
8.	**ELTR-124**	Electrical Circuits	3	3	4
9.	**ELTR-133**	Electronic Devices	2	3	3
10.	**ELTR-142**	Basic Engineering Drawing and CAD	1	3	2
11.	**ELTR-151**	Electrical wiring	0	3	1
Total			**16**	**21**	**23**

2nd Year

Sr. No	Code	Name of Subject	Credit Hrs.		
			T	P	C
1.	GEN-201	Islamiat & Pak Studies	1	0	1
2.	TTQ-211/ Civic-211	Tarjumat-ul-Quran / Civics	1	0	1
3.	Math-233	Applied Mathematics-II	3	0	3
4.	**OHSE-211**	Occupational Safety, Health and Environment	1	0	1
5.	**ELTR-214**	Communication Networks	3	3	4
6.	**ELTR-224**	Analog Electronics	3	3	4
7.	**ELTR-263**	Electrical Instruments & Measurements	2	3	3
8.	**Comp-272**	Introduction to Computer Programming	1	3	2
9.	**ELTR-273**	Electrical Machines	2	3	3
10.	**ELTR-283**	Digital Logic Design	2	3	3
11.	**ELTR-291**	PCB Designing	0	3	1
Total			**19**	**21**	**26**

3rd Year

Sr. No	Code	Name of Subject	Contact/ Credit (Revised)		
			T	P	C
1.	GEN-301	Islamiat & Pak Studies	1	0	1
2.	MGM-361	Industrial Management and Leadership	1	0	1
3.	MGM-341	Entrepreneurship	1	0	1
4.	COMS-331	Soft Skills & Professional Ethics	1	0	1
5.	ELTR-323	Equipment Maintenance & Servicing	1	6	3
6.	ELTR-342	Mobile and Wireless Networks	2	0	2
7.	ELTR-373	Industrial Electronics	2	3	3
8.	ELTR-383	Power Electronics	2	3	3
9.	ELTR-393	Microcontroller Programming and Applications	1	6	3
10.	ELTR-302	Final Year Project	0	6	2
Total			**12**	**24**	**20**

اسلامیات/مطالعہ پاکستان

		ٹی	پی	سی
حصہ اول اسلامیات	GEN III			
حصہ دوم مطالعہ پاکستان		1	0	1
موضوعات حصہ اول اسلامیات	سال اول	کل وقت: 20 گھنٹے		

کتاب و سنت

(ا) قرآن مجید

-1 تعارف قرآن مجید 2- نزول قرآن 3- مکی و مدنی سورتوں کی خصوصیات 4- وحی کی اقسام 5- پندرہ منتخب آیات مع ترجمہ

1.1 تنالو البر حتی تنفقوا مما تحبون

1.2 واعتصموا بحبل اللّٰہ جمیعا" ولا تفرقو

1.3 ولا یجرمنکم شنان قوم علی ان لا تعدلوا

1.4 ان اللّٰہ یامرکم ان تودوا الامانات الی اھلھا

1.5 ان اللّٰہ یامر بالعدل والاحسان

1.6 ان الصلوتہ تنھی عن الفحشاء والمنکر

1.7 لقد کان لکم فی رسول اللّٰہ سوۃ حسنتہ

1.8 ان اکرمکم عند اللّٰہ اتقاکم

1.9 وما آتاکم الرسول فخرزووما نھی عنھوا نتھوا

1.10 ولوفو بالعھد

1.11 وماشروھن بالمعروف

1.12 یمحق اللّٰہ الربوویربی الصمدقات

1.13 واصبر علی ما اصابک

1.14 وقولو قولا سدیدا

1.15 ان الدین عند اللّٰہ السلام

(ب) سنت

-1 سنت کی اہمیت

-2 دس منتخب احادیث مع ترجمہ و تشریح

1- انما الاعمال بالنیات

2- انما بعثت لاتمم مکارم الاخلاق

3- لا یومن احدکم حتی یحب لاخیہ ما یحب لنفسہ

4- المسلم من سلم المسلمون من سنہ المسلمون من لسانہ ویدہ

5- قل امنت باللہ ثم استقم

6- خیرکم خیرکم لاہلہ

7- سباب المسلم فسوق وقتالہ کفر

8- المومن اخو المومن

9- کل المسلم علی المسلم حرام بمعہ وما لہ وعرضہ

10- ایتہ المنافق ثلاث اذا حدیث کذب واذا اوتمن خان واذا وعد اخلف

دین اسلام

2.1 اسلام کے بنیادی مقاصد کی وضاحت اور انسان کی انفرادی و اجتماعی زندگی پر ان کے اثرات

1- توحید

2- رسالت

3- آخرت

4- ملائکہ

5- آسمانی کتب

2.2 عبادات

1- نماز 2- روزہ 3- حج 4- زکوٰۃ

مندرجہ بالا عبادات کی اہمیت و فضیلت، حکمتیں اور انسان کی انفرادی و معاشرتی زندگی پر اس کے اثرات

حصہ اول

حصہ اسلامیات

تدریسی مقاصد

۱- قرآن مجید

عمومی مقصد: طالب علم یہ سمجھنے کے قابل ہو کہ اسلام کی تعلیمات کا اصل سرچشمہ قرآن مجید ہے

خصوصی مقاصد: طالب علم اس قابل ہو جائے گا کہ

☆ قرآن مجید کی تعریف کر سکے گا

☆ قرآن مجید کے نزول کی صورت بیان کر سکے

☆ قرآن مجید کی کی دس مدنی سورتوں کی پہچان کر سکے

☆ منتخب آیات کا ترجمہ و تشریح کر سکے

عمومی مقصد: یہ سمجھنے کے قابل ہو جائے گا کہ منتخب قرآنی آیات کے ذریعے اسلامی تعلیمات کا مفہوم کیا ہے

☆ قرآنی آیات کا ترجمہ تشریح کر سکے

☆ قرآنی تعلیمات کی روشنی میں اپنی اور معاشرتی اصلاح کر سکے

2- سنت

عمومی مقصد: طالب علم سنت نبوی کی اہمیت اور ضرورت کو اچھی طرح سمجھنے کے قابل ہو جائے گا

خصوصی مقصد:

☆ سنت کی تعریف بیان کر سکے

☆ سنت کی اہمیت و ضرورت کی وضاحت کر سکے

☆ سنت کی روشنی میں اسوہ حسنہ پر عمل کر سکے

3- منتخب احادیث نبویہ

عمومی مقصد: احادیث کی روشنی میں اخلاقی اقدار سے آگاہی حاصل کر سکے

خصوصی مقصد: احادیث کا ترجمہ و تشریح کر سکے

رسول اللہ ﷺ کے اسوۂ حسنہ کی پیروی کا جذبہ پیدا ہو سکے

-4 دین اسلام

عمومی مقاصد: دین اسلام کے بنیادی مقاصد اور عبادات کے بارے میں جان سکے اور بیان کر سکے

خصوصی مقاصد

لفظ دین اسلام کے لغوی اور اصطلاحی معنی بیان کر سکے

اسلام کے بنیادی مقاصد کی اہمیت بیان کر سکے

اسلام کے بنیادی مقاصد سے انسان کی انفرادی و اجتماعی زندگی پر پڑنے والے اثرات بیان کر سکے

عبادت کے لغظی و اصطلاحی معنی بیان کر سکے

عقیدے اور عبادت کا فرق بیان کر سکے

عبادات (نماز، روزہ، حج، زکواۃ) کے فوری، انفرادی اور انسانی زندگی پر ان کی اثرات بیان کر سکے

اسلامی مقاصد و عبادات کے مطابق اپنی زندگی ڈھال کر ایک اچھا مسلمان بن سکے

(غیر مسلم طلباء کے لئے)

نصاب اخلاقیات سال اول	GEN III	ئی	بی	سی
حصہ دوم مطالعہ پاکستان		1	0	1
	موضوعات	کل وقت - 20 گھنٹے		

اخلاقیات کی تعریف اور اہمیت

اخلاقیات کا معیار (قانون، عقل، الہی کتب)

مندرجہ ذیل اخلاق کی وضاحت

- ☆ دیانت داری
- ☆ وفاداری
- ☆ نظم و ضبط
- ☆ راست گوئی
- ☆ صبر و استقلال
- ☆ حوصلہ مندی
- ☆ وقت کی پابندی
- ☆ صفائی
- ☆ اعتماد
- ☆ باہمی احترام
- ☆ مصلحت

نصاب اخلاقیات (سال اول)

تدریسی مقاصد

عمومی مقاصد: اعلیٰ اخلاق کی وجہ سے ملکی ترقی میں مثبت قدر اضافہ کر سکے

خصوصی مقاصد: طالب اس علم سے اس قابل ہو گا کہ

- ☆ موضوعات کا مطلب بیان کر سکے
- ☆ عملی زندگی سے مثالوں کی نشاندہی کر سکے
- ☆ اپنی شخصیت اور معاشرے پر موضوعات کے مثبت اثرات پیدا کرنے کے طریقے بیان کر سکے
- ☆ وراثت داری کی اہمیت بیان کر سکے
- ☆ وفاداری کی اہمیت بیان کر سکے
- ☆ نظم و ضبط کی افادیت بیان کر سکے
- ☆ صدق بیان کی ضرورت بیان کر سکے
- ☆ حوصلہ مندی کے فوائد بیان کر سکے
- ☆ وقت کی پابندی کے فوائد بیان کر سکے
- ☆ صفائی اور باہمی اختیار سے حسن کارکردگی کو بیان کر سکے
- ☆ مصلحت کے فوائد بیان کر سکے

نصاب (سال اول) Gen III

حصہ دوم　　مطالعہ پاکستان　　کل وقت 12 گھنٹے

موضوعات

☆ حریت فکر: مسلمان قوم میں آزادی فکر کی تاریخ - مسلمانوں میں سیاسی آزادی کی اہمیت اور ضرورت - ذہنی، جسمانی غلامی کے متعلقات

☆ نظریہ پاکستان

قیام پاکستان کی اساس (دین اسلام) قیام پاکستان کی غرض و غایت نظریہ پاکستان کی وضاحت - نظریہ پاکستان اور مسلم اقبال اور قائداعظم کے ارشادات کی روشنی میں

☆ نظریہ پاکستان کا تاریخی پس منظر

محمد بن قاسم کی آمد - مجدد الف ثانی اور شاہ ولی اللہ کی تبلیغی خدمات سید احمد شہید کی تحریک مجاہدین

☆ تعلیمی تحریکیں

علی گڑھ - ندوۃ العلماء (لکھنؤ) - مدرسۃ الاسلام - (کراچی) اسلامیہ کالج (پشاور) انجمن حمایت اسلام (لاہور)

مطالعہ پاکستان (حصہ دوئم)

تدریسی مقاصد

حریت فکر:

عمومی مقصد

طالب علم یہ جان لے کہ اسلام میں اور مسلمان قوم میں آزادی فکر کی کیا اہمیت ہے

خصوصی مقاصد

- ☆ حریت فکر کا معنی و مفہوم بیان کر سکے
- ☆ آزادی فکر کی اہمیت بیان کر سکے
- ☆ خصوصاً اسلام میں آزادی اظہار رائے کی اہمیت بیان کر سکے
- ☆ ذہنی غلامی کے قومی سطح پر نقصانات کے بیان کر سکے
- ☆ جسمانی غلامی قومی سطح پر نقصانات بیان کر سکے

نظریہ پاکستان

عمومی مقصد:

نظریہ پاکستان (دین اسلام) سے پوری طرح واقفیت ہو جائے

خصوصی مقاصد:

- ☆ نظریہ کی تعریف بیان کر سکے اور اس کی وضاحت کر سکے
- ☆ نظریہ پاکستان کی تعریف کر سکے اور اس کا مفہوم بیان کر سکے
- ☆ علامہ اقبال اور قائداعظم کے فرمودات کی روشنی میں نظریہ پاکستان بیان کر سکے

نظریہ پاکستان کا تاریخی پہلو

عمومی مقصد

- ☆ نظریہ پاکستان کے تاریخی پس منظر سے واقفیت حاصل کر سکے

خصوصی مقاصد:

- ☆ محمد بن قاسم کے بارے میں بیان کر سکے

- محمد بن قاسم کے ہندوستان پر حملہ کی وجہ بیان کر سکے
- محمد بن قاسم کے ہندوستان پر حملہ کے اثرات بیان کر سکے
- بیان کر سکے کہ ہندوستان میں ہندو مسلم دو قومی نظریہ کا نکتہ آغاز کیا ہے
- مجدد الف ثانی کی علمی خدمات بیان کر سکے
- شاہ ولی اللہ کی علمی خدمات بیان کر سکے
- مجدد الف ثانی اور شاہ ولی اللہ کے جو تبلیغ دین اور مسلمانوں میں سیاسی شعور پیدا کیا اسے بیان کر سکے

علمی تحریکیں

عمومی مقصد

- برصغیر کی علمی تحریکوں سے آگاہی حاصل ہو سکے

خصوصی مقاصد:

- علی گڑھ - دیوبند - ندوت العلماء مدرسۃ السلام ، اسلامیہ کالج۔ انجمن حمایت اسلام نے تعلیم کے ذریعہ سیاسی شعور مسلمانوں میں پیدا کیا اسے بیان کر سکے
- آزادی ہند کے سلسلہ میں تحریک مجاہدین کی خدمات بیان کر سکے

****

TTQ-111 / Civic-111;

Tarjumat-ul-Quran / Civics

T	P	C
1	0	1

Total Contact Hours:

Theory: **32**

Practical: **0**

Note: Syllabi for these subject would be as per BISEs / General education, developed by Punjab Curriculum TextBook Board (PCTB)

Eng-112 ENGLISH

Total contact hours

		T	P	C
Theory	64			
Practical	0	2	0	2

AIMS At the end of the course, the students will be equipped with cognitive skill to enable them to present facts in a systematic and logical manner to meet the language demands of dynamic field of commerce and industry for functional day-to-day use and will inculcate skills of reading, writing and comprehension.

COURSE CONTENTS

ENGLISH PAPER "A"

1 PROSE/TEXT 16 hours

1.1 First eight essays of Intermediate English Book-II

2 CLOZE TEST 4 hours

2.1 A passage comprising 50-100 words will be selected from the text. Every 11th word or any word for that matter will be omitted. The number of missing word will range between 5-10. The chosen word may or may not be the one used in the text, but it should be an appropriate word.

ENGLISH PAPER "B"

3 GRAMMAR 26 hours

3.1 Sentence Structure.
3.2 Tenses.
3.3 Parts of speech.
3.4 Punctuation.
3.5 Change of Narration.
3.6 One word for several
3.7 Words often confused

4. COMPOSITION 8 hours

4.1 Letters/Messages
4.2 Job application letter
4.3 For character certificate/for grant of scholarship
4.4 Telegrams, Cablegrams and Radiograms, Telexes, Facsimiles
4.5 Essay writing
4.6 Technical Education, Science and Our life, Computers, Environmental Pollution, Duties of a Student.

5. TRANSLATION 10 hours

5.1 Translation from Urdu into English.
For Foreign Students: A paragraph or a dialogue.

REFERENCE BOOKS

- Technical English developed by Mr. Zia Sarwar, Mr. Habib-ur –Rehman, Evaluated by Mr.Zafar Iqbal Khokhar, Mr. Zahid Zahoor, Vol - I, National Book Foundation

Eng-112 ENGLISH

INSTRUCTIONAL OBJECTIVES

PAPER-A

1. DEMONSTRATE BETTER READING, COMPREHENSION AND VOCABULARY

1.1 Manipulate, skimming and scanning of the text.
1.2 Identify new ideas.
1.3 Reproduce facts, characters in own words
1.4 Write summary of stories

2. UNDERSTAND FACTS OF THE TEXT

2.1 Rewrite words to fill in the blanks recalling the text.
2.2 Use own words to fill in the blanks.

PAPER-B

3. APPLY THE RULES OF GRAMMAR IN WRITING AND SPEAKING

3.1 Use rules of grammar to construct meaningful sentences containing a subject and a predicate.
3.2 State classification of time, i.e. present, past and future and use verb tense correctly in different forms to denote relevant time.
3.3 Identify function words and content words.
3.4 Use marks of punctuation to make sense clear.
3.5 Relate what a person says in direct and indirect forms.
3.6 Compose his writings.
3.7 Distinguish between confusing words.

4. APPLY THE CONCEPTS OF COMPOSITION WRITING TO PRACTICAL SITUATIONS

4.1 Use concept to construct applications for employment, for character certificate, for grant of scholarship.
4.2 Define and write telegrams, cablegrams and radiograms, telexes, facsimiles
4.3 Describe steps of a good composition writing.
4.4 Describe features of a good composition.
4.5 Describe methods of composition writing
4.6 Use these concepts to organize facts and describe them systematically in practical situation.

5. APPLY RULES OF TRANSLATION

5.1 Describe confusion.
5.2 Describe rules of translation.
5.3 Use rules of translation from Urdu to English in simple paragraph and sentences.

Math-123 APPLIED MATHEMATICS-I

T	P	C
3	0	3

Pre-requisite: Must have completed a course of Elective Mathematics at Matric level.

AIMS: After completing the course the students will be able to

- Solve problems of Algebra, Trigonometry, vectors, Mensuration, Matrices and Determinants.
- Develop skill, mathematical attitudes and logical perception in the use of mathematical instruments as required in the technological fields.
- Acquire mathematical clarity and insight in the solution of technical problems.

COURSE CONTENTS

1. QUADRATIC EQUATIONS **6 Hours**

1.1 Standard Form
1.2 Solution
1.3 Nature of roots
1.4 Sum & Product of roots
1.5 Formation
1.6 Problems

2. BINOMIAL THEOREM **6 Hours**

2.1 Factorials
2.2 Binomial Expression
2.3 Binomial Co-efficient
2.4 Statement
2.5 The General Term
2.6 The Binomial Series
2.7 Problems.

3. PARTIAL FRACTIONS **6 Hours**

3.1 Introduction
3.2 Linear Distinct Factors Case I
3.3 Linear Repeated Factors Case II
3.4 Quadratic Distinct Factors Case III
3.5 Quadratic Repeated Factors Case IV
3.6 Problems

4. FUNDAMENTALS OF TRIGONOMETRY **6 Hours**

4.1 Angles
4.2 Quadrants
4.3 Measurements of Angles
4.4 Relation between Sexagesimal & circular system
4.5 Relation between Length of a Circular Arc & the Radian Measure of its central Angle
4.6 Problems

5. TRIGONOMETRIC FUNCTIONS AND RATIOS **6 Hours**

5.1 Trigonometric functions of any angle
5.2 Signs of trigonometric Functions

5.3 Trigonometric Ratios of particular Angles
5.4 Fundamental Identities
5.5 Problems

6. GENERAL IDENTITIES **6 Hours**

6.1 The Fundamental Law
6.2 Deductions
6.3 Sum & Difference Formulae
6.4 Double Angle Identities
6.5 Half Angle Identities
6.6 Conversion of sum or difference to products
6.7 Problems

7. SOLUTION OF TRIANGLES **(42) 6 Hours**

7.1 The law of Sines
7.2 The law of Cosines
7.3 Measurement of Heights & Distances
7.4 Problems

8. VECTORS AND PHASORS **12 Hours**

8.1 Scalars and Vectors
8.2 The unit Vectors i, j, k
8.3 Direction Cosines
8.4 Dot Product
8.5 Cross Product
8.6 Analytic Expressions for dot and cross products
8.7 Phasors
8.8 Significance of j Operator
8.9 Different Forms
8.10 Algebraic Operations
8.11 Problems

9. COMPLEX NUMBERS **9 Hours**

9.1 Introduction and Properties
9.2 Basic Operations
9.3 Conjugate
9.4 Modulus
9.5 Different Forms
9.6 Problems

10. BOOLEAN ALGEBRA AND GATE NETWORKS **15 Hours**

10.1 Concept and basic laws
10.2 Sums of product and products of sums
10.3 Binary, decimals and octals, presentation of decimal numbers in BCD
10.4 Intercoversion of numbers
10.5 OR Gates and AND Gates
10.6 Logical Expressions and their simplifications
10.7 Demorgan's Theorams
10.8 NAND Gates and NOR Gates
10.9 Problems

11. PLANE ANALYTIC GEOMETRY AND STRAIGHT LINE **6 Hours**

11.1 Coordinate system
11.2 Distance formula
11.3 Ration Formulas
11.4 Inclination and slope of line
11.5 Slope Formula
11.6 Problems

12. EQUATIONS OF THE STRAIGHT LINE **6 Hours**

12.1 Some Important Forms
12.2 General form
12.3 Angle Formula
12.4 Parallelism and Perpendicularity
12.5 Problems

13. EQUATIONS OF THE CIRCLE **6 Hours**

13.1 Standard and Central forms of equations
13.2 General Form of Equation
13.3 Radius and Coordinates of Center
13.4 Problems

REFERENCE BOOKS

- Applied Mathematics Math-123, by Nasir -ud-Din Mahmood, Sana-ullah Khan, Tahir Hameed, Syed Tanvir Haider, Javed Iqbal, Vol - I, National Book Foundation

INSTRUCTIONAL OBJECTIVES

1. USE DIFFERENT METHODS FOR THE SOLUTION OF QUADRATIC EQUATION

1.1 Define a standard quadratic equation.
1.2 Use methods of factorization and method of completing the square for solving the equations.
1.3 Derive quadratic formula.
1.4 Write expression for the discriminant.
1.5 Explain nature of the roots of a quadratic equation.
1.6 Calculate the sum and product of the roots.
1.7 Form a quadratic equation from the given roots.
1.8 Solve problems involving quadratic equations.

2. APPLY BINOMIAL THEOREM FOR THE EXPANSION OF BINOMIAL AND EXTRACTION OF ROOTS.

2.1 State binomial theorem for positive integral index.
2.2 Explain binomial coefficients:
(n,0), (n,1).....(n,r)....., (n,n)
2.3 Derive expression for the general term.
2.4 Calculate the specified terms.
2.5 Expand a binomial of a given index.
2.6 Extract the specified roots.
2.7 Compute the approximate value to a given decimal place.
2.8 Solve problems involving binomials.

3. APPLY DIFFERENT METHODS FOR RESOLVING A SINGLE FRACTION INTO PARTIAL FRACTIONS USING DIFFERENT METHODS

3.1 Define a partial fraction, a proper and an improper fraction.
3.2 Explain all the four types of partial fractions.
3.3 Set up equivalent partial fractions for each type.
3.4 Explain the methods for finding constants involved.
3.5 Resolve a single fraction into partial fractions.
3.6 Solve problems involving all the four types.

4. UNDERSTAND THE SYSTEMS OF MEASUREMENT OF ANGLES.

4.1 Define angles and the related terms.
4.2 Illustrate the generation of an angle.
4.3 Explain sexagesimal and circular systems for the measurement of angles.
4.4 Derive the relationship between radian and degree.
4.5 Convert radians to degrees and vice versa.
4.6 Derive a formula for the circular measure of a central angle.
4.7 Use this formula for solving problems.

5. UNDERSTAND BASIC CONCEPTS AND PRINCIPLES OF TRIGONOMETRIC FUNCTIONS.

5.1 Define the basic trigonometric functions/ratios of an angle as ratios of the sides of a right triangle.
5.2 Derive fundamental identities.

5.3 Find trigonometric ratios of particular angles.
5.4 Draw the graph of trigonometric functions.
5.5 Solve problems involving trigonometric functions.

6. USE TRIGONOMETRIC IDENTITIES IN SOLVING TECHNOLOGICAL PROBLEMS.

6.1 List fundamental identities.
6.2 Prove the fundamental law.
6.3 Deduce important results.
6.4 Derive sum and difference formulas.
6.5 Establish half angle, double and triple angle formulas.
6.6 Convert sum or difference into product and vice versa.
6.7 Solve problems.

7. USE CONCEPT, PROPERTIES AND LAWS OF TRIGONOMETRIC FUNCTIONS FOR SOLVING TRIANGLES.

7.1 Define angle of elevation and angle of depression.
7.2 Prove the law of sines and the law of cosines.
7.3 Explain elements of a triangle.
7.4 Solve triangles and the problems involving heights and distances.

8. UNDERSTAND PRINCIPLES OF VECTORS AND PHASORS

8.1 Define unit vectors i, j, k.
8.2 Express a vector in the component form.
8.3 Explain magnitude, unit vector, direction cosines of a vector.
8.4 Explain dot product and cross product of two vector.
8.5 Deduce important results from dot and cross product.
8.6 Define phasor and operator j.
8.7 Explain different forms of phasors.
8.8 Perform basic Algebraic operation on phasors.
8.9 Solve problems on phasors.

9. USE PRINCIPLES OF COMPLEX NUMBERS IN SOLVING TECHNOLOGICAL PROBLEMS.

9.1 Define a complex number and its conjugate.
9.2 State properties of complex numbers.
9.3 Give different forms of complex numbers.
9.4 Perform basic algebraic operations on complex numbers.
9.5 Solve problem involving complex numbers.

10. SOLVE TECHNICAL PROBLEMS USING PRINCIPLES OF BOOLEAN ALGEBRA

10.1 Explain fundamental concepts of Boolean algebra
10.2 Explain binary numbers, octal numbers, decimal numbers and their interconversion.
10.3 Explain digital addition and multiplication and its applications to OR gates and AND Gates
10.4 Illustrate complimentation and inversion
10.5 Evaluate logical expression
10.6 List basic Laws of Boolean Algebra
10.7 Explain De-Morgan's theorem
10.8 Explain basic duality of Boolean algebra

10.9 Derive Boolean expression
10.10 Explain combination of GATES
10.11 Illustrate sum of products and product of sum
10.12 Derive product of sum expression
10.13 Explain NAND Gates and NOR Gates
10.14 Use the map methods for simplifying expressions
10.15 Explain sub-cubes and covering

11. UNDERSTAND THE CONCEPT OF PLANE ANALYTIC GEOMETRY

11.1 Explain the rectangular coordinate system.
11.2 Locate points in different quadrants.
11.3 Derive distance formula.
11.4 Describe the ratio formula
11.5 Derive slope formula
11.6 Solve problems using the above formulae.

12. USE EQUATIONS OF STRAIGHT LINE IN SOLVING PROBLEMS.

12.1 Define equation of a straight line.
12.2 Derive slope intercept and intercept forms of equations of a straight line.
12.3 Write general form of equations of a straight line.
12.4 Derive an expression for angle between two straight lines.
12.5 Derive conditions of perpendicularity and parallelism of two straight lines.
12.6 Solve problems using these equations/formulae.

13. SOLVE TECHNOLOGICAL PROBLEMS USING EQUATIONS OF CIRCLE

13.1 Define a circle.
13.2 Describe standard, central and general forms of the equation of a circle.
13.3 Convert general form to the central form of equation of a circle.
13.4 Deduce formula for radius and coordinates of the center of a circle.
13.5 Derive equation of the circle passing through three points.
13.6 Solve problems involving these equations.

Phy-122 APPLIED PHYSICS

Total Contact Hours

		T	P	C
Theory	32			
Practical	96	1	3	2

AIMS: The students will be able to understand the fundamental principles and concept of physics, use these to solve problems in practical situations/technological courses and understand concepts to learn advance physics/technical courses.

COURSE CONTENTS

1 MEASUREMENTS. 2 Hours.

- 1.1 Fundamental units and derived units
- 1.2 Systems of measurement and S.I. units
- 1.3 Concept of dimensions, dimensional formula
- 1.4 Conversion from one system to another
- 1.5 Significant figures

2 SCALARS AND VECTORS. 4 Hours.

- 2.1 Revision of head to tail rule
- 2.2 Laws of parallelogram, triangle and polygon of forces
- 2.3 Resolution of a vector
- 2.4 Addition of vectors by rectangular components
- 2.5 Multiplication of two vectors, dot product and cross product

3 MOTION 4 Hours.

- 3.1 Review of laws and equations of motion
- 3.2 Law of conservation of momentum
- 3.3 Angular motion
- 3.4 Relation between linear and angular motion
- 3.5 Centripetal acceleration and force
- 3.6 Equations of angular motion

4 TORQUE, EQUILIBRIUM AND ROTATIONAL INERTIA. 6 Hours.

- 4.1 Torque
- 4.2 Centre of gravity and centre of mass
- 4.3 Equilibrium and its conditions
- 4.4 Torque and angular acceleration
- 4.5 Rotational inertia

5 WAVE MOTION. 5 Hours

- 5.1 Review Hooke's law of elasticity
- 5.2 Motion under an elastic restoring force
- 5.3 Characteristics of simple harmonic motion
- 5.4 S.H.M. and circular motion
- 5.5 Simple pendulum
- 5.6 Wave form of S.H.M.
- 5.7 Resonance
- 5.8 Transverse vibration of a stretched string

6 SOUND. 5 Hrs

6.1 Longitudinal waves
6.2 Intensity, loudness, pitch and quality of sound
6.3 Units of Intensity of level and frequency response of ear
6.4 Interference of sound waves silence zones, beats
6.5 Acoustics
6.6 Doppler effect.

7 LIGHT. 5 Hours

7.1 Review laws of reflection and refraction
7.2 Image formation by mirrors and lenses
7.3 Optical instruments
7.4 Wave theory of light
7.5 Interference, diffraction, polarization of light waves
7.6 Applications of polarization in sunglasses, optical activity and stress analysis

8 OPTICAL FIBER. 2 Hours

8.1 Optical communication and problems
8.2 Review total internal reflection and critical angle
8.3 Structure of optical fiber
8.4 Fiber material and manufacture
8.5 Optical fiber - uses.

9 LASERS. 3 Hours

9.1 Corpuscular theory of light
9.2 Emission and absorption of light
9.3 Stimulated absorption and emission of light
9.4 Laser principle
9.5 Structure and working of lasers
9.6 Types of lasers with brief description.
9.7 Applications (basic concepts)
9.8 Material processing
9.9 Laser welding
9.10 Laser assisted machining
9.11 Micro machining
9.12 Drilling, scribing and marking
9.13 Printing
9.14 Lasers in medicine

REFERENCE BOOKS

1 Tahir Hussain, Fundamentals of Physics Vol-I and II
2 Farid Khawaja, Fundamentals of Physics Vol-I and II
3 Wells and Slusher, Schaum's Series Physics .
4 Nelkon and Oyborn, Advanced Level Practical Physics
5 Mehboob Ilahi Malik and Inam-ul-Haq, Practical Physics
6 Wilson, Lasers - Principles and Applications

INSTRUCTIONAL OBJECTIVES

1 USE CONCEPTS OF MEASUREMENT TO PRACTICAL SITUATIONS AND TECHNOLOGICAL PROBLEMS.

1.1 Write dimensional formulae for physical quantities
1.2 Derive units using dimensional equations
1.3 Convert a measurement from one system to another
1.4 Use concepts of measurement and Significant figures in problem solving.

2 USE CONCEPTS OF SCALARS AND VECTORS IN SOLVING PROBLEMS INVOLVING THESE CONCEPTS.

2.1 Explain laws of parallelogram, triangle and polygon of forces
2.2 Describe method of resolution of a vector into components
2.3 Describe method of addition of vectors by rectangular components
2.4 Differentiate between dot product and cross product of vectors
2.5 Use the concepts in solving problems involving addition resolution and multiplication of vectors.

3 USE THE LAW OF CONSERVATION OF MOMENTUM AND CONCEPTS OF ANGULAR MOTION TO PRACTICAL SITUATIONS.

3.1 Use law of conservation of momentum to practical/technological problems.
3.2 Explain relation between linear and angular motion
3.3 Use concepts and equations of angular motion to solve relevant technological problems.

4 USE CONCEPTS OF TORQUE, EQUILIBRIUM AND ROTATIONAL INERTIA TO PRACTICAL SITUATION/PROBLEMS.

4.1 Explain Torque
4.2 Distinguish between Centre of gravity and centre of mass
4.3 Explain rotational Equilibrium and its conditions
4.4 Explain Rotational Inertia giving examples
4.5 Use the above concepts in solving technological problems.

5 USE CONCEPTS OF WAVE MOTION IN SOLVING RELEVANT PROBLEMS.

5.1 Explain Hooke's Law of Elasticity
5.2 Derive formula for Motion under an elastic restoring force
5.3 Derive formulae for simple harmonic motion and simple pendulum
5.4 Explain wave form with reference to S.H.M. and circular motion
5.5 Explain Resonance
5.6 Explain Transverse vibration of a stretched string
5.7 Use the above concepts and formulae of S.H.M. to solve relevant problems.

6 UNDERSTAND CONCEPTS OF SOUND.

6.1 Describe longitudinal wave and its propagation
6.2 Explain the concepts: Intensity, loudness, pitch and quality of sound
6.3 Explain units of Intensity of level and frequency response of ear
6.4 Explain phenomena of silence zones, beats
6.5 Explain Acoustics of buildings
6.6 Explain Doppler effect giving mathematical expressions.

7 USE THE CONCEPTS OF GEOMETRICAL OPTICS TO MIRRORS and LENSES.

7.1 Explain laws of reflection and refraction

7.2 Use mirror formula to solve problems

7.3 Use the concepts of image formation by mirrors and lenses to describe working of optical instruments, e.g. microscopes, telescopes, camera and sextant.

8 UNDERSTAND WAVE THEORY OF LIGHT

8.1 Explain wave theory of light

8.2 Explain phenomena of interference, diffraction, polarization of light waves

8.3 Describe uses of polarization given in the course contents.

9 UNDERSTAND THE STRUCTURE, WORKING AND USES OF OPTICAL FIBER.

9.1 Explain the structure of the Optical Fiber

9.2 Explain its principle of working

9.3 Describe use of optical fiber in industry and medicine.

LIST OF PRACTICALS.

1 Draw graphs representing the functions:
   a) y=mx for m=0, 0.5, 1, 2
   b) $y=x^2$
   c) y=1/x
2 Find the volume of a given solid cylinder using vernier callipers.
3 Find the area of cross-section of the given wire using micrometer screw gauge.
4 Prove that force is directly proportional to (a) mass, (b) acceleration, using fletchers' trolley.
5 Verify law of parallelogram of forces using Grave-sands apparatus.
6 Verify law of triangle of forces and Lami's theorem
7 Determine the weight of a given body using
   a) Law of parallelogram of forces
   b) Law of triangle of forces
   c) Lami's theorem
8 Verify law of polygon of forces using Grave-sands apparatus.
9 Locate the position and magnitude of resultant of like parallel forces.
10 Determine the resultant of two unlike parallel forces.
11 Find the weight of a given body using principle of moments.
12 Locate the centre of gravity of regular and irregular shaped bodies.
13 Find Young's Modules of Elasticity of a metallic wire.
14 Verify Hooke's Law using helical spring.
15 Study of frequency of stretched string with length.
16 Study of variation of frequency of stretched string with tension.
17 Study resonance of air column in resonance tube and find velocity of sound.
18 Find the frequency of the given tuning fork using resonance tube.
19 Find velocity of sound in rod by Kundt's tube.
20 Verify rectilinear propagation of light and study shadow formation.
21 Study effect of rotation of plane mirror on reflection.
22 Compare the refractive indices of given glass slabs.
23 Find focal length of concave mirror by locating centre of curvature.
24 Find focal length of concave mirror by object and image method
25 Find focal length of concave mirror with converging lens.
26 Find refractive index of glass by apparent depth.
27 Find refractive index of glass by spectrometer.
28 Find focal length of converging lens by plane mirror.
29 Find focal length of converging lens by displacement method.
30 Find focal length of diverging lense using converging lens.
31 Find focal length of diverging lens using concave mirror.
32 Find angular magnification of an astronomical telescope.
33 Find angular magnification of a simple microscope (magnifying glass)
34 Find angular magnification of a compound microscope.
35 Study working and structure of camera.
36 Study working and structure of sextant.
37 Compare the different scales of temperature and verify the conversion formula.
38 Determine the specific heat of lead shots.
39 Find the coefficient of linear expansion of a metallic rod.
40 Find the heat of fusion of ice.
41 Find the heat of vaporization.
42 Determine relative humidity using hygrometer.

Ch-132 APPLIED CHEMISTRY

Total Contact Hours		T	P	C
Theory	32	1	3	2
Practical	96			

Pre-requisite: The student must have studied the subject of elective chemistry at Secondary school level.

AIMS After studying this course a student will be able to:

1. Understand the significance and role of chemistry in the development of modern technology.
2. Becomes acquainted with the basic principles of chemistry as applied in the study of relevant Technology.
3. Knows the scientific methods for production, properties and use of materials of industrial & technological significance.
4. Gain skill for the efficient conduct of practicals in a chemistry lab.

1. INTRODUCTION **2 Hours**

1.1 The scope and significance of the subject.
1.2 Orientation with reference to Technology.
1.3 Terms used & units of measurements in the study of chemistry.

2. FUNDAMENTAL CONCEPTS OF CHEMISTRY **2 Hours**

2.1 Symbols, Valency, Radicals, formulas.
2.2 Chemical Reactions & their types.
2.3 Balancing of equations by ionic method.

3. ATOMIC STRUCTURE **2 Hours**

3.1 Sub-atomic particles.
3.2 Bohrs Atomic Model.
3.3 The periodic classification of elements and periodic law
3.4 General characteristics of a period and group.

4. CHEMICAL BOND **2 Hours**

4.1 Nature of chemical Bond.
4.2 Electrovalent bond with examples.
4.3 Covalent Bond(Polar and Non-polar, sigma & Pi Bonds with examples.
4.4 Co-ordinate Bond with examples.

5. SOLIDS AND LIQUIDS **3 Hours**

5.1 The liquid and Solids state.
5.2 The liquids and their general properties (Density, viscosity, surface tension capillary action etc).
5.3 Solids and their general properties.
5.4 Crystal structure of solids
5.5 Crystals of Si and Ge.

6. WATER **3 Hours**

6.1 Chemical nature and properties.
6.2 Impurities.
6.3 Hardness of water (types, causes & removal)
6.4 Scales of measuring hardness (Degress Clark, French, PPM, Mgm per litre).
6.5 Boiler feed water, scales and treatment.
6.6 Sea-water desalination, sewage treatment.

7. ACIDS, BASES AND SALTS **2 Hours**

7.1 Definitions with examples.
7.2 Properties, their strength, basicity & Acidity.
7.3 Salts and their classification with examples.
7.4 pH-value and scale.

8. OXIDATION & REDUCTION **2 Hours**

8.1 The process with examples.
8.2 Oxidizing and Reducing agents.
8.3 Oxides and their classifications.

9. NUCLEAR CHEMISTRY **2 Hours**

9.1 Introduction.
9.2 Radioactivity (Alpha, beta and gamma rays).
9.3 Half life process.
9.4 Nuclear reaction & transformation of elements.
9.5 Isotopes and their uses.

10. ALLOYS **2 Hours**

10.1 Introduction with need.
10.2 Preparation and properties.
10.3 Some important alloys and their composition.

11. CORROSION **2 Hours**

11.1 Introduction with causes.
11.2 Types of corrosion.
11.3 Rusting of Iron
11.4 Protective measures against corrosion.

12. ELECTRO CHEMISTRY **2 Hours**

12.1 Ionization and Arrhenius theory of Ionization.
12.2 Electrolytes and Electrolysis.
12.3 Faraday's Laws and numericals related to them.
12.4 Application of Electrolysis (Electron, lathing etc).
12.5 Electro Chemical cells.

13. ELECTRICAL INSULATING MATERIALS. **2 Hours**

13.1 Introduction.
13.2 Solid insulators with chemical nature.
13.3 Liquid insulators with chemical nature.
13.4 Gaseous insulators with chemical nature.
13.5 Uses and their classification.

14. SEMI CONDUCTORS. **2 Hours**

14.1 Introduction
14.2 Atomic structure of silicon and germanium.
14.3 Bonding & Conductivity.
14.4 Energy bands in a semiconductor.

15. ETCHING PROCESS. 2 Hours

15.1 The process and its aims.
15.2 Etching reagents.
15.3 Applications of processors.

REFERENCE BOOKS

1. Intermediate Text-Books of chemistry I & II
2. ILMI Applied Science by SH. Ata Mohammed
3. Materials science by J.C.Anderson & Leaver.
4. Polytechnic Chemistry by G.N.Ready (ELBS & Nelson, Hong Kong).
5. Chemistry for engineers by Eric Gyngell.

Ch-132 INSTRUCTIONAL OBJECTIVES

1. UNDERSTAND THE SCOPE, SIGNIFICANCE AND ROLE OF THE SUBJECT.

1.1 Define chemistry and its terms.
1.2 Define the units of measurements in the study of chemistry.
1.3 Explain the importance of chemistry in various fields of specialization.
1.4 Explain the role of chemistry in this technology.

2. UNDERSTAND LANGUAGE OF CHEMISTRY AND CHEMICAL REACTIONS.

2.1 Define symbol, valency, radical, formula with examples of each.
2.2 Write chemical formula of common compounds.
2.3 Define chemical reaction and equations.
2.4 Describe types of chemical reactions with examples.
2.5 Explain the method of balancing the equation by ionic method.

3. UNDERSTAND THE STRUCTURE OF ATOMS AND ARRANGEMENT OF SUB ATOMIC PARTICLES IN THE ARCHITECTURE OF ATOMS.

3.1 Define atom.
3.2 Describe the fundamental sub atomic particles
3.3 Distinguish between atomic no. mass no. and between isotope and isobars.
3.4 Explain the arrangements of electrons in different shells and sub energy levels and understand bohr's atomic model.
3.5 Explain the grouping and placing of elements in the periodic table especially Si & germanium.
3.6 State the periodic law of elements.
3.7 Explain the trend of properties of elements based on their position in the periodic table.
3.8 Explain general characteristics of a period and a group.

4. UNDERSTAND THE NATURE OF CHEMICAL BONDS.

4.1 Define chemical Bond.
4.2 State the nature of chemical bond.
4.3 Differentiate between electrovalent and covalent bonding.
4.4 Explain the formation of polar and non polar, sigma and pi-bond with examples.
4.5 Describe the nature of coordinate bond with examples.

5. UNDERSTAND THE STATES OF MATTER AND DISTINGUISHES SOLIDS FROM GASES.

5.1 Describe the liquid and solid states of matter.
5.2 State the general properties of liquid.
5.3 State the general properties of solid.
5.4 Explain the formation of crystals and their types.
5.5 Describe the crystal structure of Si and Ge.

6. UNDERSTAND THE CHEMICAL NATURE OF WATER.

6.1 Describe the chemical nature of water with its formula.
6.2 Describe the general impurities present in water.
6.3 Explain the causes and methods to remove hardness of water.
6.4 Express hardness in different units like mg/litre. p.p.m, degrees Clark and degrees French.

6.5 Describe the formation and nature of scales in boiler feed water.
6.6 Explain the method for the treatment of scales.
6.7 Explain the sewage treatment and desalination of sea water.

7. UNDERSTAND THE NATURE OF ACIDS, BASES AND SALTS.

7.1 Define acids, bases and salts with examples.
7.2 State general properties of acids and bases.
7.3 Differentiate between acidity and basicity.
7.4 Define salts, give their classification with examples.
7.5 Explain pH value of solution and pH scale.

8. UNDERSTAND THE PROCESS OF OXIDATION AND REDUCTION.

8.1 Define oxidation.
8.2 Illustrate the oxidation process with examples.
8.3 Define reduction.
8.4 Explain reduction process with examples.
8.5 Define oxidizing and reducing agents and give at least six examples of each.
8.6 Define oxides.
8.7 Classify the oxides and give examples.

9. UNDERSTAND THE FUNDAMENTALS OF NUCLEAR CHEMISTRY.

9.1 Define nuclear chemistry and radio activity.
9.2 Differentiate between alpha, beta and gamma particles.
9.3 Explain half life process.
9.4 Explain at least six nuclear reactions resulting in the transformation of some elements.
9.5 State the uses of isotopes.

10. UNDERSTAND THE NATURE OF ALLOYS USED IN THE RESPECTIVE TECHNOLOGY.

10.1 Define alloy.
10.2 Explain different methods for the preparation of alloys.
10.3 Explain important properties of alloys.
10.4 Explain the composition, properties and uses of alloys.

11. UNDERSTAND THE PROCESS OF CORROSION.

11.1 Define corrosion.
11.2 Describe different types of corrosion.
11.3 State the causes of corrosion.
11.4 Explain the process of rusting of iron.
11.5 Describe methods to prevent/control corrosion.

12. UNDERSTAND THE APPLICATION OF ELECTROCHEMISTRY IN DIFFERENT FIELDS OF INDUSTRIES.

12.1 Define ionization, electrolyte and electrolysis.
12.2 Describe Arrhenius theory of ionization.
12.3 State Faraday's laws of electrolysis.
12.4 Apply Faraday's laws of different fields of industry.
12.5 Solves numerical problem on Faraday's Laws.
12.6 Explain the construction and working of Daniel cell and lead accumulator.

13. KNOW THE USE OF INSULATING MATERIALS.

13.1 Define insulator, conductor.
13.2 Classify solid, liquid and gaseous insulators with their chemical nature.
13.3 Describe their uses.

14. UNDERSTAND THE NATURE AND CHEMISTRY OF SEMI CONDUCTORS.

14.1 Define semi conductors.
14.2 Draw the atomic structure of silicon and germanium.
14.3 Describe the process of bonding and conductivity in conductors and semi conductors.
14.4 Explain energy bands in semi conductors.

15. USE ETCHING PROCESS IN DIFFERENT FIELDS OF TECHNOLOGY.

15.1 Define etching process and its aims.
15.2 Enlist the chemicals/reagents used in the process.
15.3 Explain the use of the process in the technology.

CH-132 APPLIED CHEMISTRY

LIST OF PRACTICALS

1. To introduce the common apparatus, glassware and chemical reagents used in the chemistry lab.
2. To purify a chemical substance by crystallization.
3. To separate a mixture of sand and salt.
4. To find the melting point of substance.
5. To find the pH of a solution with pH paper.
6. To separate a mixture of inks by chromatography.
7. To determine the co-efficient of viscosity of benzene with the help of Ostwald vasomotor.
8. To find the surface tension of a liquid with a stalagmometer.
9. To perform electrolysis of water to produce Hydrogen and Oxygen.
10. To determine the chemical equivalent of copper by electrolysis of Cu SO.
11. To get introduction with the scheme of analysis of salts for basic radicals.
12. To analyse 1st group radicals (Ag^{+} - Pb^{++} - Hg^{+}).
13. To make practice for detection 1st group radicals.
14. To get introduction with the scheme of II group radicals.
15. To detect and confirm II-A radicals (hg^{++}, Pb^{++++}, Cu^{+}, Cd^{++}, Bi^{+++}).
16. To detect and confirm II-B radicals Sn^{+++}, Sb^{+++}, As^{+++}).
17. To get introduction with the scheme of III group radicals (Fe^{+++} - Al^{+++}, Cr^{+++})
18. To detect and confirm Fe^{+++}, Al^{+++} and Cr^{+++}.
19. To get introduction with he scheme of IV group radicals.
20. To detect and confirm An^{++} and Mn^{++} radicals of IV group.
21. To detect and conform Co^{++} and Ni^{++} radicals of IV group.
22. To get introduction with the Acid Radical Scheme.
23. To detect dilute acid group.
24. To detect and confirm CO''_3 and HCO'_3 radicals.
25. To get introduction with the methods/apparatus of conducting volumetric estimations.
26. To prepare standard solution of a substance.
27. To find the strength of a given alkali solution.
28. To estimate HCO'_3 contents in water.
29. To find out the %age composition of a mixture solution of KNO_3 and KOH volumetrically.
30. To find the amount of chloride ions (Cl') in water volumetrically.

Comp-182 ICT Fundamentals

Total Contact Hours:

		T	P	C
Theory	32			
Practical	96	1	3	2

Learning Outcomes:

After this course the student will be able to:

- Demonstrate foundational knowledge of computer systems, including hardware components, software types, and the fundamentals of data representation and storage.
- Effectively utilize operating systems, particularly Windows, including installation, configuration, and basic troubleshooting.
- Proficiently use core Microsoft Office applications (Word, Excel, and PowerPoint) for document creation, data analysis, and presentations.
- Understand fundamental internet concepts, including web browsing, email communication, basic online safety and security practices, and the ethical and responsible use of generative AI tools.

Course Contents:

1. INTRODUCTION TO COMPUTER **2 Hours**

1.1. Introduction to computer system
1.2. Understanding BIT, Byte, RAM & ROM
1.3. Input & Output devices
1.4. Secondary storage devices
1.5. Processor Types
1.6. Types of Software
1.7. Printers, scanners and other peripheral devices interfacing
1.8. Applications in Engineering, Education & Business

2. OPERATING SYSTEMS **5 Hours**

2.1 Introduction to Windows
2.2 How to install Drivers & Windows
2.3 Loading & Shut down process
2.4 Introduction to Desktop items (Creation of Icons, Shortcut, Folder & modify Taskbar)
2.5 Desktop properties
2.6 Use of Control Panel
2.7 Introduction to other Operating Systems like LINUX, UNIX and macOS

3. MS-OFFICE (MS-WORD latest Version) **4 Hour**

3.1 Introduction to MS-Office
3.2 Introduction to MS-Word & its Interface
3.3 Creating, Editing, Formatting, Saving & Opening a document
3.4 Page setup (Set the Margins & Paper)
3.5 Spell Check & Grammar
3.6 Paragraph Alignment

3.7 Inserting Page numbers, Symbols, Text box & Picture in the document
3.8 Use the different Format menu drop down commands
3.9 Insert the Table and it's Editing
3.10 Printing the document
3.11 Saving a document file as PDF format
3.12 Mail Merge using MS Word

4. MS-OFFICE (MS-EXCEL latest Version) 5 Hours

4.1 Introduction to MS-Excel & its Interface
4.2 Entering data & apply formulas in worksheet
4.3 Vlookup, Hlookup, Xlookup and Pivot Tables
4.4 Editing & Formatting the Cells, Row & Column
4.5 Insert Graphs in sheet
4.6 Page setup, Print Preview & Printing

5. MS-OFFICE (MS-POWER POINT latest Version) 4 Hours

5.1 Introduction to MS Power Point
5.2 Creating a presentation
5.3 Editing & formatting a text box
5.4 Adding pictures & colours to a slide
5.5 Making Slideshow
5.6 Adding Animations and Transitions

6. INTERNET & E-MAIL 4 Hours

6.1 Introduction to Internet & browser window
6.2 Web Browsing
6.3 Email Basics
6.4 Email Management
6.5 Uploading and downloading file(s) and software(s)
6.6 SEO and digital marketing using social media platforms.
6.7 Network Types

7. INTRODUCTION TO PRODUCTIVITY TOOLS 4 Hours

7.1 Google Workspace
7.2 Video Conferencing & Collaboration
7.3 Introduction to Canva

8. EMERGING TECHNOLOGIES AND THE USE OF GENERATIVE AI TOOLS 4 Hours

8.1 Introduction to Artificial Intelligence (AI) and Machine Learning (ML)
8.2 Generative AI Tools like ChatGPT, Gemini, CoPilot, DALL·E and others.
8.3 Applications of LLM tools like ChatGPT and Similar Tools
8.4 Ethical Considerations and Responsible AI

REFERENCE BOOKS:

1. The Microsoft Office 365 Bible by Max Clark, 2022
2. Microsoft Excel 365 Bible by Michael Alexander, 2022
3. Microsoft PowerPoint 365 Bible by Faithe Wempen
4. Generative AI - The Future of Everything by Sharad Gandhi and Christian Ehl 2023

Instructional Objectives:

1. INTRODUCTION TO COMPUTER

1.1. **Introduction to Computer System**

- 1.1.1. History of Computing
- 1.1.2. Basic Components of a Computer System (CPU, Memory, Input/Output, Storage)
- 1.1.3. Computer Architecture
- 1.1.4. Types of Computers (Supercomputers, Mainframes, Servers, Workstations, Personal Computers, Embedded Systems)

1.2. **Understanding BIT, Byte, RAM & ROM**

- 1.2.1. Binary Number System (Bits, Bytes, and their representation)
- 1.2.2. Memory Units (Kilobytes, Megabytes, Gigabytes, Terabytes, Petabytes)
- 1.2.3. Types of RAM (DRAM, SRAM, their characteristics and applications)
- 1.2.4. Types of ROM (PROM, EPROM, EEPROM, Flash Memory)
- 1.2.5. Cache Memory (Levels of Cache, its role in improving performance)

1.3. **Input & Output Devices**

- 1.3.1. Input Devices (Keyboard, Mouse, Touchscreen, Microphone, Scanner, Webcam, Joystick, Gamepad)
- 1.3.2. Output Devices (Monitor, Printer, Speaker, Projector, Headphone, Haptic Devices)

1.4. **Secondary Storage Devices**

- 1.4.1. Magnetic Storage (Hard Disk Drives - HDDs, their working and types)
- 1.4.2. Solid-State Storage (SSDs, Flash Drives, their advantages over HDDs)
- 1.4.3. Optical Storage (CDs, DVDs, Blu-ray, their capacity and limitations)
- 1.4.4. Cloud Storage (Cloud Service Providers, Cloud Storage Models, Advantages and Disadvantages)

1.5. **Processor Types**

- 1.5.1. Central Processing Unit (CPU) - Core Concept and Function
- 1.5.2. Types of CPUs (x86, ARM, RISC, CISC)
- 1.5.3. Multi-core Processors and their Benefits
- 1.5.4. Graphics Processing Units (GPUs) and their Role

1.6. **Types of Software**

- 1.6.1. System Software (Operating Systems - Windows, macOS, Linux, their functions)
- 1.6.2. Utility Software (Antivirus, Disk Defragmenters, Backup Software)
- 1.6.3. Application Software (Word Processors, Spreadsheets, Presentation Software, Databases, Multimedia Software, Games)
- 1.6.4. Open-Source vs. Proprietary Software

1.7. **Printers, scanners and other peripheral devices interfacing**

1.7.1. Printer Types (Inkjet, Laser, 3D Printers)

1.7.2. Scanner Types (Flatbed, Sheet-fed, Handheld)

1.7.3. Other Peripherals (Webcams, Microphones, Speakers, External Hard Drives)

1.7.4. Device Drivers and their Importance

1.7.5. Connecting Peripherals (USB, Bluetooth, Wi-Fi)

1.8. **Applications in Engineering, Education & Business**

1.8.1. Engineering Applications (CAD/CAM, Simulation Software)

1.8.2. Educational Applications and Software

1.8.3. Business Applications (CRM, ERP, E-commerce)

2. UNDERSTAND MS-WINDOWS (Latest Version)

2.1. **Introduction to Windows**

2.1.1. Different Windows Versions (Windows XP, 7, 8, 10, 11)

2.1.2. Key Features of the Windows Operating System (User Interface, Multitasking, File System, Security)

2.2. **How to install Drivers& Windows**

2.2.1. Hardware Drivers and their Importance

2.2.2. Methods of Installing Drivers (Manual, Automatic, Windows Update)

2.2.3. Troubleshooting Driver Issues

2.2.4. Installation of Windows

2.3. **Loading & Shut down process**

2.3.1. Boot Process

2.3.2. Shutdown Process

2.3.3. Safe Mode and its Uses

2.4. **Introduction to Desktop items (Creation of Icons, Shortcut, Folder & modify Taskbar)**

2.4.1. Creating and Deleting Desktop Icons

2.4.2. Creating Shortcuts to Programs and Files

2.4.3. Creating and Managing Folders

2.4.4. Customizing the Taskbar (Pinning Programs, Show Desktop Button, Taskbar Properties)

2.5. **Desktop properties**

2.5.1. Changing Desktop Background

2.5.2. Screen Saver Settings

2.5.3. Display Settings (Resolution, Color Depth)

2.5.4. Themes and Personalization Options

2.6. **Use of Control Panel**

2.6.1. Overview of the Control Panel

2.6.2. Key Control Panel Applets (System, Devices and Printers, Network and Internet, User Accounts)

2.7. **Introduction to other Operating Systems like LINUX, UNIX and macOS**

2.7.1. Introduction to other operating systems

2.7.2. Comparison of Windows, Linux, Unix and macOS (Strengths and Weaknesses of each)

3. UNDERSTAND MS-OFFICE (MS-WORD Latest Version)

3.1. **Introduction to MS-Office**

3.1.1. What is MS-Office Suite?

3.1.2. Benefits of using MS-Office

3.2. **Introduction to MS-Word& its Interface**

3.2.1. Overview of MS-Word

3.2.2. Word Interface (Ribbon, Quick Access Toolbar, Status Bar, Backstage View)

3.3. **Creating, Editing, Formatting, Saving & Opening a document**

3.3.1. Creating a New Document

3.3.2. Typing and Editing Text (Inserting, Deleting, Cutting, Copying, Pasting)

3.3.3. Basic Text Formatting (Font, Font Size, Color, Bold, Italic, Underline)

3.3.4. Saving a Document (Save, Save As, File Formats)

3.3.5. Opening Existing Documents

3.4. **Page setup (Set the Margins& Paper)**

3.4.1. Setting Margins (Top, Bottom, Left, Right)

3.4.2. Choosing Paper Size (Letter, A4, Legal)

3.4.3. Page Orientation (Portrait, Landscape)

3.5. **Spell Check &Grammar**

3.5.1. Using the Spell Check and Grammar Checker

3.5.2. AutoCorrect Options

3.6. **Paragraph Alignment**

3.6.1. Left, Right, Center, and Justified Alignment

3.6.2. Indentation (First Line, Hanging)

3.6.3. Line Spacing

3.7. **Inserting Page numbers, Symbols, Text box & Picture in the document**

3.7.1. Inserting Page Numbers (Header, Footer)

3.7.2. Inserting Symbols (Special Characters, Symbols Library)

3.7.3. Inserting Text Boxes (Formatting Text within Boxes)

3.7.4. Inserting Pictures (From File, Online, Shapes)

3.7.5. Image Formatting (Cropping, Resizing, Rotating)

3.8. **Use the different Format menu drop down commands (Change Case, Bullet & Numbering and Shading & Border)**

3.8.1. Change Case (Uppercase, Lowercase, Sentence case, Title Case)

3.8.2. Bullet and Numbering Lists (Creating and Formatting Lists)

3.9. **Insert the Table and it's Editing**

3.9.1. Inserting Tables (Rows, Columns)

3.9.2. Table Editing (Adding/Deleting Rows/Columns, Merging/Splitting Cells)

3.9.3. Formatting Table Cells (Borders, Shading, Alignment)

3.10. **Printing the document**

3.10.1. Print Preview and Page Setup

3.10.2. Printing Options (Number of Copies, Print Range)

3.11. **Saving a document file as PDF format**

3.11.1. Understanding PDF Format

3.11.2. Saving a Word Document as PDF

3.12. **Mail Merge using MS Word**

3.12.1. Mail Merge Options (Letters, Labels, Envelopes)

3.12.2. Previewing and Printing Merged Documents

4. UNDERSTAND MS-OFFICE (MS-EXCEL Latest Version)

4.1. **Introduction to MS-Excel& its Interface**

4.1.1. Overview of MS-Excel

4.1.2. Excel Interface (Ribbon, Quick Access Toolbar, Formula Bar, Worksheets, Workbooks)

4.1.3. Navigating the Excel Worksheet (Cells, Rows, Columns, Sheets)

4.1.4. Entering data &apply formulas in worksheet

4.1.5. Entering Data (Text, Numbers, Dates)

4.1.6. Basic Formulas (SUM, AVERAGE, COUNT, MAX, MIN)

4.1.7. Cell References (Relative, Absolute, Mixed)

4.1.8. Creating and Applying Formulas (Order of Operations, Functions)

4.2. **Vlookup, Hlookup, Xlookup and Pivot Tables**

4.2.1. VLOOKUP Function (Lookup values in a vertical table)

4.2.2. HLOOKUP Function (Lookup values in a horizontal table)

4.2.3. XLOOKUP Function (Enhanced lookup function with improved flexibility)

4.2.4. Pivot Tables (Creating and Analyzing Data Summaries)

4.2.5. Using Pivot Tables to Summarize and Analyze Data

4.3. **Editing & Formatting the Cells, Row & Column**

4.3.1. Editing Cell Contents (Inserting, Deleting, Replacing)

4.3.2. Formatting Cells (Number Formats, Font, Color, Alignment)

4.3.3. Formatting Rows and Columns (Height, Width, Hiding, Unhiding)

4.3.4. Conditional Formatting (Highlighting Cells Based on Conditions)

4.4. **Insert Graphs in sheet**

4.4.1. Types of Charts (Column, Bar, Line, Pie, Area, Scatter)

4.4.2. Creating Charts from Data

4.4.3. Chart Elements (Titles, Legends, Data Labels)

4.4.4. Chart Customization (Formatting Chart Appearance)

4.5. **Page setup, Print Preview & Printing**

4.5.1. Page Setup Options (Margins, Orientation, Scaling)

4.5.2. Print Preview (Checking the Layout Before Printing)

4.5.3. Printing Worksheets (Selecting Print Area, Setting Print Titles)

5. UNDERSTAND MS-OFFICE (MS-POWER POINT Latest Version)

5.1. **Introduction to MS PowerPoint**

5.1.1. Overview of MS PowerPoint

5.1.2. PowerPoint Interface (Ribbon, Quick Access Toolbar, Slide Pane, Notes Pane)

5.1.3. Basic Concepts of Presentations (Slides, Layouts, Themes)

5.2. **Creating a presentation**

5.2.1. Creating a New Presentation (Blank Presentation, Templates)

5.2.2. Adding Slides (New Slide, Duplicate Slide, Delete Slide)

5.2.3. Organizing Slides (Rearranging Slide Order)

5.3. **Editing & formatting a text box**

5.3.1. Adding Text Boxes to Slides

5.3.2. Formatting Text (Font, Size, Color, Bold, Italic, Underline)

5.3.3. Aligning Text within Text Boxes

5.3.4. Bullet Points and Numbering

5.3.5. Adding pictures & colors to a slide

5.3.6. Inserting Pictures (From File, Online, Shapes)

5.3.7. Formatting Pictures (Cropping, Resizing, Rotating)

5.3.8. Applying Slide Backgrounds (Colors, Gradients, Images)

5.3.9. Choosing Slide Layouts and Themes

5.4. **Making Slideshow**

5.4.1. Setting Up Slide Show (Slide Show Settings)

5.4.2. Running a Slide Show (Manual and Automatic)

5.5. **Adding Animations and Transitions**

5.5.1. Adding Transitions (Between Slides)

5.5.2. Adding Animations (To Objects on Slides)

5.5.3. Timing and Effects (Speed, Direction, Trigger)

6. UNDERSTAND INTERNET & E-MAIL

6.1. **Introduction to Internet & Web Browsers**

6.1.1. Basic Concepts (Websites, URLs, Protocols - HTTP, HTTPS

6.1.2. Web Browsers (Chrome, Firefox, Edge, Safari)

6.1.3. Browser Interface (Address Bar, Tabs, History, Bookmarks)

6.2. **Web Browsing & Online Resources**

6.2.1. Searching the Web (Search Engines, Keywords, Operators)

6.2.2. Saving Web Pages (Bookmarks, Downloads)

6.2.3. Printing Web Pages

6.3. **Email Basics**

6.3.1. Creating an Email Account (Gmail, Outlook, Yahoo)

6.3.2. Writing and Sending Emails (Compose, Recipients, Subject, Body)

6.3.3. Receiving and Reading Emails (Inbox, Sent Mail, Drafts)

6.4. **Email Management**

6.4.1. File Attachments (Sending and Receiving Files)

6.4.2. Organizing Emails (Folders, Labels, Filters)

6.4.3. Managing Spam (Spam Filters, Unsubscribe Options)

6.4.4. Email Security (Phishing, Malware, Strong Passwords)

6.5. **Online Data Transfer**

6.5.1. Uploading and Downloading Files (Cloud Storage, File Transfer Protocols)

6.5.2. Downloading and Installing Software

6.6. **Online Presence & Digital Marketing**

6.6.1. Social Media Platforms (Facebook, Twitter, Instagram, LinkedIn)

6.6.2. SEO (Search Engine Optimization) Basics

6.6.3. Digital Marketing Fundamentals

6.7. **Network Types**

6.7.1. Internet, Intranet, Extranet (Definitions and Differences)

7. INTRODUCTION TO PRODUCTIVITY TOOLS

7.1. **Google Workspace**

7.1.1. File Management & Collaboration in Google Drive

7.1.2. Core Applications: Docs, Sheets, Slides, Forms

7.2. **Video Conferencing & Collaboration**

7.2.1. Zoom, Microsoft Teams, Google Meet

7.3. **Canva for Visual Content**

7.3.1. Creating Designs: Presentations, Posters, Social Media Graphics

8. EMERGING TECHNOLOGIES AND THE USE OF GENERATIVE AI TOOLS

8.1. **Introduction to AI & ML**

8.1.1. Brief Overview of AI & Machine Learning

8.1.2. Types of AI

8.2. **Generative AI Tools**

8.2.1. Defining Generative AI

8.2.2. Key Examples: ChatGPT, DALL-E 2, CoPilot etc.

8.3. **Applications of Generative AI**

8.3.1. Content Creation, Customer Service, Education

8.4. **Ethical Considerations**

8.4.1. Bias, Privacy, Job Market Impact

LIST OF PRACTICAL: 96 Hours

1. **Identifying Computer Components**
   Identify the basic components of a computer system: CPU, RAM, ROM, input/output devices, and storage.
2. **Converting Decimal to Binary**
   Convert decimal numbers to binary and vice versa.
3. **Understanding Memory Units**
   Identify memory units and their storage capacities (KB, MB, GB, TB).
4. **Using Input Devices**
   Practice using input devices (keyboard, mouse, scanner).
5. **Using Output Devices**
   Practice using output devices (monitor, printer, speakers).
6. **Exploring Storage Devices**
   Compare HDDs, SSDs, and cloud storage in terms of speed and capacity.
7. **Installing Printers and Scanners**
   Connect and install a printer or scanner.
8. **Exploring Printer Functionality**
   Explore the functionality of a printer and practice printing documents.
9. **Exploring Scanner Functionality**
   Explore the functionality of a scanner and practice scanning documents.
10. **Booting and Shutting Down Windows**
    Boot and shut down a Windows system. Use Safe Mode.
11. **Installing Windows and Drivers**
    Install a fresh copy of Windows and drivers for hardware components.
12. **Customizing the Windows Desktop**
    Create shortcuts, folders, and customize the taskbar in Windows.
13. **Changing Desktop Properties**
    Change wallpaper, screensaver, and display resolution in Windows.
14. **Using the Control Panel**
    Explore and modify system settings using the Control Panel in Windows.
15. **Exploring MS-Word Interface**
    Identify menus, ribbons, and toolbar options in MS-Word.
16. **Creating and Saving Documents**
    Create a document, save it, and re-open it with different formats in MS-Word.
17. **Formatting Text and Pages in MS-Word**
    Apply text formatting (font, color, spacing) and page formatting (margins, orientation) in MS-Word.
18. **Using Spell Check in MS-Word**
    Practice using proofreading tools such as spell check and grammar in MS-Word.
19. **Inserting Page Numbers and Images in MS-Word**
    Insert and format page numbers, images, and symbols in documents in MS-Word.
20. **Exploring MS-Excel Interface**
    Identify menus and toolbar options in MS-Excel.
21. **Creating and Formatting Worksheets in MS-Excel**
    Create a new worksheet, format rows and columns, and apply borders in MS-Excel.

22. **Using Formulas in MS-Excel**
    Enter data and apply basic formulas (SUM, AVERAGE, etc.) in MS-Excel.
23. **Using Advanced Formulas and Pivot Tables**
    Enter data and apply advanced formulas (VLOOKUP, HLOOKUP, XLOOKUP etc.) as well as Pivot Tables in MS-Excel.
24. **Inserting Charts in MS-Excel**
    Create and format various types of charts (bar, pie, line) in MS-Excel.
25. **Page Setup and Printing in MS-Excel**
    Set up page margins and print a formatted sheet in MS-Excel.
26. **Creating a PowerPoint Presentation**
    Create a new PowerPoint presentation, add slides, and save the file.
27. **Inserting Multimedia in PowerPoint**
    Insert and format images, videos, and shapes in slides in MS-PowerPoint.
28. **Browsing and Searching Data**
    Use a search engine to find relevant data on a topic.
29. **Using Email**
    Create an email account, send/receive emails, and manage attachments.
30. **Using Google Workspace**
    Practice creating and sharing Google Docs, Sheets, and Slides in Google Workspace.
31. **Using Online Communication Tools**
    Install and explore Zoom, Microsoft Teams, or similar tools for virtual collaboration.
32. **Using GenAI Tools**
    Use and compare the output of different GenAI tools like Gemini, ChatGPT, CoPilot etc.

ELTR-124 Electrical Circuits

Total Contact Hours

		T	P	C
Theory	96			
Practical	96	3	3	4

Learning Outcomes:

After this course the student will be able to:

- Demonstrate an understanding of the principles of operation, applications, ratings, tolerances, coding, and troubleshooting of electrical and electronic components/devices in electrical circuits.
- Apply circuit laws and network theorems to calculate current, voltage, power, and power factor in electrical circuits.
- Explain the fundamentals of DC and AC circuits, as well as the concepts of electrostatics, magnetism, electromagnetism, and resonance.
- Utilize filters and coupling techniques in electronic circuits effectively.

Course Contents

(PAPER-A)

1. BASIC PRINCIPLE OF ELECTRICITY (5 Hours)

1.1 Electron Theory
- 1.1.1 Structure of atom, K, L and M shell, energy levels and valence electrons
- 1.1.2 Energy bands with reference to conductors, insulators and semiconductor

1.2 Electrical Quantities
- 1.2.1 Potential, current and resistance
- 1.2.2 Units of potential, current and resistance
- 1.2.3 Conventional and electron current

2. DC FUNDAMENTALS (16 Hours)

2.1 Ohm's Law
- 2.1.1 Definition of Ohm's law
- 2.1.2 Numerical Problems on Ohm's Law

2.2. Laws of Resistance
- 2.2.1 Specific Resistance, conductance and conductivity
- 2.2.2 Effect of temperature on resistance and temp. Coefficient of resistance
- 2.2.3 Numerical Problems on $R= \rho \times L/A$ and $R_t = R_o (1+ \alpha t)$
- 2.2.4 Resistance in series, parallel and series-parallel
- 2.2.5 Calculations on combination of resistance and cells in series, parallel and series-parallel combinations
- 2.2.6 Power and Energy their units and calculations
- 2.2.7 Power dissipation in resistors

2.3 Kirchhoff's Laws
- 2.3.1 Introduction of Kirchhoff's Laws
- 2.3.2 Calculation using KVL and KCL by loop and node methods

2.4 Resistors
- 2.4.1 Resistor construction and types
- 2.4.2 Application of resistors
- 2.4.3 Resistors, Power rating
- 2.4.4 Resistor, troubles

2.5 Batteries

2.5.1 Types of DC sources
2.5.2 Types of cells, Primary and secondary cells and their applications
2.5.3 Chemical Energy sources: Lead-acid batteries, mercury, silver oxide etc.
2.5.4. Introduction to tubular batteries, lithium-ion batteries, and safety measures
2.5.5 Solar Energy; Solar Cell
2.5.6 Internal resistance of a cell
2.5.7 Application of cell as constant voltage and constant current source

3. NETWORK THEOREMS (10 Hours)

3.1 Superposition theorem for complex circuits
3.2 Numerical calculation based on the superposition theorem
3.3 Thevenin's Theorem circuits simplification
3.4 Numerical calculation base on the Thevenin's theorem
3.5 Norton theorem and current source concept
3.6 Numerical calculation based on the Norton's Theorem
3.7 Star and Delta transformation
3.8 Numerical calculation based on Star and Delta transformation
3.9 Maximum power transfer theorem and its applications

4. ELECTROSTATICS (12 Hours)

4.1 Principle of electrostatic, positive and negative charges
4.2 Laws of electrostatic
4.3 Electrostatic induction and field strength
4.4 Properties of electric lines of force and comparison with magnetic lines
4.5. Dielectric, dielectric strength and its importance permittivity and break down voltage
4.6 Capacitance and capacitors. Capacitance of parallel plate capacitor
4.7 Types and uses of capacitors
4.8 Equivalent capacitance for series, parallel and series parallel combination of capacitors
4.9 Energy stored in capacitors
4.10 Color code, tolerance and rating of capacitors
4.11 Troubles in capacitors

5. MAGNETISM AND ELECTROMAGNETISM (12 Hours)

5.1 Magnetism.
5.1.1 Introduction to magnetism, magnetic line of force, flux, flux-density, permeability, Reluctance and their units
5.1.2 Properties of magnetic lines of force
5.1.3 Types of magnets
5.1.4 Magnetic properties of materials (ferro-, para- and dia-magnetic) magnetic induction

5.2 Electromagnetism
5.2.1 Electromagnetism, M.M.F. (AT) field intensity (H =AT/L) ampere turns/meter.
5.2.2 B-H curve and magnetic Hysteresis
5.2.3 Electromagnetic induction
5.2.4 Magnetic field around a current carrying conductor and solenoids cork screw and left-hand rules
5.2.5 Force between two magnetic fields and motor action
5.2.6 Faraday's Law of Electromagnetic induction ($R=Nd\Phi/dt.$)
5.2.7 Lenz's Law

(PAPER-B)

6. AC FUNDAMENTALS (16 Hours)

6.1 The simple AC generator

6.1.1 Sine wave, cycle, wavelength, period, frequency and units
6.1.2 AC sine wave form and its characteristics (Instantaneous, peak, average, rms or effective values and their inter relation)
6.1.3 Audio and Radio frequencies, wavelengths and periods frequency spectrum
6.1.4 Types of alternating wave forms (sinusoidal and non-sinusoidal waves) Fundamental wave and harmonics

6.2 Ohm's Law in AC Circuits
6.2.1 AC through pure resistance, Phaser quantities
6.2.2 Phase angle, in-phase, out of phase waves and phase lag & lead and power factor
6.2.3 Calculation of V,I and W for resistive circuits through inductance
6.2.4 Self inductance, and self induced voltage
6.2.5 Inductive reactance ($X_L=2\pi fL$) Phase relation between V & I
6.2.6 Phaser diagram and power for pure inductor
6.2.7 AC through R-L series circuit
6.2.8 Phaser diagram and power in a R-L series circuit
6.2.9 Time constant ,τ =L/R, and its effect
6.2.10 Impedance, Impedance triangle
6.2.11 AC through RL parallel circuit
6.2.12 Inductive reactance in series, parallel and series-parallel combination
6.2.13 Q of coil and its effects on selectivity
6.2.14 Skin effect, AF and RF chokes
6.2.15 Troubles in chokes
6.2.16 AC through pure capacitor. Phase relation between V&I and power
6.2.17 capacitive reactance
6.2.18 AC through RC series circuit
6.2.19 Time constant RC and its effect
6.2.20 Impedance, Impedance triangle
6.2.21 AC through RC parallel circuit
6.2.22 Capacitive reactance in series, parallel, and series parallel combination
6.2.23 AC through RLC series circuit, phase relation and power calculation
6.2.24 AC through RLC parallel circuit phase relation and power calculation
6.2.25 Simple calculations for RLC circuits
6.2.26 Concepts of Real Power (VI CosΦ) and Apparent Power (VA), Power Factor with simple numerical calculations

7. TRANSFORMER (8 Hours)

7.1 Principle of transformer
7.1.1 Mutual inductance
7.1.2 Coefficient of mutual inductance
7.2 Turn ratio
7.3 e.m.f. equation
7.4 Construction, types of transformers, core materials
7.5 Application of transformers in electronics
7.6 Auto-transformers, principle, advantages, disadvantages and applications
7.7 Poly phase transformers, star and delta connection
7.8 Phase, Line Voltage, Current and their inter-relation
7.8 Transformer losses
7.8.1 Core loss
7.8.2 Hysteresis loss

8. RESONANCE (8 Hours)

8.1 Condition of resonance and resonant circuit
8.2 Relation between f, L and C at resonance

8.3 Series resonant circuit. Impedance of series resonant circuit
8.4 Current, voltage and impedance characteristic of series resonant circuit
8.5 Parallel resonant circuit and its impedance
8.6 Characteristics of impedance, current and voltage of a parallel resonant circuit
8.7 Series and parallel resonance curve comparison and Bandwidth
8.8 Q of circuit, Effect of Q on the slope and width of the resonance curves
8.9 Relation between the slope of the resonance curve on selectivity
8.10 Effect of the L.C. ratio on selectivity
8.11 Use of resonance circuit in communication system

9. FILTER & COUPLING CIRCUITS (9 Hours)

9.1 Purpose and action of a filter circuit
9.2 Principle of filter action
9.3 Types of filter circuit
9.3.1 Low Pass Filter (LPF)
9.3.2 High Pass Filter (HPF)
9.3.3 K filter
9.3.4 m drive filter
9.4 Band Pass filter (BPF) Band Stop filter (BSF)
9.5 Power supply filter.
9.6 Purpose and action of coupling circuit
9.7 Coefficient of coupling and coupled impedance
9.8 Type of coupling, RC, Impedance transformer coupling
9.9 Delay action circuits, RL and RC circuits
9.10 Time constant of RL & RC circuits and its importance in rise and fall of circuit current and voltage

REFERENCE BOOKS.

1. Bird J O — Electrical and Electronic Principles and Technology, Latest Edition
2. Bird J O — Electrical Circuit Theory and Technology, Latest Edition
3. Grob, Bernard, Basic Electronics, Latest Edition

Instructional Objectives

(PAPER-A)

1. BASIC PRINCIPLE OF ELECTRICITY

1.1 Understand electron theory.

1.1.1 Describe the structure of atom.

1.1.2 Describe the K, L, and M shells.

1.1.3 Describe energy level.

1.1.4 Describe valence electron.

1.1.5 Explain energy bands with reference to conductors, insulators & semiconductors.

1.2 Understand Electrical Quantities

1.2.1 Describe potential, current & resistance

1.2.2 Describe units of potential, current & resistance

1.2.3 Differentiate between conventional current and electron current.

2. DC FUNDAMENTALS

2.1 Understand Ohm's Law.

2.1.1 Define ohm's law

2.2.2 Solve problems on Ohm's law

2.2 Understand Laws of Resistance

2.2.1 Define specific resistance

2.2.2 Define conductor

2.2.3 Define conductivity

2.2.4 Explain the effect of temperature on resistance

2.2.5 Explain coefficient of resistance

2.2.6 Solve problems on $R = \rho \times L/A$ and $R_t = R_o (1+xt)$.

2.2.7 Describe the resistance in series

2.2.8 Describe the resistance in parallel

2.2.9 Describe the resistance in series-parallel

2.2.10 Calculate the combination of resistances and cells, R_t, I & V.

2.2.11 Define power and energy

2.2.12 Describe units of power and energy

2.2.13 Explain the power dissipation in resistors

2.3 Understand Kirchhoffs' Laws

2.3.1 Define Kirchhoff's laws

2.3.2 Solve problems using Kirchhoff voltage law

2.3.3 Solve problems using kirchhoff current law

2.4 Understand Resistors

2.4.1 Define resistance and resistor

2.4.2 List types of resistors

2.4.3 Enlist use of resistors

2.4.4 Describe resistor colour codes

2.4.5 Describe power rating of resistor

2.5 Understand Batteries

2.5.1 Name types of DC source

2.5.2 Describe types of cells (Mercury, Silver oxide, Nickel cadmium)

2.5.3 Describe lead acid battery

2.5.4 Discuss solar energy

2.5.4 Describe solar cells

2.5.5 Explain the internal resistance of cell

2.5.6 Use cells in series and parallel of voltage and constant source of current

3. NETWORK THEOREMS.

3.1 Understand Superposition, Thevenin & Norton theorems
- 3.1.1 Explain Superposition theorem
- 3.1.2 Solve numerical problems based on superposition theorem
- 3.1.3 Explain Thevenin's theorem
- 3.1.4 Solve numerical problems based on Thevenin's theorem
- 3.1.5 Explain Norton's theorem
- 3.1.6 Solve numerical problems based on Norton's theorem
- 3.1.7 Explain transformation of star to delta and delta to star networks
- 3.1.8 Solve numerical problems based on star, delta transformation
- 3.1.9 Explain Maximum Power Transmission theorem
- 3.1.10 Solve numerical problems based on Maximum Power Transmission theorem

4. ELECTROSTATICS.

4.1 Understanding Electrostatics
- 4.1.1 Describe principle of electrostatic charges
- 4.1.2 Explain the effect of negative & positive charges
- 4.1.3 Describe the laws of electrostatics
- 4.1.4 Describe electrostatic induction & field strength
- 4.1.5 Explain properties of electric lines of force
- 4.1.6 Compare between electric lines of force and magnetic lines of force
- 4.1.7 Describe dielectric & dielectric strength/dielectric constant
- 4.1.8 Describe the importance of dielectric & dielectric strength
- 4.1.9 Describe capacitor and capacitance
- 4.1.10 Describe breakdown voltage
- 4.1.11 Describe the capacitance of parallel plate capacitor
- 4.1.12 Describe types of capacitors
- 4.1.13 Describe the use of capacitors
- 4.1.14 Calculate the total capacitance in series in parallel and series-parallel combination
- 4.1.15 Explain the energy stored in capacitor
- 4.1.16 Describe the color coding, tolerance and voltage rating of capacitors
- 4.1.17 Describe the troubles in capacitors

5. MAGNETISM & ELECTROMAGNETISM

5.1 Understand magnetism
- 5.1.1 Describe lines of force, flux, flux density, permeability, reactance & their units
- 5.1.2 Explain properties of magnetic lines of force
- 5.1.3 Describe types of magnets
- 5.1.4 Explain magnetic properties of materials
- 5.1.5 Define and list ferromagnetic, paramagnetic and diamagnetic materials.
- 5.1.6 Describe magnetic induction.

5.2 To understand electromagnetism
- 5.2.1 Describe electromagnetism
- 5.2.2 Describe magneto-motive force
- 5.2.3 Describe field intensity (H=AT/L)
- 5.2.4 Draw B-H Curve
- 5.2.5 Explain B-H curve
- 5.2.6 Describe magnetic hystersis
- 5.2.7 Explain electromagnetic induction
- 5.2.8 Explain magnetic field around a current carrying conductor
- 5.2.9 Define inductor

5.2.10 Write formula for inductance base on physical parameters of an inductor [L= Ur x (N)*2 x A / L]
5.2.11 Solve problem using the above formula for inductor and Describe solenoids
5.2.13 Describe cork screw rule and left hand rule
5.2.14 Explain force between two magnetic fields and motor action
5.2.15 Define Faraday's law of electromagnetic induction ($e = Nd\Phi/dt$)
5.2.16 Define Lenz's Law

(PAPER-B)

6. AC FUNDAMENTALS.

6.1 Understand A.C Waveform

6.1.1 Describe sine wave (cycle, wave length, period, frequency and their units)
6.1.2 Draw AC sine waveform (sinusoidal, square, saw tooth)
6.1.3 Describe Instantaneous value, peak value, average value, r.m.s. value, effective value and their inter-relation
6.1.4 Describe Audio & Radio frequencies and their wavelengths
6.1.5 Draw the electromagnetic wave spectrum
6.1.6 Define harmonic and fundamental wave.

6.2 Understand AC circuits

6.2.1 Describe Ohm's Law in AC circuits
6.2.2 Describe AC through resistors
6.2.3 Describe phase angle, in phase & out of phase waves
6.2.4 Describe phase lag, lead & power factor
6.2.5 Calculate voltage, current & power(v,i,w) for resistive circuit
6.2.6 Describe AC through inductance using waveforms and phasor diagram
6.2.7 Define self inductance & self induced voltage
6.2.8 Explain inductive reactance ($X_L=2\pi fL$), phase relation between voltage & current
6.2.9 Draw its phaser diagram
6.2.10 Calculate power for pure inductor
6.2.11 Explain AC through RL series circuit
6.2.12 Draw phaser diagram for RL series circuit
6.2.13 Calculate power factor for RL series circuit
6.2.14 Calculate time constant for L/R
6.2.15 Define impedance
6.2.16 Draw impedance triangle
6.2.17 Explain AC through RL parallel circuit
6.2.18 Calculate inductive reactance for series, parallel and series-parallel inductor
6.2.19 Describe skin effect
6.2.20 Describe audio frequency chokes
6.2.21 Describe radio frequency chokes
6.2.22 Explain ac through pure capacitor
6.2.23 Explain phase relation between voltage, current & power for AC through capacitors
6.2.24 Calculate capacitive reactance ($\frac{1}{2} \pi f C$)
6.2.25 Explain AC through R-C series circuit
6.2.26 Explain time constant for R-C series circuit
6.2.27 Explain AC through R-C parallel circuit
6.2.28 Calculate capacitive reactance for capacitor in series, in parallel and series parallel combination
6.2.29 Explain AC through RLC series circuit
6.2.30 Explain phase relation

6.2.31 Calculate power for RLC series circuit
6.2.32 Explain real power (VI Cos Φ), apparent power (VI)
6.2.33 Calculate power factor

7. TRANSFORMER.

7.1 Understand the transformers
7.1.1 Explain the principle of transformer
7.1.2 Define mutual induction
7.1.3 Define coefficient of mutual induction
7.1.4 Describe turn ratio of transformer
7.1.5 Describe construction of transformer
7.1.6 Enlist the types of transformer
7.1.7 Enlist core material of transformer
7.1.8 Describe auto transformer
7.1.9 Explain star, delta connections of three phase transformer
7.1.10 Explain phase & line voltage for star and delta connection
7.1.11 Explain phase & line current for star and delta connection of three phase system
7.1.12 List the applications of transformer in electronics:
i) step down transformer,
ii) impedance matching
iii) coupling
7.1.13 Explain transformer losses.
7.1.14 Explain hysteresis loss and core loss.

8. UNDERSTAND RESONANCE

8.1 Explain resonance
8.2 Explain the relation between frequency, inductance & capacitance at resonant
8.3 Draw the series resonant circuit
8.4 Explain series resonant circuit
8.5 Draw the characteristics of series resonant circuit
8.6 Calculate current, voltage and impedance of series resonant circuit
8.7 Draw the diagram of parallel resonant circuit
8.8 Explain the parallel resonant circuit
8.9 Draw the characteristics of parallel resonant circuit
8.10 Compare series and parallel resonant circuit
8.11 Describe the band width of a resonant circuit
8.12 Describe Q of a circuit
8.13 Explain the effect of the L.C ratio on selectivity
8.14 Enlist the use of resonant circuit in in communication system

9. UNDERSTAND FILTERS & COUPLING CIRCUITS

9.1 Explain purpose & action of a filter circuit
9.2 Enlist the types of filter circuits
9.3 Explain low pass filter circuit
9.4 Explain high pass filter circuit
9.5 Explain K-filter & m-derived filters
9.6 Explain band pass filter & band stop filter
9.7 Explain action & purpose of a coupling circuit
9.8 Define coefficient of coupling
9.9 Enlist types of coupling
9.10 Explain RC, impedance, and transformer coupling
9.11 Define time constant of RL & RC Circuits
9.12 Explain importance of rise and fall of circuit current and voltage in reactive circuit.

LIST OF PRACTICAL 96 Hours

1. Study of Ammeter, Voltmeter and Multimeter.
2. a) Measurement of current, voltage and resistance.
   b) Verification of Ohm's Law by:
      Keeping the voltage constant.
      Keeping the resistance constant.
3. a) Verify the laws of series and parallel combination of resistances by
      i) Ohmmeter method.
      ii) Voltmeter-Ammeter method.
4. Study of Oscilloscope
5. Verify Kirchhoffs' laws.
6. a) Measurement of power by:
      i) Voltmeter/Ammeter method.
      ii) Wattmeter.
   b) Measurement of Energy by:
      i) Wattmeter and clock method.
      ii) Energy meter.
7. a) Practice of resistor colour coding.
   b) Use of potentiometer and Rheostat as voltage divider and current limiter.
8. Combine cells in series and parallel and verify the net voltage.
9. a) Study of lead acid battery, practice and use of hydrometer and electrolyte preparation.
   b) Practice charging of a lead acid battery.
10. a) Determine the internal resistance of a cell.
    b) Study of E.M.F. of cell and measurement of their voltages.
11. Plot magnetic line of forces of bar magnets in different positions.
12. Study of the magnetic effect of a current carrying:
    i) Conductor.
    ii) coil.
13. Study the change in the Magnetic power of an Electromagnet by the introduction of various cores in the coil.
14. Study of the effect on a current carrying conductor when placed in a magnetic field.
15. Verify Faraday's Laws of Electromagnetic induction.
16. Differentiate various types of capacitors and perform their colour coding
17. Verify laws of combination of capacitors
18. Observe capacitor charging and discharging
19. Study of function generator
20. Study of sine wave on an oscilloscope and determine its peak, peak to peak, r.m.s. and average values of current and voltage.
21. Determine of wave length, time period and frequency of a given AC signal by oscilloscope.
22. Determine the power factor of a given AC circuit using a power factor meter.
23. Study the principles of self and mutual induction in coils.
24. a) Determine the inductance of a choke coil by using digital LCR meter
    b) Determine the capacitance of a capacitor by using digital LCR meter
25. Determine phase relationship between voltage and current in inductive circuit by showing phase difference between VR and VL using an oscilloscope.
26. Study the behavior of inductance and capacitance with AC and DC supplies.

27. a) Determine active and reactive power in an AC circuit.
    b) Calculate power factor for the above circuit.
28. a) Study of the frequency response of R.L.C. series circuit and resonance effect.
    b) Study of the frequency response of R.L.C. parallel circuit and resonance effect.
29. a) Study of various type of transformers used in electronics field.
    b) Study of single-phase transformer and determine its transformation ratio.
30. Practice of core assembly and winding of the core type transformers.
31. a) Study of various type of incandescent and vapour lamps.
    b) Connect a fluorescent tube light.
32. Verify the line and phase values of current and voltage in star and delta connections.

ELTR-133-Electronics Devices

Total Contact Hours

		T	P	C
Theory	64			
Practical	96	2	3	3

Learning Outcomes:

After this course the student will be able to:

- Understand the basic principles of semiconductor materials, including their atomic structure, energy bands, and the behaviour of charge carriers (electrons and holes)
- Explain the formation and characteristics of PN junctions, including concepts like depletion region, forward and reverse bias, and breakdown voltage
- Describe the operation and applications of various types of diodes, such as rectifiers, Zener diodes, and light-emitting diodes (LEDs)
- Explain the operation and characteristics of bipolar junction transistors (BJTs) and field-effect transistors (FETs), including their different configurations and applications

Course Contents:

1. DIODES AND APPLICATIONS **12 Hours**

- 1.1 Brief History of Vacuum Tubes
- 1.2 Semi-Conductors
  - 1.2.1 Semi -Conductors doping
  - 1.2.2 Intrinsic & extrinsic semi-conductor
- 1.3 Biasing the PN junction
  - 1.3.1 Depletion region, Junction barrier potential
  - 1.3.2 Forward and reverse bias
- 1.4 Rectifier Diode
  - 1.4.1 Half wave and full wave (Bridge) rectifier
  - 1.4.2 Ripple factor, surge current
  - 1.4.3 Rectifier filter: L, PI and T filters
- 1.5 Diode Multiplier
  - 1.5.1 Voltage multiplier circuits (Doubler, Tripler, Quadrupler)
- 1.6 Diode Data Sheet
- 1.7 Diode as a switch
- 1.8 Diode Clipper
- 1.9 Diode Clamper

2. BIPOLAR JUNCTION TRANSISTORS **12 Hours**

- 2.1 Transistor types and BJT construction
- 2.2 Basic Transistor operation, Forward, Reverse Bias. Transistor current
- 2.3 Transistor Parameters and Ratings
- 2.4 Transistor as a voltage amplifier
- 2.5 Transistor amplifier configuration, comparison and uses
- 2.6 Transistor, modes of operation
- 2.7 Transistor as a switch
- 2.8 Transistor Clipper

2.9 Transistor Chopper

3. FIELD EFFECT TRANSISTOR 10 Hours

3.1 Field Effect Transistor and its Biasing:
- 3.1.1 Junction Field Effect Transistor (JFET)
- 3.1.2 JFET Characteristics and parameter
- 3.1.3 JFET Biasing
- 3.1.4 Metal oxide Semiconductor FET (MOSFET) types
- 3 1.5 MOSFET Biasing.

3.2 Introduction of Chopper Amplifier
- 3.2.1 FET Chopper
- 3.2.2 Comparison of BJT and FET Chopper

4. SPECIAL DIODES 15 Hours

4.1 Zener Diodes.
- 4.1.1 Zener Diode as voltage Regulator
- 4.1.2 Zener limiting

4.2 Optical Diodes
- 4.2.1 Light Emitting Diode (LED)
- 4.2.2 Organic Light Emitting Diode(OLED)
- 4.2.3 Photo diode.

4.3 Varactor Diodes.
- 4.3.1 Varactor in Tuning Circuits.

4.4 Other Diodes.
- 4.4.1 Schottky diode, construction, characteristics, uses
- 4.4.2 Tunnel Diode, Negative resistance region.
- 4.4.3 Tunnel Diode Oscillator.
- 4.4.4 PIN Diode.
- 4.4.5 Step Recovery Diode.
- 4.4.6 LASER Diode

4.5 Introduction of SMD Components (Diode, Transistor, Capacitors, Inductor, IC, Resistor. etc.)

5. THYRISTOR & SPECIAL DEVICES 15 Hours

5.1 The shockley diode.
5.2 Silicon Controlled Rectifier (SCR)
5.3 Light Activated SCR (LASCR)
5.4 Photo transistor
5.5 Opto-coupler.
5.6 SCR Applications.
5.7 Silicon Controlled Switch (SCS)
5.8 Diac and Triac
5.9 Unijunction Transistor (UJT)

REFERENCE BOOKS:

1. TL Floyd “Electronics Devices” 8th ed. Prentice Hall
2. “Electronics Devices” by Boylsted latest edition

Instructional Objectives

1. SEMICONDUCTOR DIODES.

1.1 Understand electronic emission and brief history of vacuum tubes

1.2 Understand characteristics and types of semiconductor materials

- 1.2.1 Explain semiconductor doping
- 1.2.2 List donor and acceptor materials for silicon & germanium
- 1.2.3 Define majority carries and minority charge carriers.
- 1.2.4 Explain the effect of temperature & light on the resistance of
  - (a) Intrinsic semiconductor
  - (b) Extrinsic semiconductor

1.2 PN Junction Theory

- 1.2.1 Draw a PN Junction
- 1.2.2 Define the terms depletion layer capacitance & diffusion capacitance
- 1.2.3 Sketch the voltage-current characteristics curve for a PN junction
- 1.2.4 Describe R_F, RR and I_s from the diode characteristics curve
- 1.2.5 List the typical values of barrier potentials for silicon and germanium diode

1.3 Understand PN Junction Diode Applications

- 1.3.1 List the uses of PN diode
- 1.3.2 Explain half and full wave rectifier using circuit diagram
- 1.3.3 Define Ripple factor, surge current
- 1.3.4 Explain function of rectifier (L, PI, and T) filters
- 1.3.5 Explain its uses as voltage multiplier (doubler)
- 1.3.6 Explain the working of a voltage doubler circuit
- 1.3.7 List the applications of voltage multiplier circuit
- 1.3.8 Explain the operation of a diode as a switch.
- 1.3.9 Describe the operation of Diode Clipper
- 1.3.10 Describe the operation of Diode Clamper

2. BIPOLAR JUNCTION TRANSISTORS (BJTs)

2.1 Understand bipolar junction, its biasing and basic BJT circuits

- 2.1.1 Draw and label physical structure and symbols for NPN and PNP transistors
- 2.1.2 Show the four operation mode of BJT and application of each mode (cut off active, active and inverse)
- 2.1.3 Compute the values of IE, and Beta (dc) for given value of I_B and I_C
- 2.1.4 Explain the working of basic BJT voltage amplifier w.r.t. bias of junctions, flow of charge carriers and transistor currents
- 2.1.5 Define cut off and breakdown voltages of transistor
- 2.1.6 List four maximum ratings specified by manufacturer's parameters of transistors
- 2.1.7 Drive the expression for I_C versus IB for CE Configuration in the active region
- 2.1.8 Sketch the input and output static characteristics curves for common base (CB) amplifier
- 2.1.9 Repeat 3.1.8 for CE amplifier
- 2.1.10 Repeat 3.1.8 for CC amplifier
- 2.1.11 List the types of transistor structures
- 2.1.12 Draw and label the structure of epitaxial transistor

2.1.14 Enlist the advantages of I.C. over conventional circuit
2.1.15 List the three broad categories of BJTs with package types used for each
2.1.16 Identify the high frequency limitations of BJT

2.2 Discuss the operation of Transistor as a switch

2.3 Discuss the operation of Transistor Clipper

2.4 Discuss the operation of Transistor Chopper

3. FIELD EFFECT TRANSISTOR

3.1 Understand Field Effect Transistors

3.1.1 Explain the principle of the n-channel JFET using illustrations
3.1.2 Sketch the construction of n-channel JFET & its symbol
3.1.3 Sketch & label a family of drain characteristics of an n-channel JFET
3.1.4 Define the terms I Dss and Vp.
3.1.5 Explain the effect of change in VGS the JFET characteristics
3.1.6 Explain above from 4.4.1 through 4.4.3 for p-channel JFET
3.1.7 Define the major data-sheet parameter of a JFET
3.1.8 Explain the principle of n-channel enhancement MOSFET
3.1.9 Sketch & label the family of drain characteristics of n-channel enhancement MOSFET
3.1.10 Repeat 4.4.9 for n-channel depletion-enhancement MOSFET
3.1.11 Sketch symbols for p & n-channel JFET, n-channel enhancement MOSFET, p- and n- channel depletion- enhancement MOSFET
3.1.12 List three advantages of n-channel over p-channel MOSFET
3.1.13 Sketch the cross- section of V-MOSFET
3.1.14 Explain the working of V-MOSFET
3.1.15 Compare the V-MOSFET with other FETs
3.1.16 List the applications of MOSFET
3.1.17 Sketch the cross section of complementary MOSFET (CMOS)
3.1.18 List the applications of CMOS

3.5 Understand FET Biasing

3.5.1 Explain to FET biasing
3.5.2 Draw DC load line and locate bias point on the family of drain characteristic curves of JFET
3.5.3 Draw a self-bias arrangement p-channel & n-channel JFET
3.5.4 Set the Q-point for a self-biased JFET
3.5.5 Explain the Q-point stability of a JFET
3.5.6 Show zero bias of D-MOSFET

3.6 Understand Basic FET Circuits

3.6.1 List the three of configuration of FET amplifier
3.6.2 Sketch & label the circuit for CS-JFET amplifier
3.6.3 Write down expressions for Av and Zi and Zo for CS, CD, CG, JFET amplifier
3.6.4 Draw MOSFET amplifier configuration
3.6.5 Define (i) transconductance, gm (ii) drain resistance,rd and (iii) amplification factor of an FET

3.7 Understand chopper amplifier

3.7.1 Explain the principle of chopper amplifier
3.7.2 Draw the block diagram of a chopper amplifier
3.7.3 Explain the function of each block of chopper amplifier
3.7.4 Explain the operation of FET chopper amplifier

4. SPECIAL DIODES

4.1 Understand the characteristics and applications of diode used for a special purposes Zener Diode

- 4.1.1 Explain the construction of Zener and draw its symbol
- 4.1.2 Draw the V-I characteristic of a Zener diode
- 4.1.3 Identify the characteristic features of Zener diode
- 4.1.4 Explain the working of Zener diode as voltage regulator
- 4.1.5 Define the terms line regulation, and load regulation for Zener diode
- 4.1.6 Compare formulae to find the range of series resistor (R_s) and load resistor (R_L) for a Zener regulator for given variations in line voltage and current
- 4.1.7 List the applications of Zener diode

4.2 Understand the characteristics of Optical Diodes (LED, OLED and Photodiode)

- 4.2.1 Define the term optical devices
- 4.2.2 List the name of opto electronic devices
- 4.2.3 Explain the electroluminescence process in LED
- 4.2.4 List the materials with color of emission used for LED
- 4.2.5 Explain the effect of bias on the operation of normal and color emissive LED
- 4.2.6 List the applications of LEDs
- 4.2.7 Describe the term Organic LED
- 4.2.8 Explain the working principle OLED
- 4.2.9 Compare OLED with LED
- 4.2.10 List the applications of OLED
- 4.2.11 Explain the operation of a photo diode
- 4.2.12 List the materials used for photodiode with their colour sensitivity and characteristics
- 4.2.13 List the applications of photodiodes
- 4.2.14 Draw a circuit of photoelectric relay using a photodiode

5. THYRISTORS & SPECIAL DEVICES.

5.1 Understand thyristors, UJT with their applications

- 5.1.1 Explain the term thyristor
- 5.1.2 Name the important thyristor family devices
- 5.1.3 Sketch the construction of Shockley diode
- 5.1.4 Draw and label the forward v-i characteristics for a Shockley diode
- 5.1.5 List the methods to turn off and turn on Shockley diode
- 5.1.6 Explain the working of a shockley diode relaxation oscillator
- 5.1.7 Compare an SCR with a shockley diode
- 5.1.8 Draw and label the schematic symbol for an SCR
- 5.1.9 Explain the turn-on process of SCR using transistor equivalent circuit
- 5.1.10 Sketch and label the V-I characteristics for an SCR
- 5.1.11 Interpret the SCR data sheet parameters
- 5.1.12 Explain the phase-control of an SCR
- 5.1.13 Draw basic circuits for SCR used in the areas of
  - a) Power control
  - b) Switching and
  - c) Protection
- 5.1.14 Explain briefly the circuits drawn under 6.1.13
- 5.1.15 Compare a Diac with a shockley diode in terms of
  - a) Basic structure
  - b) Symbol

c) Operation

5.1.16 Compare a triac with an SCR in terms of
   a) Basic structure
   b) Symbol operation

5.1.17 Sketch and label the transistor equivalent circuit for a triac

5.1.18 Explain the phase-shift control of triac with a diac as a switching device as used in light for UJT

5.2 Understand Unijunction Transistor characteristics

5.2.1 Sketch the structure of a unijunction transistor (UJT)

5.2.2 Sketch the equivalent circuit and symbol for UJT

5.2.3 Explain the working of UJT circuit of 6.2.2

5.2.4 Draw the V-I characteristic curve for UJT

5.2.5 Draw a circuit for UJT relaxation oscillator

5.2.6 List the three factors controlling the period of oscillation frequency of a relaxation oscillator

5.2.7 Sketch a UJT time delay circuit

5.3 Understand properties of Photo-sensitive BJT&LASCR

5.3.1 Compare a photo-transistor with a conventional BJT

5.3.2 List the factors controlling collector current of a photo transistor

5.3.3 Draw the circuit for forward and reverse acting light operated relay using a phototransistor

5.3.4 Sketch the circuit of a photo Darlington pair

5.3.5 List the requirements to turn-on and turn-off of light activated SCR (LASCR)

5.3.6 List the types of input devices normally used in a opt coupler

5.3.7 List five types of output devices used in opto-coupler

5.3.8 List the applications of opto-coupler

LIST OF PRACTICAL 96 Hours

1. Identify the various diodes, transistors & IC package, number system and terminals
2. Draw the forward & reverse characteristics of a P.N. junction diode
3. Assemble a half wave diode rectifier circuit and observe its input and output waveforms
4. Assemble a full wave diode rectifier circuit with center tab transformer and observe its input and output waveforms.
5. Assemble a full wave bridge rectifier circuit and observe its input and output waveforms
6. Demonstrate the working of diode as a switch with LED as a load
7. Assemble L type filter circuit and calculate its ripple factor
8. Assemble π and T type filter circuits and calculate their ripple factors
9. Troubleshoot a faulty diode rectifier circuit
10. Assemble a voltage doubler circuit observe its input and output
11. Assemble a voltage tripler circuit observe its input and output
12. Assemble a voltage quadrupler circuit observe its input and output
13. Consult data sheet for a transistor to study its parameters and ratings
14. Plot the input & output characteristics of a transistor in common base configuration
15. Plot the input & output characteristics of a transistor in common emitter configuration
16. Plot the input and output characteristics of transistor in common collector configuration
17. Assemble a BJT Switch circuit and check it's in put and output
18. Plot the transfer characteristics curve of transistor in CE configuration
19. Assemble a transistor voltage amplifier and find its voltage gain
20. Demonstrate the characteristics of CB, CE & CC amplifier using curve tracer
21. Consult data sheet for a FET to study its parameters and ratings
22. Plot a characteristics curve for a common source FET amplifier
23. Demonstrate MOSFET as a switch and study its performance
24. Draw the forward and reveres characteristics of a Zener diode
25. Use a Zener diode as voltage regulator with diode rectifier
26. Assemble a Zener diode Limiter circuit and observe it's in put and output waveforms
27. Assemble a double Zener diode limiter circuit and observe it's in put and output waveforms
28. Assemble a seven-segment display with the help of LEDs
29. Assemble a circuit of photoelectric relay using a photodiode
30. Plot the characteristics curves for SCR and UJT
31. Assemble a UJT relaxation oscillator and observe its waveform
32. Assemble a light dimmer with the help of Diac and Triac

ELTR-142 BASIC ENGINEERING DRAWING & CAD

Total Contact Hours

		T	P	C
Theory	32			
Practical	96	1	3	2

Learning Outcomes:

After this course the student will be able to:

- Master fundamental drafting skills, including line work, dimensioning, and geometric constructions.
- Create accurate 2D and 3D drawings using both manual drafting techniques and AutoCAD software.
- Apply technical drawing principles to effectively solve engineering design problems and communicate design information through professional-quality technical drawings.

Course contents:

1. Introduction of Technical Drawing **2 Hours**

1.1. Need and significance of Technical Drawings
1.2. Bill of material and Bill of Quantity
1.3. Types of Drawings
1.4. Symbol of devices and components

2. Drafting Equipment, Types of Lines and Lettering **3 Hours**

2.1. List of drawing equipment
2.2. Basic lines and Types of line
2.3. Lettering

3. Basic Dimensioning **2 Hours**

3.1. Elements of dimensioning
3.2. System of measurements
3.3. Tolerance
3.4. Note & specification.

4. Drafting Geometry, Sketching, And Engineering Curves **3 Hours**

4.1. Introduction to geometry, plane, and solid type
4.2. Different conventional shapes, surfaces, and objects
4.3. Introduction to sketching techniques.
4.4. Introduction to the curve
4.5. Cone and conic section
4.6. Spiral and Involutes
4.7. Cycloid, Epicycloids, Hypocycloid

5. Introduction to Multi-View Drawings **3 Hours**

5.1. Introduction to the plane and its types
5.2. Projection of point, lines, plane, and solids

5.3. Definition and concept of multi-view drawings
5.4. Perceptual views of plan of projections
5.5. Orthographic projections
5.6. 1st angle and 3rd angle projection
5.7. Isometric sketching
5.8. Principal views and its arrangements
5.9. multi-view drawings and missing line

6. Introduction to AutoCAD **2 Hours**

6.1. Introduction to Auto CAD
6.2. User Interface
6.3. Templates
6.4. Layers and Objects

7. Drawing Aids and Coordinate System **2 Hours**

7.1. Object snap and ortho
7.2. Dynamic input setting
7.3. Units and user Coordinate system
7.4. Methods of drawing lines
7.5. Introduction, Creation and working in layers.

8. Dimensions, Symbols and Drawing Layout **2 Hours**

8.1. Creating Dimension
8.2. Creating Symbols and annotations.
8.3. Creating Layout
8.4. Creating Drawing Frame
8.5. Creating Contents and Template

9. Sketching of different objects in 2D **2 Hours**

9.1. Creating 2D sketch.
9.2. Modify 2D Sketch.

10. 3D Design and Solid Modeling **5 Hours**

10.1. Conversion of 2D into 3D
10.2. Extrude command.
10.3. Revolve command.
10.4. Sweep command.
10.5. Loft command.
10.6. Conversion of 3D into 2D

11. 3D Surface Modeling **4 Hours**

11.1. Plane surface, ruled surface
11.2. Extrude surface, revolved surface
11.3. Sweep surface, Loft surface
11.4. Surface trim and extend
11.5. Part surface
11.6. Ballooning surface

12. Bills of material, Parts List, Final checks **2 Hours**

12.1. Bill of materials and bill of quantities
12.2. Parts List and Surfaces
12.3. Review and final checks of drawings

REFERENCE BOOKS:

1. First year Engineering Drawing, by A. C. Parkinson, Latest Edition.
2. Engineering Drawing and Graphic Technology, by T. E. French, C. J. Vierck, R. J. Foster, McGraw Hill.
3. CAD Packages by T.F. French.

Instructional objectives:

1. Introduction to Technical Drawing

1.1 Explain the need and significance of technical drawing in various industries.
1.2 Describe how accurate technical drawings contribute to efficient communication and problem-solving.
1.3 Describe the need of defining Bill of Materials and Bill of Quantity
1.4 Differentiate between BOM and BOQ.
1.5 Differentiate between different types of technical drawings, such as orthographic, isometric, and perspective drawings.
1.6 Recognize real-world applications of technical drawing in fields like engineering, architecture, manufacturing, and more.
1.7 Explain how different technical drawings are used to communicate design intent, manufacturing and assembly instructions, and specifications.
1.8 Recognize and explain common symbols used to represent devices and components in technical drawings.
1.9 Interpret technical drawings with various symbols and annotations.
1.10 Create a reference sheet that lists and explains commonly used symbols in technical drawings.

2. Drafting Equipment, Types of Lines, and Lettering

2.1. Explain the purpose of each drafting tool and its contribution to creating accurate drawings.
2.2. Define the concept of basic lines in technical drawings.
2.3. Differentiate between various types of basic lines, such as straight, curved, and freehand lines.
2.4. Demonstrate the ability to draw neat and precise basic lines.
2.5. Classify different types of lines used in technical drawings, including object lines, hidden lines, centerlines, and more.
2.6. Apply appropriate pencil techniques to create consistent and accurate lines, such as light lines, dark lines, and hatching.
2.7. Apply the knowledge of different types of lines to create accurate technical drawings.
2.8. Use appropriate line types to represent different features of objects, such as visible, hidden, and dimension lines.
2.9. Demonstrate the ability to create consistent and legible lettering using appropriate techniques.
2.10. Create and use guidelines effectively to maintain proper alignment, spacing, and proportions in drawings.

3. Basic Dimensioning

3.1. Define dimensioning and its importance in technical drawings.
3.2. Differentiate between linear, angular, and radial dimensions.
3.3. Explain the purpose of dimension lines, extension lines, and arrowheads in dimensioning.
3.4. Identify and describe the elements of dimensioning, including dimension lines, extension lines, arrowheads, and leaders.

3.5. Apply proper placement and alignment of dimensions on technical drawings.
3.6. Define tolerance and its significance in engineering design.
3.7. Explain the concepts of upper and lower limits, and nominal dimensions.
3.8. Interpret tolerance notations on technical drawings.
3.9. Write and interpret notes related to material, finish, and other special instructions.

4. Drafting Geometry, Sketching, and Engineering Curves

4.1. Differentiate between plane and solid geometry.
4.2. Identify different conventional shapes and objects used in technical drawings.
4.3. Understand the basics of sketching techniques used in technical drawings.
4.4. Create accurate and neat sketches of simple geometric shapes.
4.5. Define engineering curves and their applications in technical drawings.
4.6. Identify different types of curves, including conic sections, spirals, involutes, and more.

5. Introduction to Multi-View Drawings

5.1. Understand the concept of planes and their significance in projection.
5.2. Differentiate between different types of planes, such as principal planes and auxiliary planes.
5.3. Understand the concept of multi-view drawings and their purpose in communicating object details.
5.4. Identify and create principal views, including front, top, and side views.
5.5. Differentiate between 1st angle and 3rd angle projection methods.
5.6. Create isometric sketches to represent objects in three dimensions.
5.7. Identify and arrange principal views to communicate object features effectively.
5.8. Understand the concept of missing lines in multi-view drawings.

6. Introduction to AutoCAD (Latest version of AutoCAD)

6.1. Navigate and understand the key components of the AutoCAD Mechanical user interface.
6.2. Identify various tools, panels, and menus in the software interface.
6.3. Describe the concept of templates in AutoCAD and their role in consistent drawing creation.
6.4. Create, modify, and utilize templates for efficient workflow.
6.5. Define layers and their importance in organizing drawing elements.
6.6. Explain object properties and their control through layers.
6.7. Identify and explain the benefits of using AutoCAD Mechanical in mechanical engineering tasks.

7. Drawing Aids and Coordinate System

7.1. Define object snap and ortho functions and their role in accurate drawing creation.
7.2. Apply object snap and ortho settings effectively for precise alignment and drawing.
7.3. Explain dynamic input and its benefits in enhancing drafting efficiency.
7.4. Utilize dynamic input settings for real-time input and feedback during drawing.
7.5. Define units and their importance in maintaining consistency and scale in drawings.
7.6. Set up and manipulate the user coordinate system (UCS) for convenient drawing alignment.
7.7. Demonstrate various methods of drawing lines, including specifying endpoints, angles, and lengths.

7.8. Apply different line-drawing techniques to create accurate and complex shapes.
7.9. Understand the concept of layers and their organization within a drawing.
7.10. Create, manage, and manipulate layers effectively for clear and organized drawings.

8. Dimensions, Symbols, and Drawing Layout

8.1. Explain the role of dimensions in communicating object size and relationships.
8.2. Create different types of dimensions, including linear, angular, and radial dimensions.
8.3. Define symbols and annotations and their significance in conveying additional information.
8.4. Create symbols and annotations using appropriate tools and techniques.
8.5. Understand the concept of layouts in AutoCAD and their role in presenting drawings.
8.6. Create and manage layouts for various views and presentations.
8.7. Understand the importance of creating content blocks and templates for efficient drawing creation.
8.8. Develop content blocks and templates for reuse in different drawings.

9. Sketching of Different Objects in 2D

9.1. Define the process of creating 2D sketches in AutoCAD.
9.2. Create accurate and detailed 2D sketches of various objects using appropriate tools.
9.3. Demonstrate the ability to modify and edit 2D sketches to refine shapes and dimensions.
9.4. Utilize various editing tools for manipulation and adjustments.

10. 3D Design and Solid Modeling

10.1. Explain the concept of converting 2D sketches into 3D models.
10.2. Utilize appropriate tools to extrude and generate 3D solids from 2D sketches.
10.3. Define the extrude command and its role in creating 3D objects.
10.4. Apply the extrude command to generate simple 3D forms.
10.5. Explain the revolve command and its use in generating 3D shapes through rotation.
10.6. Create 3D objects using the revolve command with various profiles.
10.7. Define the sweep command and its purpose in creating complex 3D shapes.
10.8. Apply the sweep command to generate objects along specified paths.
10.9. Understand the loft command and its role in creating smooth transitions between 3D profiles.
10.10. Create 3D objects using the loft command with multiple profiles.
10.11. Explain the process of converting 3D models back into 2D drawings.
10.12. Generate 2D orthographic projections and sections from 3D models.

11. 3D Surface Modeling

11.1. Explain the concept of Plane surface,
11.2. Explain the concept of ruled surface
11.3. Explain the concept of extrude surface
11.4. Explain the concept of revolved surface
11.5. Explain the concept of Sweep surface
11.6. Explain the concept of Loft surface

11.7. Explain the concept of Surface trim
11.8. Explain the concept of extend
11.9. Explain the concept of Ballooning surface

12. Bills of material, Parts List, Final checks

12.1. Explain the concept of Bill of material
12.2. Explain the concept of Part surface
12.3. Perform review and final checks of drawings

LIST OF PRACTICAL: 96 Hours

(Note: Tentatively, for 3 Months the Lab./Practical may be conducted in Drawing Hall, while remaining session may be used for AutoCAD Lab.)

Manual Drawing 39 Hours

1. Read out and interpretation of technical, assembly, and flow drawings
2. Taking quantities from technical drawings
3. Identification and application of basic drawing tools
4. Practice of single-stroke capital vertical and inclined lettering
5. Construction of angles, triangles, quadrilaterals, and circle elements
6. Construction of inscribed and circumscribed figures (square, triangle, and hexagon)
7. Construction of pentagon, hexagon, and octagon by various methods
8. Construction of tangents to circles (inside and outside)
9. Construction of ellipse, parabola, and hyperbola curves
10. Construction of involutes, cycloids, epicycloids, and hypocycloids
11. Orthographic projection in 1st and 3rd angles
12. Orthographic projection and isometric drawing
13. Development of prism, cylinder, cone, and pyramid

AutoCAD Drawing 57 Hours

14. Installation and activation of AutoCAD
15. Introduction to Title Bar, Toolbar, Menu Bar, Browser, Status Bar, and Command Line
16. Practice with Zoom, Pan, Orbit, Object Snap, Grid, and Orthogonal tools
17. Layer and object property management
18. Construction and centre lines
19. Units, Coordinate System, and Save commands
20. Line, polyline, circle, arc, and ellipse commands
21. Rectangular and polygon commands
22. Dimensioning and hatching
23. Text commands, copy, mirror, offset, move, rotate, and scale
24. Trim, extend, join, and break commands
25. Fillet, chamfer, and explode commands
26. Basic 2D drawings
27. Mechanical drawing exercises
28. Extrude, revolve, sweep, and loft commands
29. Plane surface and ruled surface commands
30. Extrude surface, revolve surface, sweep surface, loft surface, surface trim, and extend
31. Practice of basic 3D drawings
32. Comprehensive project integrating 2D and 3D drawing skills

ELTR-151 Electric Wiring

Total Contact Hours

Theory	0	T	P	C
Practical	96	0	3	1

Learning Objectives:

After this course the student will be able to:

- Select appropriate wire gauge for different applications.
- Properly strip and connect electrical wires using various methods.
- Install electrical boxes, switches, outlets, and fixtures according to code.
- Install and terminate different types of cables.
- Use electrical testing tools like voltage testers, ohmmeters, and circuit breakers.
- Design basic residential electrical systems.

LIST OF PRACTICAL:

1. Study of wiring tools, accessories and cables (types and sizes)
2. Handling of Wire
3. Handing of Cable
4. Introduction to International standards
5. Making straight, Tee, Duplex joints, Married joint, Rat – trail joint, and Britannia joint

Single Phase Wiring.

a) Single lamp circuit controlled by SPST switch
b) Single lamp controlled by two ways (SPDT) switches
c) Single lamp with 5A socket each controlled by individual SPST switches
d) Wiring bell circuit controlled by single and three push buttons
e) Fluorescent Lamps Circuit
f) Installation of Test Board

Three Phase Industrial Wiring.

Making of Single-Phase Motor Connection Reversing by Drum Switch
Making of 3 Phase Motor Connection by Drum Switch ON / OFF with Indicator
Making of 3-Phase Motor Connection Reversing by Drum Switch with indicator
Making of 3 Phase Motor Connection ON / OFF by Contactor
Making of 3 – Phase Connection Reversing by Contactor
Making of 3 Phase Motor Connection Star Delta by Drum Switch
Making of 3 Phase Motor Connection Star Delta by Contactor
Making of 3 Phase Motor Connection Star Delta Auto by Contactor
Making of 3 Phase Motor Connection Star Delta Reversing by Contactor
Making of 3 phase motor connection 2 speed by contactor

اسلامیات/مطالعہ پاکستان

نصاب سال دوئم

حصہ اول اسلامیات

حصہ دوئم مطالعہ پاکستان

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کل وقت 20 گھنٹے:

موضوعات:

1۔ سورۃ المومنون ایک تا گیارہ آیات کا ترجمہ مع تشریح

2۔ دس منتخب احادیث مع ترجمہ وتشریح

() خیر کم من تعلم القرآن و علمه

() لا ایمان لمن لا امانته له ولا دین لا من لا اعهد له

() و یاکم والظن ان الظن اکرب الحدیث

() من احدث فی امرنا هذا ما لیس منه فهورد

() من حمل علینا السلاح فلیس منا

() انا و کافل الیتیم فی الجنه

() لا ضرور ولا ضرار فی السلام

() کلکم راع و کلکم راع و کلکم مسول عن رعیته

3۔ سیرۃ طیبہ

() مکی زندگی۔ولادت۔بعثت۔ہجرت

() مدنی زندگی۔مواخات۔میثاق مدینہ۔فتح مکہ(اسباب ونتائج)

4۔ حضورﷺ بحیثیت

() خطبہ حجۃ الوداع۔انسانی حقوق کا اعلامیہ/حقوق انسانی پالیسی 2018

() معلم کامل۔سربراہ خاندان

5۔ اسلامی معاشرہ

نظام تعلیم اوراس کے مقاصد۔عدل وانصاف۔امر بالمعروف۔نہی عن المنکر۔انسانی حقوق کا معاشرتی اور معاشی ترقی میں کردار

جہاد۔کسب حلال۔مسجد(اہمیت وفضیلت)

6۔ اسلامی ریاست کی تعریف۔اسلامی ریاست کی خصوصیات۔اسلامی حکومت کے فرائض۔اسلامی طرز حکومت۔

اسلامیات

تدریس مقاصد:

عمومی مقاصد: طالب علم یہ جان سکے کہ آیات قرآنی کی روشنی میں مومن کے اوصاف کیا ہیں

() قرآن مجید () منتخب آیات قرآنی

خصوصی مقاصد:

() قرآنی آیات کا ترجمہ

() قرآنی آیات کی تشریح

() قرآنی آیات کی روشنی میں ایک مومن کے اوصاف بیان کر سکے

() قرآنی آیات میں بیان کردہ مومن کے اوصاف اپنے اندر پیدا کر سکے

احادیث نبوی:

عمومی مقاصد:

() احادیث کی روشنی میں اسلامی اخلاقی اقدار (انفرادی واجتماعی) سے آگاہ ہو سکے

خصوصی مقاصد:

() احادیث کا ترجمہ بیان کر سکے

() احادیث کی تشریح کر سکے

() احادیث کی روشنی میں اسلام کی اخلاقی اقدار کی وضاحت کر سکے

() احادیث کی دی گئی تعلیمات کے مطابق اپنی زندگی گزار سکے

سیرت طیبہ:

() عمومی مقاصد: حضورﷺ کی سیرت طیبہ کے بارے میں جان سکے

خصوصی مقاصد:

() حضورﷺ کی ابتدائی زندگی اختصار کے ساتھ بیان کر سکے

() حضورﷺ کی ہجرت کا واقع بیان کر سکے

() حضورﷺ کی مدنی زندگی اختصار سے بیان کر سکے

() حضورﷺ کی بطور معلم خصوصیات بیان کر سکے

حقوق آگاہی رمعلومات تک رسائی

۔ملازم پیشہ خواتین کا تحفظ

() حضور ﷺ کی بطور سربراہ بیان کر سکے

حضور ﷺ بحیثیت

() خطبہ حجۃ الوداع ۔ انسانی حقوق کا اعلامیہ حقوق انسانی پالیسی 2018 کے بارے جان سکے

اسلامی معاشرہ:

عمومی مقاصد: اسلامی معاشرہ کی خصوصیات سے آگاہی حاصل کر سکے

خصوصی مقاصد:

() اسلامی معاشرہ کا معنی ومفہوم کر سکے

() اسلامی معاشرہ کی امتیازی خصوصیات بیان کر سکے

() اسلامی معاشرہ میں عدل واحسان کی اہمیت بیان کر سکے

() تبلیغ کے لغوی معنی بیان کر سکے

() تبلیغ کی اہمیت اور ضرورت بیان کر سکے

() جہاد کے لفظی واصطلاحی معنی بیان کر سکے

() جہاد کی اہمیت بیان کر سکے

() جہاد اور قتل میں فرق بیان کر سکے

() جہاد کی مختلف اقسام بیان کر سکے

() لفظ مسجد کی تعریف بیان کر سکے

() مسجد کی سابقہ حیثیت کو بحال کرنے کے بارے میں اقدامات کو مان سکے

() انسانی حقوق کی معاشی اور معاشرتی ترقی میں اہمیت اور کردار بیان کر سکے

اسلامی ریاست:

عمومی مقاصد:

() اسلامی ریاست کی خصوصیات بیان کر سکے

خصوصی مقاصد:

() ریاست کی تعریف بیان کر سکے

() اسلامی ریاست میں طرز حکومت سے آگاہی حاصل کر سکے

() اسلامی ریاست کی خصوصیات بیان کر سکے

() اسلامی ریاست کے اغراض ومقاصد بیان کر سکے

() اسلامی ریاست کے قیام کی لیے جدوجہد کر سکے

() حقوق آگاہی رمعلومات تک رسائی کا قانون جان سکے

() ملازمت پیشہ خواتین کے حقوق کا تحفظ جان سکے اور

() معاشرے میں خواتین کے حقوق کا تحفظ یقینی بنائے

نصاب مطالعہ پاکستان

سال دوئم

حصہ دوم

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کل وقت 12 گھنٹے

موضوعات:

() دوقومی نظریہ

() تحریک پاکستان

() انڈین کانگریس

() مسلم لیگ

() تقسیم بنگال

() میثاق لکھنو

() تحریک خلافت

() سندھو تحریک

() تجاویز دہلی

() نہرو رپورٹ

() قائداعظم کے چودہ نکات

() خطبہ آلہ آباد

() انتخابات 1938 اور انتقال اقتدار

() قرارداد پاکستان

حصہ دوم

مطالعہ پاکستان

تدریس مقاصد:

تحریک پاکستان:

عمومی مقاصد:

() قیام پاکستان کے اسباب وتحریک کو بیان کر سکے

خصوصی مقاصد:

() قومیت کے مفہوم کو بیان کر سکے

() دو قومی نظریہ کی تعریف وتوضیح کر سکے

() دوقومی نظریہ کی اہمیت بیان کر سکے

() ہندوستانی مسلمانوں کی محرومیوں کو بیان کر سکے

() قومی تشخص کو بحال رکھنے کے لیے مسلمانان ہند کی مساعی بیان کر سکے

() آزادی ہند اور قیام پاکستان علامہ اقبال اور قائداعظم کی مساعی بیان کریں

() قیام پاکستان سے مستقبل اسلامی مملکت کے قیام کے لیے مسلم عوام کی کوششوں کو بیان کر سکے

() مسلم لیگ کے قیام پاکستان کے لیے جدو جہد بیان کر سکے

(غیر مسلم طلباء کے لیے)

نصاب اخلاقیات

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سال دوم

کل وقت 20 گھنٹے

موضوعات:

معاشرتی اقدار بلحاظ ہمسایہ۔قوم۔قومی سطح۔شہری سطح۔صنعتی اداروں کی سطح۔ضروریات۔ورثہ

() حقوق وفرائض

() قوت برداشت

() قوت ارادی

() لگن وجذبہ

() وسیع النظری

() بے غرضی

() انسانی دوستی

() حفاظتی شعور

() پاس آزادی

() کامل آگاہی

() تغیرات کو قبول کرنا

() خودشناسی

() انسانی حقوق کا اعلامیہ/حقوق انسانی پالیسی 2018

() انسانی حقوق کا معاشرتی اور معاشی ترقی میں کردار

() حقوق آگاہی/معلومات تک رسائی۔ملازم پیشہ خواتین کا تحفظ

نصاب اخلاقیات

سال دوم

تدریس مقاصد:

طالب علم اخلاقیات کی اہمیت وضرورت سے آگاہ ہو سکے اور بیان کر سکے

خصوصی مقاصد: طالب علم اس قابل ہو کہ

() موضوعات کا مطلب بیان کر سکے

() عملی زندگی سے مثالوں کی نشاندہی کر سکے

() اپنی شخصیت اور معاشرے پر موضوعات کے مطابق اثرات پیدا کرنے کے طریقے بیان کر سکے

() اعلیٰ اخلاقی اقدار میں سے قوت برداشت۔قوت ارادی۔لگن وجذبہ۔وسیع النظری۔بے غرض۔انسانی دوستی شعور۔پاس آزادی۔کامل آگاہی اور خودشناسی کی اہمیت

() اخلاقیات سے متصف ہو کر قومی خدمت بہتر طور پر انجام دے سکے

() انسانی حقوق کا اعلامیہ/حقوق انسانی کی پالیسی 2018 کے بارے میں جان سکے

() انسانی حقوق کا معاشرتی اور معاشی ترقی میں اہمیت اور کردار بیان کر سکے

() حقوق اگاہی/معلومات تک رسائی کے قانون کو جان سکے

() ملازم پیشہ خواتین کا تحفظ کو اخلاقیات کا حصہ تصور کرے

TTQ-211 / Civic-211;

T	P	C
1	0	1

Total Contact Hours:

Theory: **32**
Practical: **0**

Tarjumat-ul-Quran / Civics

Note: Syllabi for these subject would be as per BISEs / General education, developed by Punjab Curriculum TextBook Board (PCTB)

MATHS-233 Applied Mathematics-II

Total Contact Hrs:

		T	P	C
Theory	96			
Practical	0	3	0	3

Aims & Objectives:

After completing the course the students will be able to:
Solve the problems of calculus and analytical Geometry.

Course Contents:

1.**FUNCTIONS & LIMITS.** 6 Hours

- 1.1 Constants and variables
- 1.2 Functions & their types
- 1.3 The concept of limit
- 1.4 Limit of a function
- 1.5 Fundamental theorems on limit
- 1.6 Some important limits
- 1.7 Continuous function
- 1.8 Problems

2.**DIFFERENTIATION.** 06 Hours

- 2.1 Increments
- 2.2 Geometrical interpret
- 2.3 Differentiation ab –initio by first principle.
- 2.4 Geometrical interpretation of differential coeff.
- 2.5 Differentiation coefficient of X^n and $(a+b)^n$
- 2.6 Problems.

3.DIFFERENTIATION OF ALGEBRAIC FUNCTIONS 9 Hours

- 3.1 Explicit Functions
- 3.2 Implicit Functions
- 3.3 Parametric Forms
- 3.4 Problems

4. DIFFERENTIATION OF TRIGONOMETRIC FUNCTIONS 6 Hours

- 4.1 Differential Coefficient of Sinx, Cosx, Tanx from first principle.
- 4.2 Differential Coefficient of Cosecx, Secx, Cotx.
- 4.3 Differential Coefficient of Inverse Trigonometric Functions
- **4.4** Problems

5. DIFFERENTIATION OF LOGARITHMIC & EXPONENTIAL FUNCTION 15Hours

- 5.1 Differentiation of lnx
- 5.2 Differentiation of Log a^x
- 5.3 Differentiation of a^x
- 5.4 Differentiation of e^x
- 5.5 Problems

6. RATE OF CHANGE OF VARIABLES. 6 Hours

- 6.1 Increasing and decreasing functions
- 6.2 Maxima and Minima
- 6.3 Criteria for maximum & minimum values
- 6.4 Methods of finding maximum & minimum
- 6.5 Rate measure
- 6.6 Slope of a line
- 6.7 Velocity and acceleration
- 6.8 Problems

7. INTEGRATION (SIMPLE BASIC RULES) 9 Hours

7.1 Concept
7.2 Fundamental Formulae
7.3 Important Rules
7.4 Problems

8. METHODS OF INTEGRATION 9 Hours

8.1 Integration by substitution
8.2 Integration by parts
8.3 Problems

9. DEFINITE INTEGRALS. 6 Hours

9.1 Properties
9.2 Application to area
9.3 Problems.

10. DIFFERENTIAL EQUATION. 6 Hours

10.1 Introduction
10.2 Order and Degree
10.3 First Order Differential Equation of 1st Degree
10.4 Solution of Problems
10.5 Problems

11. LAPLACE TRANSFORMATION. 9 Hours

11.1 Laplace Transformations
11.2 Inverse Laplace Transformations
11.3 Problems

12. FOURIER SERIES 9 Hours

12.1 Introduction
12.2 Periodic Functions
12.3 Even and Odd Functions
12.4 Problems

13. STATISTICS 6 Hours

13.1 Concept of mean, median and mode
13.2 Standard Deviation
13.3 Laws of probability
13.4 Problems

REFERENCE BOOKS

1. Thomas Finny, Calculus and Analytic Geometry
2. Ghulam Yasin Minhas, Technical Mathematics Vol – I & II, Ilmi Kitab Khana, Lahore
3. Riaz Ali Khan, Polytechnic Mathematic Series Vol I & II, Majeed Sons, Faisalabad.
4. Sana Ullah Bhatti, Calculus and Analytic Geometry, Punjab Text Book Board, Lahore.

MATH-233 APPLIED MATHEMATICS-II

INSTRUCTIONAL OBJECTIVES

1. USE THE CONCEPT OF FUNCTIONS AND THEIR LIMITS IN SOLVING SIMPLE PROBLEMS.

1.1 Define a function.
1.2 List all types of functions.
1.3 Explain the concept of limit and limit of a function.
1.4 Explain fundamental theorems on limits.
1.5 Derive some important limits.
1.6 Solve simple problems on limits.

2. UNDERSTAND THE CONCEPT OF DIFFERENTIAL COEFFICIENT.

2.1 Define differential coefficient.
2.2 Derive mathematical expression of a derivative.
2.3 Explain geometrically the meaning of differential coefficient.
2.4 Differentiate ab-initio x^n and $(ax+b)^n$.
2.5 Solve problems of these formulas.

3. USE RULES OF DIFFERENTIATION FOR SOLVING PROBLEMS OF ALGEBRAIC FUNCTIONS.

3.1 Derive product rule, quotient rule and chain rule.
3.2 Interpret the chain rule.
3.3 Differentiate explicit and implicit functions.
3.4 Find derivatives of parametric forms of a function w.r.t another function, by rationalization.
3.5 Use these important rules to find derivatives of relevant functions.

4. USE RULES OF DIFFERENTIATION TO SOLVE TRIGONOMETRIC FUNCTIONS.

4.1 Differentiate from first principle sin x, Cos x, tan x.
4.2 Derive formulas for derivatives of Sec x, Cosec x, Cot x.
4.3 Find derivatives of inverse trignometric functions.
4.4 Solve problems based on these formulas.

5. USE RULES OF DIFFERENTIATION TO LOGARITHMIC AND EXPONENTIAL FUNCTIONS.

5.1 Derive formulas for differential coefficients of Logarithmic and exponential functions.
5.2 Solve problems using these formulae.

6. UNDERSTAND RATE OF CHANGE OF ONE VARIABLE WITH ANOTHER

6.1 Derive formulas for velocity, acceleration and slope of a line
6.2 Use derivative as a measure of rate of change.
6.3 Explain an increasing and a decreasing function.
6.4 Show graphically maxima and minima values and point of inflexion.
6.5 Explain criteria for finding maxima and minima.
6.6 Solve problems based upon these topics.

7. USE PRINCIPLES OF INTEGRATION IN SOLVING RELEVANT PROBLEMS.

7.1 Explain concept of integration.

7.2 Write basic theorems of integration.
7.3 Define fundamental formulas of integration.
7.4 List some important rules of integration.
7.5 Solve problems based on these rules.

8. UNDERSTAND VARIOUS METHODS OF INTEGRATION

8.1 List standard formulas of integration.
8.2 Integrate a function by substitution method.
8.3 Use method of integration by parts for finding integrals.
8.4 Employ these methods to solve problems.

9. UNDERSTAND THE METHODS OF SOLVING DEFINITE INTEGRALS.

9.1 Define definite integral.
9.2 List properties of definite integrals.
9.3 Use definite integral in the computation of areas.
9.4 Solve problems involving definite integrals.

10. USE DIFFERENT METHODS OF INTEGRATION TO SOLVE DIFFERENTIAL EQUATIONS.

10.1 Define a differential equation, its degree and order.
10.2 Explain method of separation of variables for solving differential equations of first order and first degree.
10.3 Solve differential equations of first order and first degree.

11. USE LAPLACE AND INVERSE LAPLACE TRANSFORMATION FOR SOLVING PROBLEMS.

11.1 Define Laplace and Inverse Laplace Transformation
11.2 List properties of Laplace Transformation
11.3 Solve problems using Laplace Transformations

12. EXPAND FUNCTIONS USING FOURIER SERIES

12.1 Define a Fourier series.
12.2 Write extended rule of integration by parts.
12.3 Illustrate periodic functions, even and odd functions.
12.4 Explain Fourier expansion and Fourier constants.
12.5 Expand the given functions of Fourier series.

13. UNDERSTAND THE BASIC CONCEPTS OF STATISTICS

13.1 Define mean, median and mode
13.2 Explain standard deviation
13.3 State laws of probability
13.4 Calculate the above mentioned quantities using the proper formula

OHSE-211 Occupational Health, Safety and Environment

Total Contact Hours

		T	P	C
Theory	32			
Practical	0			
		1	0	1

Learning Outcomes:

After this course the student will be able to:

- Know how to identify and control hazards in the workplace.
- Carry out a risk assessment and identify control measures.
- Understand the methods used when reporting and recording accidents and incidents.
- Understand the key features of health and safety legislation and regulations.

Course Contents

1. Identification and control of Hazards (15 Hours)

- 1.1 Methods of identify hazards with in the work place.
  - 1.1.1 Statements
  - 1.1.2 Analysis of significant risks
  - 1.1.3 Prediction of results or outcomes of those risks
  - 1.1.4 Use of accident data
  - 1.1.5 Careful consideration of work methods
- 1.2 Consideration of the workplace and its potential for harm.
  - 1.2.1 Confined spaces
  - 1.2.2 Working at heights
  - 1.2.3 Electrical hazards
  - 1.2.4 Chemicals
  - 1.2.5 Noise
- 1.3 Hazards which become risks:
  - 1.3.1 Identification of minor or major risk
  - 1.3.2 Potential to cause harm
  - 1.3.3 Choosing appropriate control measures
  - 1.3.4 Electrical safety
    - 1.3.4.1 Cause of injury in electrical work
    - 1.3.4.2 Effects of electricity on the body
    - 1.3.4.3 Circuit overloading
  - 1.3.5 Mechanical safety
    - 1.3.5.1 Cause of injury in mechanical work
    - 1.3.5.2 Rotating equipment
    - 1.3.5.3 Sharp edges
- 1.4 Safety Devices
  - 1.4.1 Residual current device (RCD)
  - 1.4.2 Fuses
  - 1.4.3 Guards
  - 1.4.4 Sensors

2. Risk assessment and identify control measures (07 Hours)

- 2.1 Risk assessments: five steps
  - 2.1.1 Principal hazards

2.1.2 Who is likely to be injured/ harmed?
2.1.3 Evaluate the risks and decide on adequacy of precautions
2.1.4 Recording findings
2.1.5 Review assessment

2.2 Use of control measures:
2.2.1 Use of recognized procedures
2.2.2 Substances control
2.2.3 Guarding
2.2.4 Lifting assessments and manual handling assessments
2.2.5 Regular inspection
2.2.6 Use of Personal Protective Equipment (PPE)
2.2.7 Training of personnel
2.2.8 Other personal procedures for health, safety and welfare

3. Methods used when reporting and recording accidents and incidents. (06 Hours)

3.1 Why employers keep records of serious accidents, incidents and emergencies
3.2 Responsibilities of competent persons
3.3 Cost of accidents
3.4 Recording of trends such as major causes, fatal and serious injury
3.5 Methods of classification
3.6 Statistics
3.7 Recording and reporting procedures
3.7.1 Accident book, company procedures
3.7.2 Procedures to deal with near miss or dangerous occurrences

4. Key features of health and safety legislation and regulations. (04 Hours)

4.1 General Safety, health & Condition of work
4.1.1 Labour Code of Pakistan 1986

4.2 Industries and Occupations
4.2.1 Hazardous Occupation Rules 1963
4.2.2 The Factories Act 1934
4.2.3 Punjab Factories Rules 1978

REFERENCE BOOKS.

1. Safety Practices and Procedures by NISTE
2. Health and Safety Executive — *A Guide to Risk Assessment Requirements: Common Provisions in Health and Safety Law* (HSE Books-Latest Ed.).
3. Health and Safety Executive — *Management of Health and Safety at Work* -HSE Books, (Latest Ed.).

Instructional Objectives

1. Understand how to Identify and control of Hazards

- 1.1 Understand methods of identify hazards with in the work place.
  - 1.1.1 Discuss the role of statements
  - 1.1.2 Describe the analysis of significant risks
  - 1.1.3 Discuss the prediction of results or outcomes of the risks
  - 1.1.4 Discuss the use of accident data
  - 1.1.5 Describe the careful consideration of work methods
- 1.2 Understand the consideration of the workplace and its potential for harm.
  - 1.2.1 Describe confined spaces
  - 1.2.2 Discuss working at heights
  - 1.2.3 Discuss Electrical hazards
  - 1.2.4 Discuss Chemicals related to hazards
  - 1.2.5 Discus role of noise.
- 1.3 Understand Hazards which become risks:
  - 1.3.1 Able to identification of minor or major risk
  - 1.3.2 Describe potential to cause harm
  - 1.3.3 Able to choosing appropriate control measures
  - 1.3.4 Understand Electrical safety
    - 1.3.4.1 Describe cause of injury in electrical work
    - 1.3.4.2 Describe effects of electricity on the body
    - 1.3.4.3 Describe circuit overloading
  - 1.3.5 Understand Mechanical safety
    - 1.3.5.1 Describe cause of injury in mechanical work
    - 1.3.5.2 Discuss the role of rotating equipment in hazards.
    - 1.3.5.3 Discuss the role of sharp edges in hazards.
- 1.4 Understand role of Safety Devices
  - 1.4.1 Understand the role of residual current device (RCD)
  - 1.4.2 Understand the role of fuses
  - 1.4.3 Understand the role of guards
  - 1.4.4 Understand the role of sensors

2. Risk assessment and identify control measures

- 2.1 Understand five steps Risk assessments
  - 2.1.1 principal hazards
  - 2.1.2 who is likely to be injured/harmed
  - 2.1.3 evaluate the risks and decide on adequacy of precautions
  - 2.1.4 recording findings
  - 2.1.5 review assessment
- 2.2 Understand the use of control measures
  - 2.2.1 Discuss use of recognized procedures
  - 2.2.2 Discuss substances control
  - 2.2.3 Discuss guarding
  - 2.2.4 Discuss lifting assessments and manual handling assessments
  - 2.2.5 Discuss regular inspection
  - 2.2.6 Discuss use of Personal Protective Equipment (PPE)
  - 2.2.7 Discuss training of personnel
  - 2.2.8 Discuss other personal procedures for health, safety and welfare

3. Understand the Methods used when reporting and recording accidents and incidents.

3.1 Discuss why employers keep records of serious accidents, incidents and emergencies
3.2 Describe the responsibilities of competent persons
3.3 Discuss cost of accidents
3.4 Discuss recording of trends such as major causes, fatal and serious injury
3.5 Discuss methods of classification
3.6 Discuss statistics used in recording
3.7 Understand Recording and reporting procedures
3.7.1 Describe accident book, company procedures
3.7.2 Discuss the procedures to deal with near miss or dangerous occurrences

4. Key features of health and safety legislation and regulations.

4.1 Understand General Safety, health & Condition of work mentioned in rules in Pakistan
4.1.1 Understand related clauses of Labour Code of Pakistan 1986
4.2 Understand the related clauses in Industries and Occupations rules in Pakistan.
4.2.1 Understand related clauses of Hazardous Occupation Rules 1963
4.2.2 Understand related clauses of The Factories Act 1934
4.2.3 Understand related clauses of Punjab Factories Rules 1978

ELTR- 214 Communication Networks

Total Contact Hours

		T	P	C
Theory	96			
Practical	96	3	3	4

Learning Outcomes:

- Introduce students to fundamental concepts of communication networks, including wired and wireless transmission media and their applications.
- Provide foundational knowledge of data communication protocols, network architecture models (OSI, TCP/IP), and IP addressing.
- Equip students with a basic understanding of network/information security principles and measures to safeguard communication systems.
- Familiarize students with the principles and functions of PSTN and digital exchange, as well as the fundamentals of optical fibre communication and GPON networks.
- Lay the groundwork for future studies in wireless networks, covering introductory wireless communication, antennas, and multiple access techniques

Course Contents

Paper A

1. Basics of Communication Networks 06 Hours

1.1 Definition of Communication Networks
1.2 Communication Process
1.3 Communication Channel
1.4 Transmission Media, Guided un-Guided and its types
1.5 Applications of Transmission Media in Communication Networks
1.6 Transmitters and Receivers for Wired Media
1.7 Transmitters and Receivers for Wireless Media

2. Data Communication 12 Hours

2.1 Definition
2.2 Components, characteristics and specifications of Data Communication
2.3 Data Communication Modes
2.4 Data transmission (Analog & Digital)
2.5 Types of Data Networks
2.6 Network Topologies

3. Internetworking 14 Hours

3.1 Principal of Internetworking
3.2 Types of internetworking
3.3 Introduction to Network Models
3.4 OSI Reference Model
3.5 TCP / IP Model
3.6 Comparison of OSI and TCP/IP Models
3.7 Introduction to IP Addressing
3.8 Introduction to Routing

3.9 Network Devices

4. Cyber / Information Security 06 Hours

4.1 Overview of Network and Information Security
4.2 Core Principles of Security
4.3 Common Threats and Vulnerabilities in Networks
4.4 Types of Security Measures and Tools
4.5 Security in Wireless Networks

5. Public Switched Telephone Network (PSTN) 10 Hours

5.1 Overview of PSTN (Public Switched Telephone Network)
5.2 Basic Components of PSTN
5.3 Switching Technologies in PSTN
5.4 Digital Exchange
5.5 PSTN to Digital Transition
5.6 PSTN Network Architecture
5.7 Introduction to Digital Subscriber Line (DSL)
5.8 How DSL Works with PSTN
5.9 Advantages and Limitations of DSL
5.10 Introduction to Multi-Service Access Gateway (MSAG)

Paper B

6. Optical Fiber and Gigabit Passive Optical Network Networks 08 Hours

6.1 Introduction to Optical Fiber and Fiber To The Home (FTTH)
6.2 Optical Fiber Parameters and Characteristics
6.3 Splicing of Optical Fiber
6.4 Basic Components of Optical Fiber Communication Systems
6.5 Types of Optical Network
6.6 Gigabit Passive Optical Network (GPON)
6.7 Architecture of GPON Network
6.8 Advantages of GPON Networks
6.9 Introduction to Multi-Service Access Gateway (MSAG)
6.10 Applications of Optical Fiber and GPON Networks
6.11 Challenges and Limitations of Optical Fiber and GPON

7. Wireless Networks 16 Hours

7.1 Introduction to Wireless Communication
7.2 Basics of Signals
7.3 Electromagnetic Waves
7.4 Basic Block Diagram of a Wireless Network
7.5 Modulation and Demodulation Techniques
7.6 Amplitude Modulation, Transmitter & Receiver
7.7 Frequency Modulation, Transmitter & Receiver
7.8 Electromagnetic Waves and their Propagation
7.9 Electromagnetic Spectrum and Its Applications
7.10 Introduction to Filters and Their Types

8. Transmission Lines & Waveguides 08 Hours

8.1 Introduction to Transmission Lines
8.2 Parameters of Transmission Lines
8.3 Signal Propagation on Transmission Lines

8.4 Losses in Transmission Lines
8.5 Introduction to Waveguides
8.6 Wave Propagation in Waveguides
8.7 Comparison of Transmission Lines and Waveguides

9. Antennas and multiple access techniques 16 Hours

9.1 Introduction to Antennas
9.2 Working Principal of Antenna
9.3 Hertzian Dipole
9.4 Half Wave Dipole Antenna
9.5 Quarter Wave mono pole Antenna
9.6 Fundamental Properties and Parameters of Antennas
9.7 Antennas Types and Their Applications
9.8 Multiple Access Techniques
9.9 Frequency Division Multiple Access (FDMA)
9.10 Time Division Multiple Access (TDMA)
9.11 Code Division Multiple Access (CDMA)
9.12 Orthogonal Frequency Division Multiple Access (OFDMA)
9.13 Comparison of Multiple Access Techniques

REFERENCE BOOKS:

1. Data and Computer Communications" by William Stallings (Latest Edition)
2. Computer Networking: A Top-Down Approach" by James Kurose and Keith (Latest Edition)
3. Network Security Essentials: Applications and Standards" by William Stallings (Latest Edition)
4. Optical Fiber Communications" by John M. Senior (Latest Edition)
5. Fundamentals of Wireless Communication" by David Tse and Pramod Viswanath (Latest Edition)
6. Advance Electronics Communication System by Wayne Tomasi (Latest Edition)

Instructional Objectives

Paper A

1. Basics of Communication Networks

- 1.1 Definition of Communication Networks.
- 1.2 Communication Process,
  - 1.2.1 Basic block diagram explaining Sender, Encoder, Communication Channel, Decoder and Receiver.
- 1.3 Describe communication channel.
- 1.4 Describe transmission media, Guided un-Guided and its types
  - 1.4.1 Describe Wired Media (Twisted Pair, Coaxial Cable, Strip-line, Optical Fiber etc.).
  - 1.4.2 Describe Wireless Media (Antennas, Wave guides etc.).
- 1.5 Enlist the Applications of Transmission Media in Communication Networks.
- 1.6 Describe Transmitters and Receivers for Wired Media,
  - 1.6.1 Define Electrical Transmitter and Receiver.
  - 1.6.2 Define Optical Transmitter and Receiver.
- 1.7 Describe transmitters and receivers for Wireless Media,
  - 1.7.1 Define Antennas.
  - 1.7.2 Define Waveguides.

2. Data Communication

- 2.1 Definition, its components, characteristics and specifications.
- 2.2 Data Communication Modes,
  - 2.2.1 Define Simple, Half Duplex, and Full Duplex.
- 2.3 Data transmission Types,
  - 2.3.1 Define Analog & Digital.
- 2.4 Describe types of Data Networks,
  - 2.4.1 LAN,
  - 2.4.2 MAN,
  - 2.4.3 WAN.
- 2.5 Explain Network Topologies,
  - 2.5.1 Bus,
  - 2.5.2 Ring,
  - 2.5.3 Star,
  - 2.5.4 Mesh,
  - 2.5.5 Tree,
  - 2.5.6 Hybrid.

3. Internetworking

- 3.1 State principle of Internetworking.
- 3.2 Types of internetworking,
  - 3.2.1 Define Internet & Intranet.
- 3.3 Introduction to Network Models.
- 3.4 Briefly explain OSI Reference Model,
  - 3.4.1 Overview.
  - 3.4.2 Detailed breakdown of OSI Layers.
  - 3.4.3 OSI Model Functionality in Real Networks.
- 3.5 Briefly explain TCP / IP Model,

3.5.1 Overview.
3.5.2 Detailed breakdown of TCP/IP Layers.
3.5.3 TCP/IP Model Functionality in Real Networks.

3.6 Explain the comparison of OSI and TCP/IP Models.

3.7 Explain IP Addressing,
3.7.1 Define IP Addresses.
3.7.2 Describe the purpose of IP Addresses.
3.7.3 Distinguish between Public vs. Private IP Addresses.
3.7.4 Describe types of IP Addresses.
3.7.5 Explain IPv4 Address Classes.
3.7.6 Describe IPv6 Addressing Basics.
3.7.7 Describe Subnet.

3.8 Introduction to Routing,
3.8.1 Describe the basics of Routing (Purpose of Routing, Router Functions, Routing Tables).
3.8.2 Enlist and define the types of routing (Static and Dynamic).

3.9 Network Devices,
3.9.1 Overview.
3.9.2 Explain the types and working of Network Devices
3.9.2.1. Router,
3.9.2.2. Switch,
3.9.2.3. Hub,
3.9.2.4. Bridge,
3.9.2.5. Access Point,
3.9.2.6. Modem, Firewall,
3.9.2.7. And Network interface card.
3.9.3 Describe Specialized Network Devices (Load Balancer, Gateway, Repeaters).

4. Information / Cyber Security

4.1 Overview of Network and Information Security
4.1.1 Definition of Network Security.
4.1.2 Definition of Information Security.
4.1.3 Definition of Cyber Security.
4.1.4 Importance of Security.

4.2 Core Principles of Security (CIA Triad),
4.2.1 Define Confidentiality.
4.2.2 Define Integrity.
4.2.3 Define Availability.

4.3 Describe common threats and vulnerabilities in networks,
4.3.1 Describe types of threats,
- Malware,
- Phishing,
- Denial of Services (DoS) Attacks,
- Man-In-Middle (MiM) Attacks,
- And Unauthorized Access.

4.3.2 Describe network vulnerabilities.

4.4 Describe types of security measures and tools,
4.4.1 Define Physical Security.
4.4.2 Describe Authentication and Authorization.

4.4.3 Describe Encryption.
4.4.4 Define Firewalls.
4.4.5 Define Antivirus and Anti-Malware Software.
4.4.6 Describe Virtual Private Networks (VPNs).

4.5 Security in Wireless Networks,
4.5.1 Overview of Challenges in Wireless Security.
4.5.2 Describe basic Wi-Fi Security Standards.
4.5.3 Describe Security Policies and Best Practices,
- Importance of Security Policies,
- User Awareness and Training,
- Regular Updates and Patch Management,
- And Incident Response.

5. Public Switched Telephone Network (PSTN)

5.1 Overview of a PSTN,
5.1.1 Definition of PSTN.
5.1.2 Describe historical background.
5.1.3 Describe Importance of PSTN.

5.2 Basic Components of PSTN,
5.2.1 Definitions of Subscriber Lines, Local Exchange, Trunks, Switching Systems, and Signaling.

5.3 Switching Technologies in PSTN,
5.3.1 Describe Analog Switching.
5.3.2 Describe Digital Switching.

5.4 Digital Exchange,
5.4.1 Define Digital Exchange.
5.4.2 Explain primary functions of Digital Exchange,
- Authentication,
- Call setup and routing,
- Call Termination,
- Billing and Accounting,
- And Subscriber Management.

5.5 PSTN to Digital Transition,
5.5.1 Describe Analog to Digital Transformation.
5.5.2 Describe the role of Integrated Services Digital Network (ISDN)

5.6 Briefly explain the PSTN Architecture.

5.7 Explain DSL (Digital Subscriber Line).
5.7.1 Define DSL.
5.7.2 Describe the types of DSL Technologies,
- Asymmetric DSL,
- Symmetric DSL,
- And Very-high bit rate DSL.

5.8 Describe How DSL Works with PSTN?
5.8.1 Describe the role of DSL Modem.
5.8.2 Describe DSLAM (Digital Subscriber Line Access Multiplexer).

5.9 Describe the advantages and limitations of DSL.

Paper B

6. Optical Fiber and Gigabit Passive Optical Networks

6.1 Introduction to Optical Fiber and FTTH,

6.1.1 Definition and Working Principal of optical fiber.
6.1.2 Explain the Structure of optical fiber.
6.1.3 Describe the types and capacity of optical fibers (Single Mode, Multimode).
6.1.4 State the working Principal.
6.1.5 Describe cone of acceptance.
6.1.6 Advantages of using optical fibers in networks.
6.1.7 Describe FTTH protocol.

6.2 Optical Fiber Parameters and Characteristics,
6.2.1 Define Attenuation.
6.2.2 Define Dispersion.
6.2.3 Define Bandwidth and Data Rates.

6.3 Splicing of Optical Fiber,
6.3.1 Describe Fusion Splicing.
6.3.2 Define Mechanical Splicing.

6.4 Basic Components of Optical Fiber Communication Systems,
6.4.1 Define Optical Transmitter,
6.4.2 Define Optical Receive,
6.4.3 Define Optical Amplifiers,
6.4.4 Define Optical Multiplexers and Demultiplexers.

6.5 Types of Optical Networks,
6.5.1 Define Active Optical Network (AON).
6.5.2 Define Passive Optical Network (PON).

6.6 Introduction to GPON (Gigabit Passive Optical Network),
6.6.1 Definition.
6.6.2 Explain the elements of GPON
- Explanation of GPON as a point-to-multipoint access,
- Optical Line Terminal (OLT),
- Optical Network Unit (ONU),
- And Passive Optical Splitter.

6.7 Explain the Architecture of GPON Network

6.8 Describe the Advantages of GPON Networks in terms of,
- High Bandwidth and Data Rates,
- Cost-Effective Solution,
- Low Maintenance and Scalability,
- Improved Data Security.

6.9 Introduction to Multi-Service Access Gateway (MSAG).

6.10 Enlist the applications of Optical Fiber and GPON Networks with respect to,
- Broadband Internet Services,
- Enterprise and Data Center Connections,
- Telecommunications Backbones,
- Smart Cities and IoT.

6.11 Describe the challenges and limitations of Optical Fiber and GPON with respect to,
- Installation and Infrastructure Cost
- Distance Limitations and Signal Loss

- Physical Vulnerabilities

7. Basics of Wireless Networks

7.1 Introduction to Wireless Communication,

7.1.1 Definition and Overview.

7.1.2 Describe its importance.

7.1.3 Describe its advantages and limitations.

7.2 Basics of Signals,

7.2.1 Describe the signals in communication

7.2.2 Define the types of signals: Analog vs. Digital.

7.2.3 Describe the characteristics of signals: Frequency, Amplitude, and Phase.

7.2.4 Describe the losses in signals, Noise, Attenuation, Distortion

7.3 Electromagnetic Waves (EM),

7.3.1 Introduction to EM waves.

7.3.2 Describe wave propagation in lossy dielectrics.

7.3.3 Describe plane waves in free space.

7.3.4 Describe plane waves in good conductors.

7.4 Basic block diagram of a wireless network,

7.4.1 Describe the components of a Wireless Communication System.

7.5 Modulation and Demodulation Techniques in Wireless Communication,

7.5.1 Why we need Modulation?

7.5.2 Definition of Modulation.

7.5.3 Describe Modulation Index.

7.5.4 Explain types and applications of Analog Modulation Techniques,

- Amplitude Modulation,
- Frequency Modulation,
- and Phase Modulation.

7.5.5 Comparison of modulated waves of different Analog Modulation techniques.

7.5.6 Explain types and applications of Digital Modulation techniques,

- Amplitude Shift Keying,
- Frequency Shift Keying,
- And Phase Shift Keying.

7.5.7 Comparison of modulated waves of different Digital Modulation techniques.

7.5.8 Describe Quadrature Modulation.

7.6 Amplitude Modulation (AM),

7.6.1 Define AM modulation.

7.6.2 Describe the analysis of AM modulated wave.

7.6.3 Describe Modulation Index and Bandwidth.

7.6.4 Define Single Side Band (SSB) and Double Side Band (DSB) with the help of diagram.

7.6.5 Discuss AM modulators and their types.

7.6.6 Explain the AM Transmitter.

7.6.7 State the principle of AM reception.

7.6.8 Explain AM Receiver and its function.

7.6.9 Describe block diagram of super-heterodyne receiver.
7.6.10 State the principle of super-heterodyning.
7.6.11 Enlist the application, merits and demerits of AM.

7.7 Frequency Modulation (FM),

7.7.1 Define Frequency Modulation.
7.7.2 State the principle of frequency modulation.
7.7.3 Discuss the concept of Index of modulation, frequency deviation, frequency swing effect on side band and band width.
7.7.4 Define Bassel functions graph.
7.7.5 Explain FM Transmitter.
7.7.6 Explain the block diagram of FM transmission with automatic arrangement of controlled modulation.
7.7.7 Describe the stereo broadcasting transmission.
7.7.8 Discuss the Significance of Pre-emphasis and de-emphasis.
7.7.9 Explain the FM Receiver.
7.7.10 State the principle of FM microphone.
7.7.11 State the principle of FM reception.
7.7.12 Explain FM receiver with help of block diagram.
7.7.13 Enlist the application, merits and demerits of FM.

7.8 Electromagnetic (EM) Waves and their Propagation,

7.8.1 Discuss the overview of EM waves.
7.8.2 Define EM wave.
7.8.3 Describe the relationship between frequency, wavelength, and the speed of light.
7.8.4 Enlist the types and frequency range of Electromagnetic Wave (Radio, Microwaves, Infrared etc.).
7.8.5 Describe the propagation mechanisms.
7.8.6 Describe the propagation models,
- Line of Sight (LOS),
- And Non-Line of Sight (NLOS).

7.8.7 Describe the losses associated to EM waves.

7.9 Electromagnetic Spectrum and Its Applications,

7.9.1 Definition of Electromagnetic Spectrum.
7.9.2 Describe the frequency bands for communication.
7.9.3 Discuss the importance of spectrum allocation and regulation.
7.9.4 Describe the role of Pakistan Telecommunication Authority (PTA) in Regulation.
7.9.5 Enlist the applications of RF spectrum.

7.10 Introduction to Filters and Their Types,

7.10.1 Describe the purpose of filters in wireless communication.
7.10.2 Definition of Filters.
7.10.3 Describe the Types of Filters,
- Low Pass Filter,
- High Pass Filter,
- Band Pass Filter,
- and Band Stop Filter.

8. Transmission Lines & Waveguides

8.1 Introduction to Transmission Lines,

8.1.1 Definition and Purpose of Transmission Lines.

8.1.2 Enlist the applications in communication systems.

8.1.3 Explain the types of Transmission Lines,

- Twisted Pair,
- Coaxial Cable,
- Stripline
- Microstrip Lines,
- and Waveguides.

8.2 Parameters of Transmission Lines,

8.2.1 Define electrical parameters: Resistance (R), Inductance (L), Capacitance (C), and Conductance (G).

8.2.2 Define Characteristic Impedance (Z_0).

8.2.3 Define Propagation Constant (γ).

8.2.4 Define Attenuation and Distortion.

8.3 Signal Propagation on Transmission Lines,

8.3.1 Describe wave propagation Concepts: Reflections and Standing Waves.

8.3.2 Define Voltage Standing Wave Ratio (VSWR).

8.3.3 Describe the importance of impedance matching.

8.4 Losses in Transmission Lines,

8.4.1 Describe Conduction Losses.

8.4.2 Describe Dielectric Losses.

8.4.3 Describe Radiation Losses.

8.5 Introduction to Waveguides,

8.5.1 Definition and purpose of Waveguides.

8.5.2 Describe the types of Waveguides,

- Rectangular,
- Circular,
- and Flexible Waveguides.

8.5.3 Enlist the applications of Waveguides in communication systems

8.6 Wave Propagation in Waveguides,

8.6.1 Explain the Modes of Propagation,

- TE (Transverse Electric),
- TM (Transverse Magnetic),
- and TEM (Transverse Electromagnetic) Modes.

8.6.2 Describe the Cutoff Frequency and Bandwidth of Waveguides.

8.6.3 Enlist the advantages and limitations of waveguides.

8.7 Comparison of Transmission Lines and Waveguides.

9. Antennas and Multiple Access techniques

9.1 Introduction to Antennas,

9.1.1 Definition.

9.1.2 And Purpose.

9.2 Working Principal of Antenna.

9.3 Describe Hertzian Dipole.

9.4 Describe Half Wave Dipole Antenna.

9.5 Describe Quarter Wave mono pole Antenna.

9.6 Fundamental Properties and Parameters of Antennas,

9.6.1 Define Gain.

9.6.2 Define Directivity.
9.6.3 Define Polarization.
9.6.4 Define Bandwidth.
9.6.5 Define Radiation Pattern.
9.6.6 Define Radiation Intensity.
9.6.7 Define Radiation Efficiency.

9.7 Describe the Types of Antennas and Their Applications,

- Omni / Isotropic Antenna,
- Directional Antenna,
- Wire Antenna (Dipole, Monopole, Loop Antenna),
- Aperture Antenna (Horn, Slot Antenna),
- Reflector Antenna (Parabolic Reflector, Corner Reflector),
- Array Antena (Phased Array Antenna, Yagi-Uda Antenna),
- And Strip Antenna (Microstrip, Patch Antenna).

9.8 Describe Multiple Access Techniques,
9.8.1 Definition and Purpose of Multiple Access Techniques.
9.8.2 Enlist the types of Multiple Access Techniques.

9.9 Explain Frequency Division Multiple Access (FDMA),
9.9.1 Definition.
9.9.2 Diagram.
9.9.3 Describe the features of FDMA.
9.9.4 Enlist the Drawbacks of FDMA.

9.10 Explain Time Division Multiple Access (TDMA),
9.10.1 Definition.
9.10.2 Diagram.
9.10.3 Describe the features of TDMA.
9.10.4 Enlist the Drawbacks of TDMA.

9.11 Explain Code Division Multiple Access (CDMA),
9.11.1 Definition.
9.11.2 Diagram.
9.11.3 Describe Coding in CDMA.
9.11.4 Describe the features of CDMA.
9.11.5 Enlist the Drawbacks of CDMA.

9.12 Explain Orthogonal Frequency Division Multiple Access (OFDMA),
9.12.1 Definition.
9.12.2 Diagram.
9.12.3 Comparison of FDMA and OFDMA.
9.12.4 Describe the features of OFDMA.
9.12.5 Enlist the Drawbacks of OFDMA.

9.13 Comparison of Multiple Access Techniques.

LIST OF PRACTICAL 96 Hours

1. Identifying various hardware devices of a network.
2. Identifying network interface card (Wired & Wireless).
3. Make a straight / crossover cable using UTP / STP.
4. Connecting Wireless Access Point / Wireless Extender.
5. Router Configuration & Wireless Network Setup.
6. Configure Mac Filtering on routers.
7. Assigning IP address to a device and calculating its subnet mask.
8. Configure Static and Dynamic IP addresses.
9. Setting up a small local area (LAN) network with multiple devices.
10. Setting up and testing a wireless network,
11. Visit an internet service provider station.
12. Visit a digital telephone exchange.
13. Study the construction of the optical fiber cable.
14. Study the transmission & Reception with optical fiber.
15. Connect long-distance fiber links with minimal loss to support high-speed internet and phone services.
16. Preparation of Optical Fiber Cable for Splicing.
17. Splicing of fiber optics cable and also use its connectors.
18. Testing Fiber optics splicing.
19. Conducting a test with an Optical Time Domain Reflectometer to locate fault measure loss and to check fiber quality.
20. Assembly a simple AM radio receiver.
21. Align the assembled AM radio receiver.
22. Assemble a FM radio receiver.
23. Align the assembled FM radio receiver.
24. Generation of AM double side band waveforms.
25. Calculate the bandwidth and modulation index of the AM wave.
26. Construct FM Modulator using varactor diode and measure the frequency swing and deviation of a FM signal.
27. Demonstrate a frequency modulated wave on Cathode Ray Oscilloscope (CRO).
28. Assemble a simple FM Transmitter.
29. Demonstrate the performance of FM Transmitter using CRO.
30. Field visit of any Wireless Network service provider.

(ELTR- 224) Analog Electronics

Total Contact Hours:

		T	P	C
Theory	96			
Practical	96	3	3	4

Learning Outcomes:

- To understand the basic concepts and classification of amplifiers, including their biasing and stabilization techniques.
- To explore the design and operation of multi-stage amplifiers and coupling methods.
- To study the principles and applications of audio power amplifiers, feedback amplifiers, and RF amplifiers.
- To gain insights into oscillator circuits, operational amplifiers, multivibrators, and pulse generators, emphasizing their practical usage in electronic systems.

Course Contents

Paper A

1. Introduction to Amplifiers **20 Hours**

1.1 Introduction to amplifiers and amplification process
1.2 Basic amplifier concept using transistors (BJT & FET)
1.3 Classification of amplifiers
1.4 Regions of transistor biasing
1.5 Biasing methods of amplifier
1.6 Amplifiers Configuration w.r.t to input and output signals
1.7 Q Point and Load Line
1.8 Instability in Q Point and Thermal Runaway
1.9 Methods of Stabilization of Q-point

2. Multi-stage Amplifiers **08 Hours**

2.1 Definition and need of coupling
2.2 Single stage and multistage amplifiers
2.3 Block diagram of multi stage amplifiers
2.4 Principle of coupling
2.5 Types of Coupling of Amplifiers
2.6 RC coupled amplifier
2.7 Impedance coupled amplifier
2.8 Transformer coupled amplifiers
2.9 Direct coupled amplifiers

3. Audio Power Amplifiers **06 Hours**

3.1 Distinction between voltage, Current and power amplifier
3.2 Classification of power amplifier
3.3 Class B Push-Pull amplifiers
3.4 Center Tapped class B Push-Pull amplifier
3.5 Complementary pair class B push-pull amplifier
3.6 Cross-over distortion and its remedies
3.7 Heat sinks for power amplifier

4. Feedback Amplifiers **08 Hours**

4.1 Definition and Principal feedback in amplifiers
4.2 Positive Feedback

4.3 Negative Feedback and its types
4.4 Effects of Feedback
4.5 Emitter follower

5. Radio Frequency (RF) Amplifiers **06 Hours**

5.1 Definition and Requirements of RF amplifier
5.2 Principle and characteristics of RF Amplifier
5.3 Multistage RF amplifier
5.4 Class-C RF power amplifier using tuned circuit as load
5.5 Grounded base RF amplifier
5.6 Neutralization in RF amplifiers
5.7 Troubles in RF amplifier
5.8 Applications of RF amplifier

Paper B

6. Intermediate Frequency (IF) Amplifiers **04 Hours**

6.1 Need and requirement of IF amplifier
6.2 Single stage IF amplifier
6.3 Multistage IF amplifier
6.4 Automatic Gain control and stagger tunning
6.5 Neutralization of IF amplifiers
6.6 Integrated Circuit IF Amplifier
6.7 Troubles in IF amplifier
6.8 Applications of RF amplifier

7. Oscillators **10 Hours**

7.1 Definition of Oscillator
7.2 Conditions for an amplifier to work as an oscillator
7.3 Requisites of an oscillator
7.4 Classification of oscillator circuits
7.5 RC phase shift oscillator
7.6 Wien bridge oscillator
7.7 Hartley Oscillator
7.8 Colpitts Oscillator
7.9 Crystal Oscillator
7.10 Condition of sustained oscillation
7.11 Voltage controlled oscillator using 555 timer IC
7.12 Reasons of instability in oscillator circuit
7.13 Remedies of instability in oscillator
7.14 Applications of oscillator

8. Operational Amplifier **16 Hours**

8.1 Introduction to Operational Amplifier (Op-Amp)
8.2 Op-Amp data sheet parameters
8.3 Op-Amp with negative feedback
8.4 Non-Inverting Amplifier
8.5 Inverting Amplifier
8.6 Differential Amplifier
8.7 Voltage follower
8.8 Summing Amplifier
8.9 Op-amp as differentiator
8.10 Op-amp as integrator
8.11 Introduction to 741 Op-amp

9. Multivibrators (MVs) 08 Hours

9.1 Definition and types of multivibrators
9.2 Monostable MV
9.3 Collector coupled monostable MV
9.4 Emitter Coupled monostable MV
9.5 Op-amp as monostable MV
9.6 Applications of monostable MV
9.7 Stable MV
9.8 Emitter Coupled stable MV
9.9 Generation of square, rectangular, sawtooth and pulse by using stable multivibrator
9.10 Control of period and frequency of stable MV
9.11 Applications of stable MV

10. Ramp and Pulse Generators 06 Hours

10.1 RC ramp generator
10.2 Constant current ramp generator
10.3 UJT relaxation oscillator
10.4 Bootstrap ramp generator
10.5 Miller integrator ramp generator
10.6 Pulse Generator
10.7 Introduction to Function Generator

11. Comparator And Schmitt Trigger 04 Hours

11.1 Introduction to comparator
11.2 Diode comparator
11.3 Transistor Schmitt trigger circuit
11.4 Output/Input characteristics
11.5 Op-amp Schmitt trigger circuit

REFERENCE BOOKS

1. Electronics Devices by Thomas L. Floyd (Latest Edition)
2. Analog Circuit Design by Bob Dobkin and Jim Williams (Latest Edition)
3. Electronic Devices and Circuits Theory by Robert L. Boylestad (Latest Edition)

Instructional Objectives

(Paper A)

1. Introduction to Amplifiers

1.1 Introduction to amplifiers and amplification process,
- 1.1.1 Define amplifier.
- 1.1.2 Describe its importance and explain need of amplification.

1.2 Basic amplifier concept using transistors (BJT & FET),
- 1.2.1 Define the terms current gain, voltage and power gain.

1.3 Classification of amplifiers,
- 1.3.1 Classify the amplifiers with respect to,
  - 1.3.1.1 Device used.
  - 1.3.1.2 Circuit configuration.
  - 1.3.1.3 Band of frequency handled.
  - 1.3.1.4 Class of biasing employed.
  - 1.3.1.5 Type of application.

1.4 Region of transistor biasing,
- 1.4.1 Define Active Region.
- 1.4.2 Define Cut off Region.
- 1.4.3 Define Breakdown Region.
- 1.4.4 Define Saturation Region.

1.5 Biasing methods of amplifier,
- 1.5.1 Describe Fixed Bias.
- 1.5.2 Describe Self-Bias.
- 1.5.3 Describe Voltage Divider Bias.
- 1.5.4 Describe Stabilized Bias.

1.6 Amplifiers Configuration w.r.t to input and output signals,
- 1.6.1 Draw and explain the working of Common Base Configuration.
- 1.6.2 Draw and explain the working of Common Emitter Configuration.
- 1.6.3 Draw and explain the working of Common Collector Configuration.
- 1.6.4 Draw and explain the working of Common Source Configuration.
- 1.6.5 Draw and explain the working of Common Gate Configuration.
- 1.6.6 Draw and explain the working of Common Drain Configuration.

1.7 Describe Q Point and Load Line.

1.8 Describe Instability in Q Point and define Thermal Runaway.

1.9 Describe the methods of Stabilization of Q-point.

2. Multi-stage Amplifiers

2.1 Definition and need of coupling.

2.2 Define single stage and multistage amplifiers.

2.3 Draw and describe block diagram of multi stage amplifiers.

2.4 State principle of coupling.

2.5 Describe the types of Coupling of Amplifiers.

2.6 RC coupled amplifier,
- 2.6.1 Definition.
- 2.6.2 Circuit.

2.6.3 Frequency Response.
2.6.4 Merits and Demerits.
2.6.5 Uses.

2.7 Impedance coupled amplifier,
2.7.1 Definition.
2.7.2 Circuit.
2.7.3 Frequency Response.
2.7.4 Merits and Demerits.
2.7.5 Uses.

2.8 Transformer coupled amplifiers,
2.8.1 Definition.
2.8.2 Circuit.
2.8.3 Frequency Response.
2.8.4 Merits and Demerits.
2.8.5 Uses.

2.9 Direct coupled amplifiers,
2.9.1 Definition.
2.9.2 Circuit.
2.9.3 Frequency Response.
2.9.4 Merits and Demerits.
2.9.5 Uses.

3. Audio Frequency (AF) Power Amplifiers

3.1 Describe the distinction between voltage, Current and power amplifier.
3.2 Classification of power amplifier.
3.3 Class A AF power amplifier,
3.3.1 Circuit and working.
3.4 Define Class B Push-Pull amplifiers.
3.5 Explain working of Center Tapped class B Push-Pull amplifier.
3.6 Explain working of Complementary pair class B push-pull amplifier.
3.7 Define Cross-over distortion and its remedies.
3.8 Define Heat sinks for power amplifier.

4. Feedback Amplifiers

4.1 Definition and Principle of feedback in amplifiers,
4.1.1 List the problems faced in amplifier without feedback with reference to distortion, instability and bandwidth.
4.2 Define Positive Feedback and describe its uses.
4.3 Define negative feedback and its types,
4.3.1 describe the principle of negative feedback in amplifiers.
4.4 Effects of Feedback,
4.4.1 Discuss the effect of negative feedback on amplifier:
4.4.1.1 Gain,
4.4.1.2 Bandwidth,
4.4.1.3 Distortion,
4.4.1.4 And Stability.
4.5 Draw and explain Emitter follower.

5. Radio Frequency (RF)Amplifiers

5.1 Definition and Requirements of RF amplifier.
5.2 Principle and characteristics of RF Amplifier.
5.3 Multistage RF amplifier,
5.3.1 Names different methods of coupling in R.F amplifier.

5.3.2 List the applications muti-stage RF amplifiers.

5.4 Class-C RF power amplifier using tuned circuit as load,

5.4.1 Draw and explain the circuit diagram of class C power amplifier with tunned load.

5.5 Grounded base RF amplifier,

5.5.1 Draw the circuit diagram of grounded base R.F amplifier.

5.6 Describe neutralization in RF amplifiers.

5.7 Discuss the problems arises in RF amplifier.

5.8 Enlist the applications of RF amplifier.

(Paper B)

6. Intermediate Frequency (IF)Amplifiers

6.1 Describe the need and requirement of IF amplifier.

6.2 Single stage IF amplifier,

6.2.1 Draw and explain the circuit, diagram of single stage IF amplifier.

6.3 Multistage IF amplifier,

6.3.1 Draw and explain the circuit diagram of multistage IF amplifier.

6.4 Define the concepts of Automatic Gain control and stagger tunning.

6.5 Describe the neutralization of IF amplifiers.

6.6 Define Integrated Circuit IF Amplifier.

6.7 Discuss the problems arises in IF amplifier.

6.8 Enlist the applications of RF amplifier.

7. Oscillators

7.1 Definitions of oscillator and oscillation.

7.2 Conditions for an amplifier to work as an oscillator.

7.3 Requisites of an oscillator.

7.4 Classification of oscillator circuits.

7.5 Explain RC phase shift oscillator,

7.5.1 Definition.

7.5.2 Circuit.

7.5.3 Frequency Range.

7.5.4 Formula for Frequency.

7.5.5 Uses.

7.6 Explain Wien bridge oscillator,

7.6.1 Definition.

7.6.2 Circuit.

7.6.3 Frequency Range.

7.6.4 Formula for Frequency.

7.6.5 Uses.

7.7 Explain Hartley Oscillator,

7.7.1 Definition.

7.7.2 Circuit.

7.7.3 Frequency Range.

7.7.4 Formula for Frequency.

7.7.5 Uses.

7.8 Explain Colpitts Oscillator,

7.8.1 Definition.

7.8.2 Circuit.

7.8.3 Frequency Range.

7.8.4 Formula for Frequency.

7.8.5 Uses.

7.9 Explain Crstal Oscillator,

7.9.1 Definition.

7.9.2 Piezo Electric Effect.

7.9.3 Circuit.

7.9.4 Frequency Range.

7.9.5 Formula for Frequency.

7.9.6 Uses.

7.10 Describe Condition of sustained oscillation.

7.11 Explain Voltage controlled oscillator using 555 timer IC.

7.12 Explain the reasons of instability in oscillator circuit.

7.13 Remedies of instability in oscillator.

7.14 Enlist the applications of oscillator.

8. Operational Amplifier

8.1 Introduction to operational Amplifier,

8.1.1 Draw the block diagram and symbol for an operational amplifier.

8.1.2 Identify the function of each block of an Op-amp.

8.1.3 Describe Ideal Op-amp.

8.1.4 Describe Practical Op-amp.

8.2 Enlist ten important data sheet parameters of om-amp.

8.3 Explain Op-Amp with negative feedback.

8.4 Draw and explain working of Non-Inverting Amplifier.

8.5 Draw and explain working of Inverting Amplifier.

8.6 Draw and explain working of Differential Amplifier,

8.6.1 Explain Modes of Operation amplifiers.

8.6.2 Define Common Mode Rejection Ratio.

8.7 Draw and explain working of Voltage follower.

8.8 Draw and explain working of Summing Amplifier.

8.9 Draw and explain working of Op-amp as differentiator.

8.10 Draw and explain working of Op-amp as integrator.

8.11 Introduction to 741 Op-amp.

9. Multivibrators

9.1 Definition and types of multivibrators.

9.2 Explain Monostable MV.

9.3 Draw and Explain working of Collector coupled monostable MV.

9.4 Draw and Explain working of Emitter Coupled monostable MV.

9.5 Draw and Explain working of Op-amp as monostable MV.

9.6 Enlist the applications of monostable MV.

9.7 Explain Stable MV.

9.8 Draw and Explain working of Emitter Coupled stable MV.

9.9 Explain generation of square, rectangular, sawtooth and pulse by using stable MV.

9.10 Describe control of period and frequency of stable MV.

9.11 Enlist the applications of stable MV.

10. Ramp and Pulse Generators

10.1 Draw Ramp waveform and enlist its method of generation.

10.2 Draw and explain working of RC ramp generator.

10.3 Draw and explain working of constant current ramp generator.

10.4 Draw and explain working of UJT relaxation oscillator.

10.5 Draw and explain working of Bootstrap ramp generator.
10.6 Draw and explain working of miller integrator ramp generator.
10.7 Draw and explain working of Pulse Generator.
10.8 Introduction to Function Generator.

11. Comparator And Schmitt Trigger

11.1 Introduction to comparator.
11.2 Draw and explain working of Diode comparator.
11.3 Draw and explain working of Transistor Schmitt trigger circuit.
11.4 Output/Input characteristics.
11.5 Draw and explain working of Op-amp Schmitt trigger circuit.

LIST OF PRACTICAL 96 Hours

1. Assemble a CE Amplifier circuit and study its characteristics.
2. Assemble a class A power amplifier and measure its power gain.
3. Assemble a 25-W and 50-W power amplifier using IC amplifiers.
4. Measurement the power, distortion, gain and efficiency the previously assembled IC power amplifier.
5. Study the frequency response of directed coupled audio amplifier and calculate its bandwidth.
6. Study the frequency response of RC coupled audio amplifier and calculate its bandwidth.
7. Study the frequency response of transformer coupled amplifier and calculate its bandwidth
8. Assemble a RF amplifier and measure its voltage gain.
9. Assemble and study the class-C operation of RF amplifier and measure its power output.
10. Study of frequency response of RF amplifier using tuned load.
11. Assemble a RC Phase Shift oscillator and study it's working.
12. Assemble a Hartley oscillator and study it's working.
13. Assemble a Colpitis oscillator and study it's working.
14. Assemble a Crystal oscillator and study it's working.
15. Construct non-inverting amplifier with the help of Op-Amp. and study its operation.
16. Construct Inverting amplifier with the help of Op-Amp. and study its operation.
17. Construct an Op-Amp Summer and study its operation.
18. Construct an Op-Amp Unity follower and study its operation.
19. Construct an Op-Amp Integrator and study its operation.
20. Construct an Op-Amp Differentiator and study its operation.
21. Construct an Op-Amp Comparator and study its operation.
22. Study the working of an emitter-coupled stable multivibrator.
23. Assemble an emitter-coupled monostable multivibrator.
24. Assemble a bistable multivibrator with collector triggering.
25. Study the behavior of RC differentiator and integrator circuits for step, square, and pulse input.
26. Study the performance of RC Ramp generator.
27. Study the performance of a constant current sweep generator.
28. Assemble a UJT Relaxation oscillator and observe its output wave forms.
29. Assemble a bootstrap ramp generator.
30. Assemble a Miller integrator ramp generator.
31. Assemble a diode comparator and study it's working.
32. Construct a Schmitt trigger using Op-Amp.

Eltr-263- Electrical Instruments & Measurements

Total Contact Hours:

		T	P	C
Theory	64			
Practical	96	2	3	3

Learning Outcomes:

After this course the students will be able to:

- Become proficient in using every tool and instrument in industry.
- Troubleshoot plant process problems while using these instruments and tools, and they will be able to improve process accuracy by calibrating industrial sensors.
- Develop skills in the proper selection, use, handling, maintenance, and repair of various electrical and electronic instruments

Course Contents

1. MEASUREMENTS AND ERROR **02 Hours**

1.1 Precision of measurements
1.2 Types of errors
1.3 Accuracy rating of instruments

2. INDICATING INSTRUMENTS **16 Hours**

2.1 Introduction to meters
2.2 D'arsonval Meter movements
2.3 Ammeters, millimetres, micrometre and shunts
2.4 Shunt calculations
2.5 Voltmeter, multiplier and sensitivity
2.6 Basic Ohmmeter (Conversion of ammeter into ohmmeter)
2.7 Ac meters (rectifier, moving iron-vane, electrodynamometer, thermocouple and clamp-on type)

3. VOLT-OHM MILLI-AMMETER (VOM) **03 Hours**

3.1 Basic requirements
3.2 Ranges and Sub functions
3.3 Basic types of Volt-Ohm-Milli-ammeters
3.4 Application

4. BRIDGES AND BRIDGE-TYPE EQUIPMENT **10 Hours**

5.1 Introduction
5.2 Wheatstone bridge and Guarded Whetstone Bridge
5.3 AC bridges (magnitude and phase balancing)
5.4 Maxwell bridge
5.5 Hay's bridge
5.6 Schering bridge
5.7 Wien bridges
5.8 Q meter
5.9 LC meter

6. OSCILLOSCOPES **07 Hours**

6.1 Theory and operation
6.2 Single/dual trace (general purposes)
6.3 Triggered Sweep
6.4 Digital Storage Oscilloscope

7. DIGITAL INSTRUMENTS. 07 Hours

7.1 Digital Voltmeter
7.2 Digital Multi-meter
7.3 Frequency Counter
7.4 Digital LCR meter
7.5 Digital I.C. tester
7.6 Signal Tracer
7.7 X- Y Recorder
7.8 Analysers

8. MISCELLANEOUS TEST INSTRUMENTS 06 Hours

8.1 Wattmeter, electro-dynamometer type
8.2 Energy meter, induction type
8.3 Wattmeter, RF
8.4 Sound level meter
8.5 Field strength meter
8.6 Earth Ground Tester and Methods of earth testing

9. PROBES 04 Hours

9.1 High Voltage probes
9.2 RF probes
9.3 Logic probes
9.4 Logic pulser
9.5 Logic clip

10. CALIBRATION OF INSTRUMENTS 04 Hours

10.1 Calibration Standards
10.2 Calibration Techniques
10.3 Types of Calibration Instruments

11. VIRTUAL INSTRUMENTATION 05 Hours

11.1 Introduction of Virtual Instrumentation.
11.2 Virtual Instrumentation Architecture.
11.3 Applications of Virtual Instrumentation.

RECOMMENDED BOOKS

1. Cycle N. Herrick Instruments & Measurement for Electronics (Latest edition).
2. Measurement and Instrumentation Principles - Alan S Morris, (Latest edition)
3. Malvino, Electronic Instrumentation Fundamentals, (Latest edition)
4. Introduction to Instrumentation and Measurements– Robert B. Northrop, (Latest edition)

Instructional Objectives

1. MEASUREMENTS AND ERROR

1.1 Precision of measurements

1.2 Types of errors

1.3 Accuracy rating of instruments

2. INDICATING INSTRUMENTS

2.1 Introduction to meters

2.1.1 List the types of indicating instruments

2.2 D'arsonval Meter movements

2.2.1 Explain the working of PMMC (D'Arsonval) movement

2.2.2 Enlist the uses of (PMMC) mechanism

2.3 Ammeters, millimetres, micrometre and shunts

2.3.1 Working principles of Ammeter, millimetres and micrometres

2.3.2 Derive the formula to find the value of shunt resistor, Rs= RmIm / (I-Im)

2.4 Shunt calculations

2.5 Voltmeter, multiplier and sensitivity

2.5.1 Identify the function of multiplier resistor

2.5.2 Derive the formula to find the value of multiplier resistance, Rm = (V- ImRm)/ Im

2.5.3 Draw a circuit arrangement of a multi-range voltmeter using multiplier resistors

2.6 Basic Ohmmeter (Conversion of ammeter into ohmmeter)

2.6.1 Draw the circuit of a basic Ohmmeter

2.6.2 Explain the working of a basic Ohmmeter

2.6.3 List the uses of Ohmmeter

2.7 Ac meters (rectifier, moving iron-vane, electrodynamometer, thermocouple and clamp-on type)

2.7.1 List the classes of AC meters

2.7.2 Name the type of instrument mechanism used for each class of AC meter

2.7.3 Draw the schematic diagram a rectifier type AC meter

2.7.4 Explain the working of rectifier type AC meter

2.7.5 Describe the working principle of a clamp-on AC meter

2.7.6 Explain the working principal of moving iron-vane mechanism

2.7.7 Draw the schematic diagram of an electrodynamometer movement

2.7.8 Compare the rectifier, moving iron-vane and electrodynamometer type AC meter

2.7.9 Draw the schematic diagram of a basic thermocouple instrument

2.7.10 Explain the working of thermocouple instrument

2.7.11 List the uses of above four types of AC meters

3. VOLT-OHM MILLI-AMMETER (VOM)

3.1 Basic requirements

3.1.1 Identify the importance of volt-ohm milliammeter (multi-meter)

3.1.2 Draw and label the block diagram showing three functions of multi-meter (VOM)

3.2 Ranges and Sub functions

3.3 Basic types of Volt-Ohm-Milli-ammeters

3.4 Application

3.4.1 Describe the use of VOM in making:
a. Voltage measurement (AC + / - and DC)
b. Current measurement.
c. Decibel measurement

4. BRIDGES AND BRIDGE-TYPE EQUIPMENT

4.1 Introduction of AC and DC bridges
4.2 Wheatstone bridge and Guarded Whetstone Bridge
4.2.1 Draw the circuit diagram of Wheatstone bridge
4.2.2 Explain the working of Wheatstone bridge
4.2.3 Identify the function of Guard terminal in a Guarded Wheatstone bridge
4.2.4 List the applications of Wheatstone bridge
4.3 AC bridges (magnitude and phase balancing)
4.3.1 Draw the general diagram of an AC bridge
4.3.2 State the balance (Magnitude and Phase) equation for a general AC bridge
4.4 Maxwell bridge
4.4.1 Draw the schematic diagram of Maxwell Bridge
4.4.2 Describe the procedure of balancing Maxwell bridge
4.4.3 Derive the balance equation of Maxwell bridge to find the unknown inductance
4.5 Hay's bridge
4.5.1 Draw the schematic diagram of Hay bridge
4.5.2 Drive the equation to find the unknown inductance
4.6 Schering bridge
4.6.1 Draw the schematic diagram of Schering bridge
4.6.2 Write the balance equation for Schering bridge to find Cx, p.f, D and Q of series RC circuit
4.7 Wien bridges
4.7.1 Draw the schematic diagram of Wien bridge
4.7.2 Describe the procedure of balancing Wien bridge to find the value of unknown frequency of a signal
4.7.3 List the application of Wien bridge
4.8 Q meter
4.8.1 Draw the schematic diagram of basic Q-meter
4.8.2 Explain the working of Q-meter
4.9 LC meter
4.9.1 Draw a block diagram of LC meter
4.9.2 Identify the function of each block of LC meter

6. OSCILLOSCOPES

6.1 Theory and operation
6.1.1 List the four fundamental parameters that may be represented by an oscilloscope.
6.1.2 Sketch a cathode ray tube (CRT) and label the most important parts.
6.1.3 Describe the function of each part of a CRT.
6.1.4 Sketch the control circuit of a CRT.
6.1.5 Explain the purpose of each control of CRT
6.2 Single/dual trace (general purposes)
6.2.1 Draw the block diagram of general-purpose oscilloscope.
6.2.2 Explain the function of each block of the oscilloscope.
6.2.3 Draw the block diagram of vertical section of an oscilloscope.
6.2.4 Explain the function of each block of vertical section of CRO

6.2.5 Describe the purpose of delay line in the vertical section of a CRO
6.2.6 Draw the block diagram of the horizontal section of a CRO
6.2.7 Explain the function of each block of horizontal section of a CRO
6.2.8 Identify the function of a sweep generator in an oscilloscope
6.2.9 List the types of sweep generator used in oscilloscopes
6.2.10 Describe the importance of dual trace oscilloscope.
6.2.11 Differentiate a dual beam CRT from a dual trace CRT.
6.2.12 Conversion single trace into a dual trace display.
6.2.13 Explain the working of electronic switch circuit for a dual trace display

6.3 Triggered Sweep
6.3.1 Identify the action of Schmitt trigger circuit in a triggered oscilloscope
6.3.2 List the application for which triggered sweep is superior to a recurrent type of sweep

6.4 Digital Storage Oscilloscope
6.4.1 Identify the purpose of storage oscilloscope
6.4.2 List the types of storage CRT
6.4.3 Draw and label the simplified diagram of storage CRT
6.4.4 Explain the function of each part of a storage CRT
6.4.5 Enlist the advantages of storage oscilloscope

7. DIGITAL INSTRUMENTS.

7.1 Digital Voltmeter
7.1.1 Enlist the types of digital voltmeter (DVM)
7.1.2 Illustrate the voltage-to-time conversion principle of ramp-type DVM
7.1.3 Draw the block diagram of ramp-type DVM
7.1.4 Draw the block diagram of staircase ramp type DVM
7.1.5 Identify the function of its each block.
7.1.6 Draw the block diagram of dual-slope type DVM
7.1.7 Explain the function of its each block
7.1.8 Compare the above three types of DVMs

7.2 Digital Multimeter
7.2.1 Draw the block diagram of dual-slope type digital multimeter
7.2.2 Identify the function of its each block.
7.2.3 Identify the function of each control of DVM and digital multimeter

7.3 Frequency Counter
7.3.1 Define the term “Frequency Counter”
7.3.2 Draw the block diagram of basic counter
7.3.3 Identify the blocks of basic counter involved in frequency measurement operation

7.4 Digital LCR meter
7.4.1 Draw the block diagram of digital LCR meter
7.4.2 Identify the function of its each block

7.5 Digital I.C. tester
7.5.1 Draw the block diagram of digital IC tester
7.5.2 Explain the operation of each block of digital IC tester
7.5.3 Explain the application of digital IC tester

7.6 Signal Tracer
7.6.1 Draw the block diagram of Signal Tracer.
7.6.2 Explain the operation of each block of Signal Tracer
7.6.3 Explain the application of Signal Tracer

7.7 X- Y Recorder
7.7.1 List the two basic types of recorders used as electronic test equipment
7.7.2 Draw the block diagram of a basic X-Y recorder or plotter system

7.7.3 Describe the function of each block of X-Y recorder

7.8 Analyzers

7.8.1 Draw the block diagram of spectrum analyzer

7.8.2 Explain the function of each block of spectrum analyzer

7.8.3 Enlist the application of spectrum analyzer

8. MISCELLANEOUS TEST INSTRUMENTS

8.1 Wattmeter, electro-dynamometer type

8.1.1 Draw the schematic diagram of electrodynamometer type watt meter

8.1.2 Explain the working of the watt meter

8.2 Energy meter, induction type

8.2.1 Draw the circuit diagram of induction type energy meter.

8.2.2 Explain the working of energy meter

8.3 RF Wattmeter

8.3.1 Draw the diagram of RF watt meter

8.3.2 Explain the operation of RF watt meter

8.3.3 List the uses of RF watt meter

8.4 Sound level meter

8.4.1 Draw the block diagram of sound level meter

8.4.2 Explain the operation of each block of sound level meter

8.4.3 Explain the application of sound level meter

8.5 Field strength meter

8.5.1 Draw the block diagram of field strength meter

8.5.2 Explain the operation of each block of field strength meter

8.5.3 List the applications of field strength meter

8.6 Define the Earth Ground Tester and explain the methods of earth testing

9. PROBES

9.1 High Voltage probes

9.1.1 Draw the circuit diagram of high voltage probe (resistance & capacitance types)

9.1.2 Explain the working of high voltage probe

9.2 RF probes

9.2.1 Draw the circuit diagram of RF probe

9.2.2 Explain the function of RF probe

9.3 Logic probes

9.3.1 Draw the block diagram of a basic logic probe

9.3.2 Explain the working of basic logic probe

9.4 Logic pulser

9.4.1 Draw the block diagram of a simple logic pulser

9.4.2 Explain the working of logic pulser

9.4.3 List the applications of logic probe and pulser

9.5 Explain the working of logic clip

10. CALIBRATION OF INSTRUMENTS

10.1 Explain Standards of Calibration of Measuring Instruments.

10.2 Explain the techniques of calibration of Measuring Instruments

10.3 Describe the report of calibration of Measuring Instruments

10.4 Explain the common faults in Digital Instruments with their symptoms, causes and remedies

10.5 Types of Calibration Instruments

10.5.1 Describe the function of HART communicators

10.5.2 Describe the function of flow meters

10.5.3 Describe the function of deadweight tester

11. VIRTUAL INSTRUMENTATION

11.1 Describe the need of Virtual Instrumentation
11.2 Discuss architecture of Virtual Instrument
11.3 Discuss sensor, computing and processing modules
11.4 Describe applications of Virtual Instrumentations

LIST OF PRACTICAL:
96Hours

1. Study and use of transistor voltmeter
2. Study of universal bridge and its use to measure unknown inductances and capacitances
3. Conversion of ammeter into voltmeter using multiplier resistance
4. Conversion of ammeter into ohmmeter
5. Study and use of transistor voltmeter
6. Study and use of transistor tester for the testing for different semiconductor devices
7. Study of whetstone bridge and its use to measure unknown resistor
8. Study of universal bridge and its use to measure unknown inductances and capacitances
9. Use digital LCR meter to measure the unknown values of L, C and R
10. Study of oscilloscope controls and connectors
11. Use of oscilloscope in measuring voltage, frequency, phase shift
12. Study of different stages of CRO and their identification. Study and use of storage and sampling oscilloscopes
13. Use of A.F. generator and measurement of its output wave with CRO
14. Use wattmeter to measure single phase a-c power
15. Use of frequency counter to measure unknown frequency
16. Use of sound level meter
17. Use of Q meter to measure Q factor of a circuit
18. Use of X-Y recorder
19. Use of clamp-on meter to measure AC current
20. Measure high tension voltage of a CRT using high voltage probe
21. Test logic signals using logic probe/logic clip and logic pulser
22. Study the working of digital circuits using a logic analyzer
23. Demonstrate voltmeter test and calibration:
    i) against a standard voltmeter
    ii) using the balance method
24. Demonstrate the analog ammeter calibration by:
    i) using precision resistance & precision voltmeter.
25. Check an AF generator for:
    i) frequency stability.
    ii) output uniformity
    iii) attenuator action
    iv) output hum
    v) output distortion
    vi) load sensitivity
26. Check oscilloscope for voltage calibration with:
    i) external DC and AC
    ii) internal AC
    iii) internal square wave
27. Locate & rectify common faults in meters (available in Lab)
28. Locate & rectify common faults in Oscilloscope.
29. Locate & rectify common faults in digital instruments (available in Lab)
30. Locate & troubleshoot common faults in bridges and analyzers.
31. Use virtual instruments for the measurement of voltage and current.
32. Use virtual instruments for the measurement of frequency and time period.

Comp-272-Introduction to Computer Programming

Total Contact Hours

		T	P	C
Theory	32			
Practical	96	1	3	2

Learning Objectives:

After this course the student will be able to:

- Foundational programming knowledge, including Demonstrate understanding of programming languages, algorithms, and problem-solving techniques.
- Develop and implement C programs using core programming concepts and data structures.
- Apply problem-solving skills to design and implement effective solutions using the C programming language.
- Gain a basic understanding of modern programming languages and their applications.

Course Contents:

1. Introduction to Computers and Programming Languages **2 Hours**

- 1.1. Programming Languages
- 1.2. Categories of Programming Languages
- 1.3. Machine Languages
- 1.4. Symbolic or Assembly Language
- 1.5. High-Level Languages
- 1.6. Features of Programming Languages

2. The Programming Cycle **2 Hours**

- 2.1. Defining the Problem
- 2.2. Planning and Coding Solution
- 2.3. Checking and Debugging
- 2.4. Importance of Readability and Documentation
- 2.5. Flowchart and Pseducode

3. C Building Blocks **2 Hours**

- 3.1. Constants and Variables
- 3.2. Input/Output
- 3.3. Operators
- 3.4. Expressions

4. Conditional Control Construct: Decisions **3 Hours**

- 4.1. The Conditional Operator
- 4.2. The if Statement
- 4.3. The if-else Statement
- 4.4. The else-if Statement
- 4.5. The switch Statement

5. Iterative Control Construct: Loops **4 Hours**

- 5.1. The for Loop
- 5.2. The while Loop
- 5.3. The do while Loop

6. Functions **3 Hours**

6.1. Introduction
6.2. Simple Functions and Value-Returning Functions
6.3. Parameter Passing
6.4. Using Multiple Functions and External Variable
6.5. Recursion & Recursive Functions

7. Arrays and Strings **4 Hours**

7.1. Arrays Introduction
7.2. Multi-dimensional Arrays
7.3. Strings and its operations.

8. Pointers **4 Hours**

8.1. Introduction to Pointer
8.2. Pointers and Functions
8.3. Pointers and Arrays
8.4. Pointers and Strings
8.5. Pointers to Pointers

9. Files **3 Hours**

9.1. Types of Disk I/O and Standard Input/Output
9.2. Binary and Text Mode for Read and Write Operation
9.3. Record Input/Output and Random Access to file
9.4. Error conditions and Redirection

10. Introduction to Modern Programming Language **5 Hours**

10.1. Introduction to some modern programming language like Python
10.2. Key syntax difference in C and Python
10.3. Concept of variable assignment, decisions, functions and strings
10.4. Introduction to List, Tuple, Set and Dictionaries

REFERENCE BOOKS:

1. C Programming: A Modern Approach by K. N. King
2. C Primer Plus by Stephen Prata
3. The C Programming Language (Latest Edition) by Brian W. Kernighan and Dennis Ritchie
4. Python Programming: An Introduction to Computer Science, (Latest Edition) by John M. Zelle
5. Python Crash Course, (Latest Edition) by Eric Matthes

Instructional objectives:

1. **Computers and Programming Languages**
   - **1.1. Programming Languages**
     - 1.1.1. Define and differentiate between machine language, assembly language, and high-level programming languages.
     - 1.1.2. Provide examples of common high-level languages (e.g., C, C++, Java, Python).
     - 1.1.3. Explain the advantages and disadvantages of each type of programming language.
   - **1.2. Categories of Programming Languages**
     - 1.2.1. Classify programming languages based on their paradigms (e.g., procedural, object-oriented, functional).
     - 1.2.2. Describe the key characteristics of each programming paradigm.
   - **1.3. Machine Languages**
     - 1.3.1. Explain the characteristics and limitations of machine language.
     - 1.3.2. Explain how machine language instructions are executed by the CPU.
   - **1.4. Symbolic or Assembly Language**
     - 1.4.1. Describe the purpose and advantages of assembly language.
     - 1.4.2. Explain the relationship between assembly language and machine language.
   - **1.5. High-Level Languages**
     - 1.5.1. Explain the key features and benefits of high-level languages.
     - 1.5.2. Discuss the role of compilers and interpreters in executing high-level language programs.
   - **1.6. Features of Programming Languages**
     - 1.6.1. Identify key features of programming languages such as data types, operators, control flow, and functions.
     - 1.6.2. Explain the significance of these features in program development.
2. **The Programming Cycle**
   - **2.1. Defining the Problem**
     - 2.1.1. Analyze a given problem to identify its requirements and constraints.
     - 2.1.2. Formulate a clear and concise problem statement.
     - 2.1.3. Break down complex problems into smaller, more manageable subproblems.
   - **2.2. Planning and Coding Solution**
     - 2.2.1. Develop an algorithm to represent the solution to the problem.
     - 2.2.2. Translate the algorithm into a working program using a chosen programming language.
     - 2.2.3. Write clean, well-structured, and readable code.
   - **2.3. Checking and Debugging**
     - 2.3.1. Identify and correct syntax errors and logical errors in a program.
     - 2.3.2. Use debugging tools and techniques (e.g., print statements, debuggers) to locate and fix program errors.
     - 2.3.3. Test programs thoroughly with different input values to ensure correctness.
   - **2.4. Importance of Readability and Documentation**
     - 2.4.1. Write well-commented and readable code.

2.4.2. Explain the importance of proper documentation for software maintenance and collaboration.
2.4.3. Create and maintain documentation (e.g., comments, user manuals) for software projects.

2.5. Flowchart and Pseducode

2.5.1. Create flowcharts and pseudocode to represent the logic of a program.
2.5.2. Interpret given flowcharts and pseudocode to understand program logic.
2.5.3. Translate between flowcharts, pseudocode, and program code.

3. C Building Blocks

3.1. Constants and Variables

3.1.1. Declare and initialize variables of different data types (int, float, char, etc.).
3.1.2. Understand the concept of scope and lifetime of variables.
3.1.3. Use constants effectively in a program to improve readability and maintainability.

3.2. Input / Output

3.2.1. Use standard input/output functions (scanf, printf) for input and output operations.
3.2.2. Format input and output using appropriate format specifiers.

3.3. Operators

3.3.1. Apply arithmetic, relational, logical, and bitwise operators in C expressions.
3.3.2. Understand operator precedence and associativity.
3.3.3. Evaluate complex expressions involving multiple operators.

3.4. Expressions

3.4.1. Evaluate C expressions involving variables, operators, and parentheses.
3.4.2. Write C expressions to solve simple mathematical problems.

4. Conditional Control Construct: Decisions

4.1. The Conditional Operator

4.1.1. Use the conditional operator (ternary operator) to make simple decisions.
4.1.2. Compare the use of the conditional operator.

4.2. The if Statement

4.2.1. Implement conditional statements using the if statement.
4.2.2. Write programs that make decisions based on given conditions.

4.3. The if-else Statement

4.3.1. Implement conditional statements using the if-else statement.
4.3.2. Handle multiple conditions using nested if-else statements.

4.4. The else-if Statement

4.4.1. Implement multi-way branching using the else-if statement.
4.4.2. Compare the use of else-if with nested if statements.

4.5. The switch Statement

4.5.1. Use the switch statement to handle multiple cases based on the value of an expression.
4.5.2. Explain the advantages and limitations of the switch statement compared to if-else.

5. Iterative Control Construct: Loops

5.1. The for Loop

5.1.1. Implement for loops to execute a block of code repeatedly for a specific number of times.
5.1.2. Use nested for loops to solve problems involving multiple iterations.

5.2. The while Loop

5.2.1. Implement while loops to execute a block of code as long as a condition is true.

5.2.2. Use while loops for indefinite iteration.

5.3. The do-while Loop

5.3.1. Implement do-while loops to execute a block of code at least once and then repeatedly as long as a condition is true.

5.3.2. Compare and contrast while loops and do-while loops.

6. Functions

6.1. Introduction

6.1.1. Explain the purpose and benefits of using functions in a program.

6.1.2. Understand the concept of modularity and code reusability.

6.2. Simple Functions and Value-Returning Functions

6.2.1. Define and call simple functions and functions that return a value.

6.2.2. Write functions to perform specific tasks within a program.

6.3. Parameter Passing

6.3.1. Pass arguments to functions by value and by reference.

6.3.2. Understand the difference between pass-by-value and pass-by-reference.

6.4. Using Multiple Functions and External Variables

6.4.1. Design and implement programs using multiple functions.

6.4.2. Understand the use of global and local variables.

6.4.3. Explain the importance of function prototyping and function signatures.

6.5. Recursion & Recursive Functions

6.5.1. Define and implement recursive functions.

6.5.2. Analyze the base case and recursive step of a recursive function.

6.5.3. Recognize and avoid infinite recursion.

7. Arrays and Strings

7.1. Arrays Introduction

7.1.1. Declare and use one-dimensional arrays.

7.1.2. Access and modify array elements using array indices.

7.1.3. Perform basic array operations (e.g., searching, sorting).

7.2. Multi-dimensional Arrays

7.2.1. Declare and use two-dimensional arrays.

7.2.2. Access and modify elements in multi-dimensional arrays using nested loops.

7.2.3. Apply multi-dimensional arrays to represent matrices and other data structures.

7.3. Strings and its operations.

7.3.1. Understand the concept of strings in C as arrays of characters.

7.3.2. Perform basic string operations (e.g., string concatenation, string comparison, string length).

7.3.3. Use string library functions (e.g., strcpy, strcat, strcmp).

8. Pointers

8.1. Introduction to Pointer

8.1.1. Declare and use pointers to variables.

8.1.2. Understand the concept of memory addresses and pointers.

8.1.3. Use pointers to access the values they point to.

8.2. Pointers and Functions

8.2.1. Pass arguments to functions by reference using pointers.

8.2.2. Return pointers from functions.

8.3. Pointers and Arrays

8.3.1. Use pointers to access and manipulate array elements.

8.3.2. Understand the relationship between arrays and pointers.

8.4. Pointers and Strings

8.4.1. Use pointers to work with strings.

8.4.2. Implement string operations using pointer arithmetic.

8.5. Pointers to Pointers

8.5.1. Declare and use pointers to pointers.

8.5.2. Understand the concept of double indirection.

9. Files

9.1. Types of Disk I/O and Standard Input/Output

9.1.1. Understand the difference between standard input/output and file I/O.

9.1.2. Explain the purpose of file streams.

9.2. Binary and Text Mode for Read and Write Operations

9.2.1. Perform file operations in binary and text modes.

9.2.2. Explain the differences between binary and text modes.

9.3. Record Input/Output and Random Access to file

9.3.1. Read and write data to files in a structured format (e.g., using structs).

9.3.2. Access specific records within a file using random access file operations.

9.4. Error conditions and Redirection

9.4.1. Handle file I/O errors (e.g., file not found, permission denied).

9.4.2. Use input/output redirection to redirect input and output to/from files.

10. Introduction to Modern Programming Language

10.1. Introduction to some modern programming language like Python

10.1.1. Identify key features and advantages of Python (e.g., high-level, interpreted, object-oriented).

10.1.2. Explain common use cases for Python (e.g., data science, web development, scripting).

10.2. Key syntax difference in C and Python

10.2.1. Compare and contrast the syntax of C and Python in terms of variable declaration, control flow, and function definitions.

10.2.2. Discuss the advantages and disadvantages of each language in terms of syntax and readability.

10.3. Concept of variable assignment, decisions, functions and strings

10.3.1. Demonstrate the implementation of variable assignment, conditional statements, functions, and string manipulation in Python.

10.3.2. Write simple Python programs to solve basic problems.

10.4. Introduction to List, Tuple, Set and Dictionaries

10.4.1. Understand the concept of data structures in Python.

10.4.2. Use lists, tuples, sets, and dictionaries to store and manipulate data.

LIST OF PRACTICAL: 96 Hours

1. **Basic C Program**

   - Write a simple "Hello, World!" program.
   - Write a program to display basic information about yourself.

2. **Data Types and Variables**

   - Declare variables of different data types (int, float, char, double) and print their sizes in memory.
   - Write a program to calculate the area and perimeter of a rectangle and a circle (use appropriate data types).
   - Write a program to swap the values of two variables using a temporary variable.
   - Write a program to convert centimeters to meters and kilometers.

3. **Operators**

   - Write a program to calculate the simple interest, compound interest, and area of a triangle (demonstrate different arithmetic operators).
   - Write a program to check if a number is divisible by 2, 3, and 5 using the modulo operator.
   - Write a program to find the roots of a quadratic equation using the quadratic formula (incorporate arithmetic and relational operators).

4. **Input/Output**

   - Write a program to read two numbers from the user and print their sum, difference, product, and quotient (cover various arithmetic operations).
   - Write a program to convert temperature from Celsius to Fahrenheit and Fahrenheit to Celsius (use appropriate input and output formatting).
   - Write a program to read a character from the user and check if it's an alphabet, digit, or special symbol (use conditional statements based on input).

5. **Conditional Statements (if-else)**

   - Write a program to check if a year is a leap year (consider divisibility by 4 and 100).
   - Write a program to assign grades based on marks (e.g., A for >= 90, B for >= 80, etc.) using if-else statements.
   - Write a program to determine if a triangle is equilateral, isosceles, or scalene based on the lengths of its sides.
   - Write a program to find the largest of three numbers using nested if-else statements.

6. **Conditional Statements (switch)**

   - Write a program to display the day of the week based on a numerical input (1 for Monday, 2 for Tuesday, etc.) using a switch statement.

- Write a program to implement a simple menu-driven calculator (add, subtract, multiply, divide) using a switch statement.
- Write a program to check if a character is a lowercase letter, uppercase letter, or a digit using a switch statement.
- Write a simple menu for a coffee shop (e.g., options for espresso, latte, cappuccino) using a switch statement.

7. Loops (for)

- Write a program to print the first n natural numbers using a for loop.
- Write a program to calculate the sum of squares of the first n natural numbers using a for loop.
- Write a program to print the Fibonacci series up to a given number of terms using a for loop.
- Write a program to print the multiplication table of a given number up to a specified limit using nested for loops.

8. Loops (while)

- Write a program to find the sum of digits of a number using a while loop.
- Write a program to check if a number is prime or not using a while loop (consider divisibility by 2 and odd numbers only).
- Write a program to generate the Armstrong numbers between a given range (numbers that are equal to the sum of the cubes of their digits) using a while loop.
- Write a program to find the greatest common divisor (GCD) of two numbers using Euclid's algorithm and a while loop.

9. Loops (do-while)

- Write a program to read an integer from the user until a positive number is entered using a do-while loop.
- Write a program to calculate the factorial of a number using a do-while loop.
- Write a program to guess a random number (between 1 and 100) within a limited number of attempts using a do-while loop.
- Write a program to print a simple menu and continuously prompt the user for choices until they select the exit option using a do-while loop.

10. Simple Functions

- Write a function to check if a number is even and call it from your main program.
- Write a function to print a welcome message with your name and call it from your main program.
- Write a function to calculate the area of a square and call it from your main program, passing the side length as an argument.
- Write a function to convert a character to uppercase and call it from your main program.

11. Functions with Parameters (Pass by Value)

- Write a function to calculate the area of a rectangle, taking length and breadth as parameters.

- Write a function to find the maximum of two numbers, taking them as parameters and returning the larger value.
- Write a function to swap the values of two integers using pass by value and call it from your main program.
- Write a function to calculate the simple interest, taking principal, rate, and time as parameters.

12. Functions with Return Values

- Write a function to calculate the factorial of a number and return the result.
- Write a function to check if a number is prime and return 1 if true, 0 otherwise.
- Write a function to calculate the sum of digits of a number and return the result.

13. Functions with Return Values

- Write a function to calculate the GCD of two numbers.
- Write a function to convert a decimal number to binary.
- Write a function to check if a string is a palindrome and return 1 if true, 0 otherwise.

14. Recursion

- Write a recursive function to calculate the factorial of a number.
- Write a recursive function to calculate the Fibonacci series.
- Write a recursive function to calculate the GCD of two numbers.
- Write a recursive function to find the nth term of the Fibonacci series.

15. Arrays (One-Dimensional)

- Write a program to find the largest element in an array.
- Write a program to calculate the average of elements in an array.
- Write a program to search for an element in an array (linear search).
- Write a program to find the sum of all even numbers in an array.

16. Arrays (One-Dimensional)

- Write a program to sort an array in ascending order.
- Write a program to find the second largest element in an array.
- Write a program to reverse the order of elements in an array.

17. Arrays (Two-Dimensional)

- Write a program to add two matrices.
- Write a program to find the largest element in a 2D array.
- Write a program to transpose a matrix.
- Write a program to multiply two matrices.

18. Strings

- Write a program to count the number of vowels in a string.
- Write a program to concatenate two strings.
- Write a program to convert all lowercase letters in a string to uppercase.

19. Strings

- Write a program to reverse a string.
- Write a program to check if a string is a palindrome.
- Write a program to count the number of words in a string.

20. Pointers (Basic)

- Declare a pointer variable and assign the address of another variable to it.
- Use a pointer to access the value it points to.
- Write a program to swap the values of two integers using pointers.
- Write a program to demonstrate pointer arithmetic.

21. Pointers and Arrays

- Write a program to access and modify array elements using pointers.
- Write a program to implement a function to find the length of a string using pointers.
- Write a program to copy one string to another using pointers.

22. Structures

- Define a structure to represent a student record (name, roll number, marks).
- Create an array of structures to store information about multiple students.
- Write a program to read and display student information using the structure.

23. File Handling

- Write a program to write data to a file.
- Write a program to read data from a file.
- Write a program to append data to an existing file.

24. Python Fundamentals

- Write a simple "Hello, World!" program.
- Write a Python program to read two numbers from the user and print their sum.
- Write a Python program to check if a number is even or odd.

25. Python Control Flow and Functions

- Write a Python program to find the largest of three numbers.
- Write a Python program to print the Fibonacci series (up to a specified number of terms).
- Write a Python program to check if a given year is a leap year.
- Write a Python program to implement a simple decision-making scenario (e.g., eligibility for a discount based on age).
- Write a Python function to calculate the factorial of a number.

26. Python Data Structures and Strings

- Create a list of numbers and perform basic operations on it (e.g., append, insert, remove, access elements).
- Create a tuple of numbers and demonstrate its immutability.

- Create a set of numbers and demonstrate its unique property (no duplicates).
- Create a dictionary to store student names and their corresponding grades.
- Write a Python program to concatenate two strings and find the length of the resulting string.

27. Lab Assignments

Some assignments ideas are listed here (1 assignment to individual / group):

i. Student Grade Management System:
- Calculate and display the average and grade of a student based on marks in different subjects.
- Handle multiple students and store the data in an array of structures.
- Include features like searching for a student's record, displaying the class topper, and calculating the class average.

ii. Inventory Management (Simplified):
- Manage a basic inventory of products (using arrays).
- Allow the user to add new products, update existing product information, delete products, and search for products.
- Include basic input validation and error handling.

iii. Library Management System (Simplified):
- Manage a basic library catalog with limited features (e.g., add/search books, basic loan/return functionality).
- Consider using a simple file to store book information (basic file handling).

iv. Employee Payroll System (Simplified):
- Calculate employee salaries, considering factors like hours worked, overtime, and tax deductions.
- Handle basic employee information (name, ID).

v. Simple Calculator:
- Implement a calculator with addition, subtraction, multiplication, division, and modulus operations.
- Include features like operator precedence and handling invalid input (e.g., division by zero).

vi. Unit Converter:
- Convert between different units of measurement (length, temperature, weight, volume).
- Allow the user to select the units to convert from and to.

vii. Currency Converter:
- Convert between different currencies using a simple exchange rate table.

viii. Number Guessing Game:
- Implement a number guessing game with multiple difficulty levels (e.g., different ranges for the random number).
- Provide hints to the user, such as "higher" or "lower."

ix. Tic-Tac-Toe Game:
- Implement a Tic-Tac-Toe game with a simple AI opponent (e.g., random moves).
- Allow players to choose whether to play against another player or against the AI.

x. Hangman Game:
- Implement the Hangman game with a word bank and basic game logic.
- Allow the user to choose the difficulty level (e.g., number of attempts).

xi. Simple To-Do List:
- Create a basic to-do list application where users can add, view, mark tasks as completed, and delete tasks.

- Consider storing the to-do list in a file.

xii. Basic Quiz Application:

- Create a simple quiz with multiple-choice questions and provide feedback to the user.
- Store quiz questions and answers in an array of structures.

xiii. Morse Code Translator:

- Convert text to Morse code and vice versa.
- Implement a basic command-line interface for user interaction.

xiv. Dice Rolling Simulator:

- Simulate the rolling of multiple dice (e.g., two dice) and calculate the sum of the rolls.
- Allow the user to specify the number of dice to roll.
- Optionally, display the probability distribution of different outcomes.

xv. Temperature Conversion Table:

- Generate a table of temperature conversions between Celsius and Fahrenheit within a specified range.
- Allow the user to input the starting and ending temperatures and the step size.

ELTR-273 ELECTRICAL MACHINES

Total Contact Hours

		T	P	C
Theory	64			
Practical	96	2	3	3

Learning Outcomes:

After this course the student will be able to:

- To understand the laws of electromagnetic induction
- To explain the principles and types of DC Generator and DC Motor
- To explain the function of three phase ac motor
- To explain the working principle of single-phase ac motor and their types
- To explain the function of special ac motors

Course Contents:

1. ELECTROMAGNETIC INDUCTION (04 Hours)

1.1 Review of Faraday's Law and Lenz's Law
1.2 Principle of simple loop generator

2. DC GENERATOR (10 Hours)

2.1 Construction
2.2 Field and armature winding and commutator
2.3 EMF Equation
2.4 Simple calculations
2.5 Types and brief description of dc generator
2.6 Methods of excitation and their characteristics

3. DC MOTOR (12 Hours)

3.1 Principle and construction of dc motor
3.2 Back emf, cause and effect
3.3 Torque Equation of dc motor and simple problems
3.4 Types of dc motors, fractional h.p & miniature dc motor
3.5 Methods and need of motor starters

4. ALTERNATOR (10 Hours)

4.1 Construction of alternator
4.2 Importance of stationary armature
4.3 Comparison with DC generator
4.4 Methods of field excitation
4.5 Brief introduction to 3-Phase as generation

5. SINGLE PHASE AC MOTORS (08 Hours)

5.1 Classification of single phase ac motors
5.2 Single phase induction motor
5.3 Double field revolving concept
5.4 Split phase and capacitor start-run induction motor
5.5 Shaded pole motor

6. THREE PHASE AC MOTORS (16 Hours)

6.1 Introduction to three phase rotating magnetic field
6.2 Types of three phase ac motors
6.3 Working principle of induction motor
6.4 Types of three phase induction motors
6.5 Methods of starting and speed control of three phase induction motors
6.6 Line diagram of induction motor starters and connections
6.7 Applications/uses of three induction motors

7. SPECIAL MOTORS (04 Hours)

1.1 Stepper Motor
1.2 Servo Motor
1.3 Linear Motor

REFERENCE BOOKS

1. Hughes A — Electric Motors and Drives: Fundamentals, Types and Applications (Newnes, Latest Edition)
2. Schultz, G — Transformers and Motors (Newnes, Latest Edition)

Instructional Objectives:

1. ELECTROMAGNETIC INDUCTION

1.1 Describe Faraday's law of electromagnetic induction and Lenz's law
1.2 Explain the principle of simple loop generator

2. DC GENERATORS

2.1 Understand the construction and working of DC generator
2.1 Draw the construction of DC generators
2.2 Explain the working of field and armature winding
2.3 Draw the construction of commutator
2.4 Explain the operation of commutator
2.5 Derive the E.M.F. Equation for DC generator
2.6 Solve problems based on EMF equitation
2.7 Enlist the types of DC generator
2.8 Explain the method of field excitation, and characteristics of each

3. UNDERSTAND THE WORKING OF D.C. MOTORS

3.1 Draw the construction of DC motor
3.2 Explain the working principle of d.c. motor
3.3 Explain back E.M.F (cause and effect of back EMF)
3.4 Write and explain the torque equation of d.c. motor.
3.5 Solve simple problems based on the torque equation of d.c. motor
3.6 Enlist the types of d.c. motors
3.7 Enlist the applications of each type of d.c motor
3.8 Describe the starting methods for d.c. motors

4. UNDERSTAND THE WORKING PRINCIPLE OF AN ALTERNATOR (AC GENERATOR)

4.1 Introduction to an alternator
4.2 Sketch the constructional view of an alternator
4.3 Compare an alternator with dc generator
4.4 Explain three phase AC generation
4.5 State the conditions for parallel operation of Alternators

5. UNDERSTAND THE WORKING PRINCIPLE, TYPES AND USES OF THREE PHASE AC MOTORS

5.1 Describe 3-phase rotating magnetic field
5.2 Enlist the types of 3-Phase AC motors
5.3 Enlist the types of 3-Phase induction motors
5.4 Explain the principle of induction motor
5.5 Explain the methods of starting 3- Phase induction motors
5.6 Explain the speed control of induction motors
5.7 Draw the line diagram of induction motor connected to a motor starter
5.8 Explain the line diagram of induction motor connected to a starter
5.9 Explain the remote Start and Stop of Motors
5.10 List the uses of three phase induction motors

6. UNDERSTAND THE WORKING PRINCIPLES, CONSTRUCTION, TYPES AND USES OF SINGLE AC PHASE MOTORS

6.1 Classify single phase AC motor
6.2 Draw the constructional view of single phase induction motor
6.3 Explain the working of single phase induction motor
6.4 Enlist the uses of single phase induction motor

6.5 Describe the uses of single phase induction motor
6.6 Explain double field revolving concept (split phase rotating field)
6.7 Draw the construction of capacitor -start -run motor
6.8 Explain the working of capacitor –start- run motor
6.9 Enlist the uses of capacitor start-run- motor
6.10 Draw the construction of shaded pole motor
6.11 Explain the working of shaded pole motor
6.12 Enlist the uses of shaded pole motor

7. UNDERSTAND THE TYPES, CONSTRUCTION, WORKING AND USES OF STEPPER AND SERVO MOTOR

7.1 Draw the construction of stepper motor
7.2 Explain the working operation of stepper motor
7.3 List the uses of stepper motor
7.4 Draw the construction of servo motor
7.5 Explain the working of servo motor
7.6 List the uses of servo motor

LIST OF PRACTICAL: 96 Hours

1. Verify the Faraday's Laws of electromagnetic induction by using a simple loop generator
2. Study of main part of a DC Generator
3. Study of dc shunt generator
4. Study of dc series generator
5. Study of dc Compound generator
6. Measurement of Resistance of Different windings
7. Plot the O.C.C. Of a DC shunt generator
8. Plot the load characteristics of DC Shunt generators
9. Study the effect of back EMF of a DC motor
10. Plotting of load characteristics of DC series motor
11. Starting a DC Series and shunt motors through starters
12. Practice speed control of DC series and shunt motors
13. Study the operation of an alternator (effect of variation field excitation and rotor speed)
14. Study of rotating magnetic field
15. Study the operation of 3-phase squirrel cage induction motor
16. Study the operation of 3-phases synchronous motor
17. Practice reversal of direction of rotation of 3-phase induction motor
18. Study the line diagram of direct-on 3-phase motor starter
19. Connect a 3-phase induction motor to supply line through a direct-on starter
20. Study the line and connection diagram of a starter-delta starter
21 Connect a 3-phase squirrel cage induction motor to supply line through a star-delta starter
22. Study operation of split-phase single phase a-c motor
23. Study the operation of capacitor-start -and-run single phase a-c motor
24. Study the operation of shaded pole single phase motor
25. Study the operation of a-c series motor
26. Study the speed control of a-c series motor
27. Study the working of miniature (reluctance and hysteresis) single phase a-c motors
28. Study the construction of stepper motor
29. Study the operation of stepper motor
30. Study the construction of servo motor
31. Study the operation of servo motor
32. Develop a control circuit with the help of servo motor

ELTR283-DIGITAL LOGIC DESIGN

Total Contact Hours:

		T	P	C
Theory	64			
Practical	96	2	3	3

Learning Outcomes:

After studying the subject, the student will be able to:

- Identify and explain the operation, applications, and functions of various logic gates, digital registers, counters, and different logic families.
- Use Boolean algebra to analyse and design combinational and sequential logic circuits effectively.
- Identify and differentiate between various types of memories and understand the interfacing between digital and analog systems.
- Analyse the principles of operation for combinational and sequential logic circuits and their real-world applications.

Course contents.

1. NUMBER SYSTEM (03 Hours)

1.1 Conversion

1.1.1 Decimal to Binary.

1.1.2. Binary to Decimal.

1.1.3 Decimal to Octal

1.1.4 Octal to Decimal

1.1.5 Decimal to Hexadecimal.

1.1.6 Hexadecimal to Decimal.

1.1.7 Octal to Binary.

1.1.8 Binary to Octal.

1.1.9 Hexadecimal to Binary.

1.1.10 Binary to Hexadecimal.

2. LOGIC GATES. (04 Hours)

2.1 Logic Gates.

2.1.1 Symbols, Circuits and functions of OR, AND, NOT, NAND, NOR Gates.

2.1.2 Truth Table and Boolean expression of each above mentioned Gates.

2.1.3 Creating Multiple Input Gates.

2.2 Duality of Logic Functions.

2.2.1 Using NOR Gates to emulate all Logic Functions.

2.2.2 Using NAND Gates to Emulate all Logic Functions.

2.3 The Exclusive OR and Exclusive NOR Functions.

2.3.1 Symbols, Circuits and functions of XOR, XNOR Gates.

2.3.2 Truth Table and Boolean expression of both above mentioned Gates.

3. BOOLEAN ALGEBRA. (06 Hours)

3.1 Boolean Expressions.
- 3.1.1 Boolean Expressions and Truth Tables.
- 3.1.2 Minterm Expressions, Sum of Products
- 3.1.3 Maxterm Expressions, Product of Sums.
- 3.1.4 Un-simplified Boolean Expression and Schematic Circuits

3.2 Logic Simplifications.
- 3.2.1 Boolean Simplification.
- 3.2.2 DeMorgan's Theorems.
- 3.2.3 Karnaugh Mapping

4. BINARY ARITHMETIC CIRCUITS. (07 Hours)

4.1 Binary Addition
- 4.1.1 Half Adder Design
- 4.1.2 Full Adder Design
- 4.1.3 N bit Binary Adder Circuit

4.2 Binary Arithmetic functions with complements
- 4.2.1 2's and 1's Complement Notation, Addition and Subtraction.
- 4.2.2 Binary Subtractor Circuit
- 4.2.3 Binary Adder/ Subtractor Circuit.

5. COMBINATIONAL CIRCUIT DESIGN. (08 Hours)

5.1 Paradigm for Combinational Logic Problems.
- 5.1.1 Word Problem.
- 5.1.2 Construct Truth Table
- 5.1.3 Create a Logic Equation from a Truth Table
- 5.1.4 Simplify the logic Equation
- 5.1.5 Development of Combinational Logic Circuit

5.2 Specific Application MSI Gates
- 5.2.1 Level of Integration (SSI, MSI, LSI)
- 5.2.2 Display Drivers
- 5.2.3 Code Converters
  - 5.2.3.1 BCD to Decimal
  - 5.2.3.2 Decimal to BCD
  - 5.2.3.3 Binary to Hexadecimal
  - 5.2.3.4 BCD to seven segment decoder.
- 5.2.4 Decoding Circuits
- 5.2.5 Multiplexing Circuits
- 5.2.6 Demultiplexing Circuits

6. SEQUENTIAL CIRCUITS. (08 Hours)

6.1 Introduction to Sequential Logic.
- 6.1.1 Latches
- 6.1.2 RS Flip Flop
- 6.1.3 Clocked RS Flip Flop

6.2 JK Flip Flop
- 6.2.1 Operation of JK Flip Flop
- 6.2.2 Asynchronous Inputs
- 6.2.3 Synchronous Inputs

6.3 Triggers

6.3.1 Positive-Edge Trigger
6.3.2 Negative-Edge Trigger
6.3.3 Positive-Level Trigger (Latch)
6.3.4 Negative-Level Trigger (Latch)

6.4 Other Flip Flops
6.4.1 Master Slave Flip Flop
6.4.2 D type Flip Flop
6.4.3 T type Flip Flop

6.5 Flip Flop timing considerations.
6.5.1 Setup and Hold Times
6.5.2 Propagation Delays
6.5.3 Timing Limitations (Minimum Pulse Width)

6.6 Elementary applications of Flip Flops
6.6.1 Data Storage
6.6.2 Frequency Division

7. SHIFT REGISTERS AND COUNTERS. (10 Hours)

7.1 Shift Register
7.1.1 Function of Shift register
7.1.2 Types of Shift registers

7.2 Asynchronous Counters.
7.2.1 Discrete Ripple Counter

7.3 Synchronous Counter.
7.3.1 Discrete Up Counter.
7.3.2 Discrete Down Counter.
7.3.3 Discrete Modulus-Synchronous Counter.

8. FAMILIES AND SPECIFICATIONS (05 Hours)

8.1 Introduction of different Logic Families
8.1.1 RTL
8.1.2 DTL
8.1.3 ECL
8.1.4 TTL
8.1.5 IIL
8.1.6 MOS
8.1.7 CMOS

8.2 Specification Sheets
8.2.1 Voltage Levels
8.2.2 Current Levels
8.2.3 Fan-out, Fan-in
8.2.4 Switching Characteristics- Propagation Delay, Noise Margin, Power dissipation.

9. INTERFACING WITH ANALOG WORLD (07 Hours)

9.1 Digital to Analog Conversion.
9.1.1 Introduction and needs
9.1.2 Binary weighted DAC

9.1.3 Ladder type DAC

9.2 Analog to Digital Conversion.

9.2.1 Introduction and needs ADC

9.2.2 Simultaneous ADC

9.2.3 Counter Type ADC

9.2.4 Dual Slope ADC

9.2.5 Successive Approximation ADC

10. MEMORY (06 Hours)

10.1 Memory Technology

10.2 General Memory Operation

10.3 Memory Considerations

10.4 Types of Memories

10.4.1 ROM

10.4.2 RAM

10.4.3 SRAM

10.4.4 DRAM

10.4.5 PLDs.

10.4.6 Magnetic and Optical Memories

10.5 Applications in Digital systems.

RECOMMENDED BOOKS:

1. Floyd "Electronic Fundamentals"
2. Floyd "Digital Fundamentals"
3. Digital Logic Design by Moris Mano (Latest edition)

Instructional objectives.

1. NUMBER SYSTEM.

1.1 Convert one number system to another system
- 1.1.1 Convert Binary numbers into Decimal numbers.
- 1.1.2 Convert Decimal numbers into Binary numbers.
- 1.1.3 Convert Decimal numbers into Octal numbers
- 1.1.4 Convert Octal numbers into Decimal numbers
- 1.1.5 Convert Hexadecimal numbers into Decimal numbers.
- 1.1.6 Convert Decimal numbers into Hexadecimal numbers.
- 1.1.7 Convert Octal numbers into Binary numbers.
- 1.1.8 Convert Binary numbers into Octal numbers.
- 1.1.9 Convert Hexadecimal numbers into Binary numbers.
- 1.1.10 Convert Binary numbers into Hexadecimal numbers.

2. LOGIC GATES.

2.1 Explain Logic Gates.
- 2.1.1 Draw Symbols of OR gate.
- 2.1.2 Draw Circuit of two input OR gate.
- 2.1.3 Discuss function of OR gate.
- 2.1.4 Describe Truth Table of OR gate.
- 2.1.5 Describe Boolean expression for OR gate.
- 2.1.6 Repeat instructional objectives no. 2.1.1 to 2.1.5 for AND gate.
- 2.1.7 Repeat instructional objectives no. 2.1.1 to 2.1.5 for NOT circuit.
- 2.1.8 Repeat instructional objectives no. 2.1.1 to 2.1.5 for NOR gate.
- 2.1.9 Repeat instructional objectives no. 2.1.1 to 2.1.5 for NAND gate.
- 2.1.10 Create Multiple Input Gates.

2.2 Describe duality of Logic Functions.
- 2.2.1 Use NOR Gates to emulate all Logic Functions.
- 2.2.2 Use NAND Gates to emulate all Logic Functions.

2.3 Understand Exclusive OR and Exclusive NOR Functions.
- 2.3.1 Draw Symbols of XOR gate.
- 2.3.2 Draw Circuit of two input XOR gate.
- 2.3.3 Discuss function of XOR gate.
- 2.3.4 Describe Truth Table of XOR gate.
- 2.3.5 Describe Boolean expression for XOR gate.
- 2.3.6 Repeat instructional objectives no. 2.3.1 to 2.3.5 for XNOR gate.

3. BOOLEAN ALGEBRA.

3.1 Use Boolean Expressions.
- 3.1.1 Use Boolean Expressions and Truth Tables.
- 3.1.2 Use Minterm Expressions, Sum of Products
- 3.1.3 Use Maxterm Expressions, Product of Sums.
- 3.1.4 Describe Un-simplified Boolean Expression & develop Schematic Circuits

3.2 Apply Logic Simplifications.
- 3.2.1 Use Boolean Simplification.
- 3.2.2 Use DeMorgan's Theorems.
- 3.2.3 Use Karnaugh Mapping

4. BINARY ARITHMETIC CIRCUITS.

4.1 Apply Binary Addition Concepts.
- 4.1.1 Discuss Half Adder Circuit.

4.1.2 Discuss Full Adder Circuit.
4.1.3 Discuss N bit Binary Adder Circuit

4.2 Understand Binary Arithmetic functions with complements
4.2.1 Apply 2's and 1's Complement Notation in Addition and Subtraction.
4.2.2 Discuss Binary Subtractor Circuit
4.2.3 Discuss Binary Adder/ Subtractor Circuit.

5. COMBINATIONAL CIRCUIT DESIGN.

5.1 Discuss Paradigm for Combinational Logic Problems.
5.1.1 Describe Word Problem.
5.1.2 Construct Truth Table
5.1.3 Create a Logic Equation from a Truth Table
5.1.4 Simplify the logic Equation
5.1.5 Develop Combinational Logic Circuits

5.2 Understand specific Application MSI Gates
5.2.1 Differentiate Level of Integration (SSI, MSI, LSI)
5.2.2 Discuss Display Drivers
5.2.3 Discuss Code Converters
5.2.3.1 Describe BCD to Decimal Converter.
5.2.3.2 Describe Decimal to BCD Converter.
5.2.3.3 Describe Binary to Hexadecimal Converter.
5.2.3.4 Describe BCD to seven segment Decoder.
5.2.4 Describe Decoding Circuits
5.2.5 Describe Multiplexing Circuits
5.2.6 Describe Demultiplexing Circuits

6. SEQUENTIAL CIRCUITS.

6.1 Understand Sequential Logic.
6.1.1 Describe Latches
6.1.2 Describe RS Flip Flop
6.1.3 Describe Clocked RS Flip Flop

6.2 Understand JK Flip Flop
6.2.1 Describe Operation of JK Flip Flop
6.2.2 Describe Asynchronous Inputs
6.2.3 Describe Synchronous Inputs

6.3 Understand Triggers
6.3.1 Describe Positive-Edge Trigger
6.3.2 Describe Negative-Edge Trigger
6.3.3 Describe Positive-Level Trigger (Latch)
6.3.4 Describe Negative-Level Trigger (Latch)

6.4 Discuss Flip Flops
6.4.1 Describe Master Slave Flip Flop
6.4.2 Describe D type Flip Flop
6.4.3 Describe T type Flip Flop

6.5 Discuss Flip Flop timing considerations.
6.5.1 Describe Setup and Hold Times
6.5.2 Describe Propagation Delays
6.5.3 Describe Timing Limitations (Minimum Pulse Width)

6.6 Discuss Elementary applications of Flip Flops
6.6.1 Express Data Storage through Flip Flops
6.6.2 Express Frequency Division through Flip Flops

7. SHIFT REGISTERS AND COUNTERS.

7.1 Discuss function of Shift Register
- 7.1.1 Describe function of Shift register
- 7.1.2 Discuss types of Shift registers

7.2 Discuss function of Asynchronous Counters.
- 7.2.1 Describe function of discrete Ripple Counter

7.3 Discuss function of Synchronous Counter.
- 7.3.1 Describe function of discrete Up Counter.
- 7.3.2 Describe function of discrete Down Counter.
- 7.3.3 Describe function of discrete Modulus-Synchronous Counter.

8. FAMILIES AND SPECIFICATIONS

8.1 Understand Logic Families
- 8.1.1 Discuss RTL
- 8.1.2 Discuss DTL
- 8.1.3 Discuss ECL
- 8.1.4 Discuss TTL
- 8.1.5 Discuss IIL
- 8.1.6 Discuss MOS
- 8.1.7 Discuss CMOS

8.2 Understand Specification Sheets
- 8.2.1 Discuss Voltage Levels
- 8.2.2 Discuss Current Levels
- 8.2.3 Discuss Fan-out, Fan-in
- 8.2.4 Describe Switching Characteristics- Propagation Delay, Noise Margin, Power dissipation.

9. INTERFACING WITH ANALOG WORLD

9.1 Understand Digital to Analog Conversion.
- 9.1.1 Discuss needs and applications of DACs
- 9.1.2 Describe Binary weighted DAC
- 9.1.3 Describe Ladder type DAC

9.2 Analog to Digital Conversion.
- 9.2.1 Discuss needs and applications of ADCs
- 9.2.2 Describe the construction and working of Simultaneous ADC
- 9.2.3 Describe the construction and working of Counter type ADC
- 9.2.4 Describe the construction and working of Dual slop ADC
- 9.2.5 Describe the construction and working of Successive Approximation ADC

10. MEMORY

10.1 Discuss Memory Technologies.

10.2 Discuss General Memory Operation.

10.3 Describe Memory Considerations

10.4 List Types of Memories
- 10.4.1 Describe ROM
- 10.4.2 Describe RAM
- 10.4.3 Describe SRAM
- 10.4.4 Describe DRAM
- 10.4.5 Describe Magnetic and Optical Memories

10.5 Discuss applications in Digital systems.

LIST OF PRACTICAL: 9**6 Hours**

1. Use the data book for digital ICs and Reading of Pin-out Diagram.
2. Assemble two inputs OR gate with the help of discrete components and verify its logic operation.
3. Assemble two inputs AND gate with the help of discrete components and verify its logic operation.
4. Assemble Binary Subtractor Circuit and verify its operation. NOT, OR and AND IC Gates.
5. Verify the operation of NAND gate.
6. Verify the operation of NOR gate.
7. Use NOR and NAND gates to emulate all logic functions.
8. Assemble XOR gate and verify its operation.
9. Assemble XNOR gate and verify its operation.
10. Assemble Half Adder and verify its operation.
11. Assemble Full Adder and verify its operation.
12. Assemble Binary Subtractor Circuit and verify its operation.
13. Assemble Binary Adder/ Subtractor Circuit and verify its operation.
14. Verify the operation of BCD to Decimal Converter.
15. Verify the operation of Decimal to BCD Converter.
16. Construct an RS Flip Flop using NAND gates.
17. Demonstrate the logical properties of clocked JK master/slave flip-flop.
18. Demonstrate the logical properties of D Type Flip Flop.
19. Demonstrate the logical properties of T Type Flip Flop.
20. Use of flip-flop as data storage element and frequency divider.
21. Verify the operation of BCD to Seven segment Decoder.
22. Verify the operation of Binary to Hexadecimal Converter.
23. Construct a 4 bit shift register and study its operation.

24-25 Construct a 4-bit binary counter and study its operation.

26-27. Construction of Simultaneous ADC and study its operation.

28. Construct an Up counter and study its operation.
29. Construct a Down counter and study its operation.
30. Construction of counter type ADC and study its operation.
31. Construct a Binary weighted DAC and study its operation.
32. Construct a Ladder ADC and study its operation.

Eltr-291 PCB DESIGNING

Total Contact Hours:

Theory	0	T	P	C
Practical	96	0	3	1

Learning Outcomes:

The Learning Outcomes of the course are as follows:

- Students will acquire the basic level knowledge and will understand the packages of electronic components, types of PCBs and history of PCB.
- Familiarization of the various types of devices/components that may be mounted on PCB.
- Perform design and printing of PCB with the help of various image transfer and soldering techniques.

Section I: Printed Circuit Board PCB Design and Manufacturing 48 Hours

1. Printed Circuit Board (PCB) Design Fundamentals
2. PCB Design Process using Computer-aided Design (CAD) Software
3. Study PCB Fabrication Techniques (Single-layer and double-layer PCB)
4. Study Soldering Techniques (Through-hole and Surface-mount components)
5. Study Etching Techniques (Etching Solutions, Equipments and Parameters)
6. Troubleshooting of Designed PCB Layout (broken traces, short circuits etc.)
7. Study Repair Techniques (Approaching, De-Soldering and Replacing of Components)
8. Study Quality, Reliability and Environmental Concerns in PCB Industry

Section II: Electronic Components, Applications & Assembly 48 Hours

Rectifiers and Power Supplies

9. Construct Half-wave rectifier circuit
10. Construct Full wave Bridge rectifier
11. Construct Full-wave center-tapped rectifier
12. Construct Voltage doubler circuit
13. Construct Voltage tripler
14. Design, fabricate, and test AC to 9V/12V DC power supply

Timers and Logic Circuits

14. Design and construct Sequential and long-duration timer circuits
15. Design and construct Half adder and Full adder circuits
16. Verify and design logic gates (NOT, OR, NOR, AND, NAND, XOR, and XNOR gates)

Display and Indicators

17. Construct the PCB for Seven-segment display
18. Construct the PCB for Battery level indicator
19. Construct the PCB for Water level indicator

Advanced Applications

20. Design and test Four-point flasher circuit
21. Construct switching circuit using a touch sensor

Design Project with CAD

22. Design and fabricate a simple PCB project using CAD tools.

PCB Design Software (use anyone from below list or any other similar software)

1. KiCAD EDA (Schematic Capture & PCB Design Software)
2. EasyEDA (Online PCB Design & Simulator)
3. Altium Designer (PCB Design Software)
4. Altium Circuit Studio (Professional PCB Design Tool)
5. Easy-PC (PCB Design Software)
6. PADS - Siemens EDA (PCB Design Software)
7. P-CAD (Electronics Design Automation Suite)

اسلامیات/مطالعہ پاکستان

نصاب سال سوئم

GEN 301

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1	0	1

کل وقت 20 گھنٹے

حصہ اول اسلامیات

حصہ دوئم مطالعہ پاکستان

موضوعات:

1۔ قرآن مجید:

سورۃ الفاتحہ، آیت الکرسی، سورۃ البقرہ کی آخری آیات از امن الرسول ﷺ تا آخر اور سورۃ اخلاق مع ترجمہ وتشریح

2۔ دس منتخب احادیث کا ترجمہ (تشریح)

() بنی الا سلام علی خمس شهادت انا الا اله الا لمر اقلم الصلوته و ایتا الزکوة و حج البیت و صوم رمضان

() الدین النصیحته

() المنشاء موتمن

() للمومن علی المومن سنت خصال یعود ماذا مرض و تژهده اذا مات و یحیبه اذا دعا

() لیسلم علیه اذا لقیه و لیثمته اذا عطس و فصیحله اذا غاب او شهد

() لا تخن من خانک

() لا یدخل الجنته قاتع

() ان الله حرم علیکم عقوق المهات و اضاعته المال

() لیسر اولا تعسر اولا تنفر

() ذاق طعم الایمان من مرضی بالله و با الا سلام دینابمجمدنبیا

() افضل الذکر لا اله الا الله

3۔ حقوق وفرائض:

حصول تعلیم بطور فرض، والدین اور اولاد کے حقوق وفرائض، ہمسایہ کے حقوق، بچوں کے حقوق، عورتوں کے حقوق، بزرگ شہریوں کے حقوق، مخنث افراد کے حقوق۔

4۔ اسلام کی اخلاقی اقدار:

صبر واستقلال، عفو ودرگزر، ایفائے عہد، اخوت، ایثار وقربانی۔

مطالعہ پاکستان (حصہ دوئم)

قیام پاکستان

تدریس مقاصد:

عمومی مقاصد:

() قیام پاکستان کے بعد درپیش مسائل سے آگاہی حاصل کرے اور بیان کرے

خصوصی مقاصد:

() باؤنڈری کمیشن تشکیل اور اس کے فرائض بیان کر سکے

() ریڈکلف اور اس کے ایوارڈ کے بارے بیان کر سکے

() بنگال اور کلکتہ کی تقسیم کی وجوہات بیان کر سکے

() پنجاب کی تقسیم کی تفصیل بیان کر سکے

() مہاجرین کی آمد سے جو مسائل پیدا ہوئے انہیں بیان کر سکے

() ریاستوں کے الحاق کے بارے میں تفصیل بیان کر سکے

() ریاست جموں کشمیر کے بارے میں بیان کر سکے

() نہری پانی کے تنازعہ کو بیان کر سکے

() قرارداد مقاصد کی تفصیلات بیان کر سکے

() 22 علماء کے متفقہ اسلامی نکات بیان کر سکے

() 1973 کے آئین میں انسانی حقوق کی دفعات (28-8)۔اقلیتوں کے حقوق اور دیگر محروم طبقات کے حقوق کے بارے

جان سکے

() قیام پاکستان کے بعد نفاذ اسلام کی کوششوں کو بیان کر سکے

() پاکستان کے محل وقوع اور اس کی جغرافیائی اہمیت بیان کر سکے اور +GSP کے تعارف اور عملی طریقہ کار بیان کر سکے

() پاکستان میں قدرتی وسائل (تیل، گیس، کوئلہ) کے بارے میں بیان کر سکے

() کفر کو اللہ کی مدد کے بغیر شکست نہیں دی جا سکتی

() اللہ ایک ہے

() اللہ کسی کا محتاج نہیں نہ اسکا کوئی شریک ہے

منتخب احادیث:

عمومی مقصد: احادیث کی روشنی میں اسلامی تعلیمات پر عمل پیرا ہو سکے

خصوصی مقاصد:

() احادیث کا ترجمہ بیان کر سکے

() احادیث کی تشریح کر سکے

() معاشرتی اور انفرادی زندگی میں احادیث سے رہنمائی حاصل کر سکے

حقوق و فرائض:

عمومی مقاصد:

() اسلامی معاشرے کا ایک اچھا فرد بن سکے

خصوصی مقاصد:

() والدین کے حقوق و فرائض بیان کر سکے

() ہمسائیوں کے حقوق بیان کر سکے

() بچوں کے حقوق بیان کر سکے

() عورتوں کے حقوق کی پاسداری کر سکے

() بزرگ شہریوں کے حقوق کا خیال رکھ سکے

() مخنث حضرات کے حقوق جان سکے اور ان کے حقوق کی پاسداری کر کے انہیں معاشرے کا ایک مفید فرد بنایا جا سکے

() اسلام میں حقوق و فرائض کی آگاہی کی صورت میں اپنے اندر خدمت خلق کا جذبہ پیدا کر سکے

اسلامی اقدار:

عمومی مقاصد:

() طالب علم جان سکے گا کہ تعلیم کا مقصد حسن اخلاق سے متصف ہونا ہے

خصوصی مقاصد:

() اخلاق کے معنی و مفہوم کو بیان کر سکے

() اسلام میں حسن و اخلاق کی اہمیت بیان کر سکے

() قرآن و سنت کی روشنی میں صبر و استقلال کی اہمیت بیان کر سکے

() ایفائے عہد کی اہمیت بیان کر سکے

() اخوت کے معنی و مفہوم بیان کر سکے

() اخوت اسلامی کی اہمیت بیان کر سکے

() اسلام کی اعلیٰ اقدار کو اپنا کر مثالی معاشرہ پیدا کر سکے

نصاب (سال سوئم)

GEN 301

مطالعہ پاکستان

ٹی	پی	سی
1	0	1

کل وقت 12 گھنٹے

حصہ دوئم

موضوعات:

() قیام پاکستان

() باؤنڈری کمیشن

() ریڈکلف ایوارڈ

() تقسیم بنگال

() تقسیم پنجاب

() مسئلہ مہاجرین

() ریاست کا الحاق

() ریاست جموں کشمیر

() نہری پانی کا تنازعہ

() قرارداد پاکستان

() علماء کے بائیس نکات

() 1956-1962-اور 1973 کے دساتیر کی اسلامی/انسانی حقوق کی دفعات (8 تا 28)۔

() اقلیتوں کے حقوق۔ دیگر محروم طبقات کے حقوق

() پاکستان کا محل وقوع اور اسکی جغرافیائی اہمیت۔ GSP+ کا تعارف اور عملی طریقہ کار

() قدرتی وسائل (تیل، گیس، کوئلہ)

غیر مسلم طلباء کے لیے

GEN301

نصاب اخلاقیات

سال سوئم

ٹی	پی	سی
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کل وقت 20 گھنٹے

موضوعات:

() احساس ذمہ داری

() مثبت ذہن

() عدل وانصاف

() قومی خدمت کا جذبہ

() ذکر ونظر کی پاکیزگی

() احترام آدمیت

() شائستگی

() عفوودرگذر

() بردباری

() خوداتحصاری

() اثر ونفوذ

() جامعیت

() اپنی ذات کی معرفت (بذریعہ ہم عمر طلباء، اساتذہ، اہم شخصیات)

() بچوں کے حقوق

() عورتوں کے حقوق

() بزرگ شہریوں کے حقوق

() مخنث حضرات کے حقوق

غیر مسلم طلباء کے لیے
نصاب اخلاقیات (سال سوئم)

تدریس مقاصد:

عمومی مقاصد:

() ملکی ترقی کے لیے اعلیٰ اوصاف کے ساتھ بہتر طور پر ملک وملت کی خدمت کر سکے

خصوصی مقاصد: طالب علم اس قابل ہو سکے کہ

() موضوعات کا مطلب بیان کر سکے

() عملی زندگی سے مثالوں کی نشاندہی کر سکے

() موضوعات کی اہمیت بیان کر سکے

() اپنی شخصیت اور معاشرے پر موضوعات کے مطابق اثرات پیدا کرنے کے طریقے بیان کر سکے

() مثبت ذہن کے ساتھ کام کر سکے

() عدل وانصاف سے ادارہ میں، دفتر میں بہتر ماحول پیدا کر سکے

() ماحول کو اخلاقی طور پر پاکیزہ بنائے

() کارکنوں کی بہتر طور پر دل جوئی کر سکے

() کارکردگی میں اضافہ کر سکے

() باہمی احترام کی برکات سے استفادہ کر سکے

() بچوں کے حقوق بیان کر سکے

() عورتوں کے حقوق کی پاسداری کر سکے

() بزرگ شہریوں کے حقوق کا خیال رکھ سکے

() مخنث حضرات کے حقوق جان سکے اور ان کے حقوق کی پاسداری کر کے انہیں معاشرے کا ایک مفید فرد بنایا جا سکے

(MGM-**361**) Industrial Management and Leadership

Total Contact Hours

Theory	32	T	P	C
Practical	0	1	0	1

Learning Outcomes:

After this course the student will be able to:

- Identify the types and essential qualities of effective leadership.
- Explain the importance of the human factor in industry and strategies for effective human-machine system allocation.
- Demonstrate an understanding of key management functions, roles, and responsibilities.

Course Contents

1. Introduction to Management Principles **6 Hours**

- 1.1 Role of a Manager
- 1.2 Leadership Styles
- 1.3 Decision Making
- 1.4 Time Management
- 1.5 Delegation Techniques

2. Team Management and Development **6 Hours**

- 2.1 Building High-Performing Teams
- 2.2 Motivating Technicians
- 2.3 Coaching and Mentoring
- 2.4 Performance Reviews
- 2.5 Conflict Resolution

3. Management in Industrial Environment **10 Hours**

- 3.1 Industrial Management
  - 3.1.1 Functions of management.
  - 3.1.2 Subdivisions of management
  - 3.1.3 Objectives of industrial management.
- 3.2 Human Engineering**.**
  - 3.2.1 Importance of human factor in industry.
  - 3.2.2 Man-machine system.
  - 3.3.3 Strategy for making allocation decisions.
- 3.3 Industrial Fatigue and Boredom
  - 3.3.1 Definition and distinction.
  - 3.3.2 Psychological causes.
  - 3.3.3 Objective causes.
  - 3.3.4 Prevention
- 3.4 Industrial Accidents
  - 3.4.1 Psychological causes.
  - 3.4.2 Objective causes.
  - 3.4.3 Prevention
- 3.5 Role of Foreman in industry
  - 3.5.1 Foreman's abilities.
  - 3.5.2 Duties and functions.

4. Project Management Skills **06 Hours**

4.1 Project Planning
4.2 Budgeting
4.3 Quality Control
4.4 Managing Deadlines

5. Performance Measurement and Continuous Improvement **04 Hours**

5.1 Key Performance Indicators (KPIs)
5.2 Monitoring and Evaluation
5.3 Continuous Learning and Development

REFERENCE BOOKS :

1. Technology Management: Activities and Tools by Dilek Cetindamar, Rob Phaal, and David Probert, Palgrave Macmillan (Latest Edition)
2. Managing Engineering and Technology by Lucy C. Morse And Daniel L. Babcock, Prentice Hall; (Latest Edition)
3. Management of Technology: Managing Effectively in Technology-Intensive Organi-zations by Hans J. Thamhain, Wiley; (Latest Edition)
4. Managing Information Technology by Carol V. Brown, Daniel W. De Hayes, Jeffrey A. Hoffer, Wainright E. Martin, and William C. Perkins, Prentice Hall; (Latest Edition)
5. Technology Management: Activities and Tools by Dilek Cetindamar, Rob Phaal, and David Probert, Palgrave Macmillan (Latest Edition)

Instructional Objectives

1. Introduction to Management Principles

1.1 Discuss the role of a Manager with key responsibilities and expectations.
1.2 Different leadership styles (like transformational, transactional, democratic) and how to choose and apply them.
1.3 Explain process of decision-making.
1.4 Discuss Time Management techniques and able to Strategies for prioritizing tasks, managing workloads, and delegating effectively.
1.5 Able how to delegate technical tasks to the right people, ensuring successful outcomes without micromanaging.

2. Team Management and Development

2.1 Discuss how to Building High-Performing Teams.
2.2 Able how to identify strengths, weaknesses, and complementary skills within a team.
2.3 Discuss Motivating Technicians.
2.4 Discuss how to motivates team members and how to keep them engaged and productive.
2.5 Explain the need of Coaching and Mentoring in any organization.
2.6 Able to guide and develop team members' technical and soft skills.
2.7 Able to conduct performance reviews, set SMART goals, and provide career development opportunities.
2.8 Discuss techniques to resolve conflicts in a team setting, especially when differing technical perspectives arise.

3 Management in Industrial Environment

3.1 Industrial Management.
- 3.1.1 Define management.
- 3.1.2 State functions of management.
- 3.1.3 Enlist subdivision of management.
- 3.1.4 Explain objectives of industrial management.

3.2 Human Engineering.
- 3.2.1 Explain importance of human engineering in the industry.
- 3.2.2 Explain man-machine system.
- 3.2.3 Explain strategy for making allocation decisions.

3.3 Industrial Fatigue and Boredom.
- 3.3.1 Define fatigue and boredom.
- 3.3.2 Describe psychological causes of fatigue and boredom.
- 3.3.3 Describe objective causes of fatigue and boredom.
- 3.3.4 Explain measures to prevent fatigue and boredom.

3.4 Industrial Accidents.
- 3.4.1 Explain psychological causes of industrial accidents.
- 3.4.2 Explain objective causes of industrial accidents.
- 3.4.3 Explain measures to prevent industrial accidents.

3.5 The Role of Foreman in an Industrial Undertaking.
- 3.5.1 Explain ability of the foreman.
- 3.5.2 Enlist duties of foreman.
- 3.5.3 Describe functions of foreman as middle management.

4. Project Management Skills

4.1 Discuss how to create project timelines, allocate resources, and monitor progress.
4.2 Describe budget constraints, cost management, and resource allocation.
4.3 Describe Quality Control and techniques to ensure quality standards.
4.4 Discuss Techniques to keep projects on track and within deadlines.

5. Performance Measurement and Continuous Improvement

5.1 Describe the role of Key Performance Indicators (KPIs) in organization.
5.2 Describe the role of Monitoring and Evaluation in organization.
5.3 Describe the role of Continuous Learning and Development in personal and team growth.

MGM-341	**ENTREPRENEURSHIP**			
TOTAL CONTACT HOURS:	**32**	**T**	**P**	**C**
Theory:	32	**1**	**0**	**1**
Practical:	0			

LEARNING OUTCOMES:

The student will be able to understand the procedures governing estimation of earth work and complete estimate of single storey building in order to:

1- Understanding the concept and elements of small business enterprise.
2- Apply the techniques for generating business ideas as well as for identifying and assessing business opportunities.
3- Understand the procedures required for establishing an enterprise.
4- Understand the procedures for assessing market and for selecting location for a small business.
5- Understand the importance of financial record keeping in a small business.
6- Develop business plan and evaluate it in real market situation.
7- Apply the concepts of Engineering on planning, designing and layout of related technical projects.

Course Contents

1- Entrepreneurship and Management 4Hours

1.1 The concept of entrepreneurship
1.2 Terminology used in entrepreneurship
1.3 Classification of business; difference between social and commercial business
1.4 Reasons for Entrepreneurship; importance in society, self employment, benefits & limitation, Importance of relations/links
1.5 Entrepreneurial motivation; setting goals and risk assessment.
1.6 Small enterprises; elements, ideas, motivation, resources, business plan etc.

2- Entrepreneurship and innovation 3 Hours

2.1 Creativity and innovation; creativity potential, techniques for developing creative abilities
2.2 Business ideas; resources of business ideas, collective thinking and creative thinking,
2.3 Risk involved in innovation
2.4 Identifying and assessing business opportunities

3- Entrepreneurs 5 Hours

3.1 Entrepreneurial characteristics
3.2 Assessment of entrepreneurial potential; assessment of individuals
3.3 Entrepreneurial Leadership: abilities for a successful businessman
3.4 Self discipline; check list for attaining self discipline
3.5 Decision making skills; steps for decision making, rating of decision making skills
3.6 Principles of negotiation; resolving business issues through

negotiation

4- Establishment of An Enterprise 8 Hours

4.1 Market; Five 'W' of market, competitors, assessment of market size & demand
4.2 Business location; importance, selection of site
4.3 Legal forms of business; Proprietorship, advantages &disadvantages
4.4 Costing of product; direct and indirect cost

5- Management of an Enterprise 8 Hours

5.1 Hiring and managing people; hiring procedures, term & condition of services and Job description etc.
5.2 Managing sales & supplies; characteristics of successful sales personals, importance of advertisement, life cycle of product, selection of supplies, work order, delivery & payment etc.

6- Business Plan 4 Hours

6.1 Purpose of business plan
6.2 Components of business plan; outline, process of writing business plan
6.3 Analysis of business plan: feasibility; breakeven point, evaluating problem in starting business
6.4 Standard business plan

Reference Books:

1 Dewhurst, J. eds., (Latest Ed.). *Small business and entrepreneurship*. London: Macmillan.
2 Drucker, P. and Maciariello, J., (Latest Ed.). . *Innovation and entrepreneurship*. Routledge.
3 Miner, J.B., (Latest Ed.). *The 4 routes to entrepreneurial success*. Berrett-Koehler Publishers.
4 Singh, P.N., Latest Edition. *Developing entrepreneurship for economic growth*. Vikas.
5 Knowing About Business (KAB), ILO

INSTRUCTIONAL OBJECTIVES

1- Understand the concept and elements of Entrepreneurship

1.1 Define entrepreneurship
1.2 Explain the concept of entrepreneurship
1.3 Explain the various types of enterprise that exist in the community
1.4 Identify and interpret the terms and elements involved in the concept of enterprise
1.5 Appreciate that the advancement of individual and society in general when entrepreneurship is adopted
1.6 Explain various motivational factors that entrepreneurs possess and utilize.
1.7 Exhibit the skills needed to assess and evaluate a risk
1.8 Describe the outline of small enterprise

2- Understand the techniques for generating business ideas as well as for identifying and assessing business opportunities

2.1 Describe the creativity and innovation
2.2 Apply the techniques for developing creative abilities
2.3 Explain the resources of business idea
2.4 Explain the collective and creative thinking
2.5 Explain how to generate a business idea
2.6 Appreciate the importance of, and posses techniques for identifying and assessing business opportunities.

3- Understand personal characteristics needed to be a successful entrepreneur

3.1 Identify the various entrepreneurial characteristics
3.2 Access personal potential for becoming future entrepreneurs.
3.3 Identify leadership qualities which are essential to the success of entrepreneurs
3.4 Identify self- management skills and how they are important to be enterprising
3.5 Apply a rational approach to make personal and business decisions
3.6 Explain the steps for decision making and rating of decision making skills
3.7 Apply the rules of negotiation for resolving business issues

4- Understand the procedures required for establishing an enterprise

4.1 Describe the market & marketing
4.2 Differentiate between sellers and buyers' market
4.3 Describe the five 'w' of market
4.4 Explain the procedure for assessing the market size and demand
4.5 Explain the major factors to be considered when selecting a location for a business
4.6 Describe the basic types of business ownership and the limitation of each
4.7 Explain the computation of initial and working capital needed to start an enterprise
4.8 Identify the advantages and disadvantages of using various sources of capital to start an enterprise
4.9 Explain the component of cost of product

5- Understand the various techniques that affect the management of an

enterprise.

5.1 Describe the hiring method/Procedures
5.2 Describe the term & conditions of services and job description for various employments
5.3 Describe the characteristics of successful sales personals
5.4 Describe the life cycle of product
5.5 Identify the various ways of selecting suppliers,
5.6 Explain the inventory management of stock, raw material and finished goods etc.
5.7 Appreciate the importance of financial record keeping in a small business
5.8 Explain techniques to keep cost as low as possible

6- Apply the entrepreneurship knowledge for development of business plan for a small business and evaluate in a real market situation.

6.1 Appreciate the importance of business plan
6.2 Explain the process of writing a business plan
6.3 Develop feasibility for a business idea
6.4 Realize the problem that may be encountered when starting a small business/Enterprise
6.5 Develop a business plan for a small business on the standard format
6.6 Evaluate the business plan in a real market satiation

Coms-331 Soft Skills & Professional Ethics

Total Contact Hours:

		T	P	C
Theory	32			
Practical	0	1	0	1

Learning Outcomes:

- To develop essential soft skills in students, including decision-making, emotional intelligence, problem-solving, and teamwork, to enhance their personal and professional effectiveness in the field of electronics.
- To equip students with advanced communication skills, covering verbal and non-verbal techniques, written communication, and presentation skills, thereby improving their ability to convey technical information clearly and effectively.
- To prepare students for successful employment through practical training in resume writing, interview techniques, and formal communication related to job applications, enhancing their career readiness in the electronics industry.
- To instill a strong understanding of professional ethics, focusing on ethical principles and responsibilities in engineering, to prepare students for integrity and accountability in their future careers.

Course contents:

1. **Introduction to Soft Skills** **06 Hours**
   - 1.1 Definition of Skills
   - 1.2 Types of Skills (Hard Skills & Soft Skills)
   - 1.3 Types of Soft Skills
     - 1.3.1 Decision Making
     - 1.3.2 Problem Solving
     - 1.3.3 Emotional Intelligence
     - 1.3.4 Leadership
     - 1.3.5 Teamwork
     - 1.3.6 Critical Thinking
     - 1.3.7 Creativity and Innovation
     - 1.3.8 Management Skills
     - 1.3.9 Communication Skills
   - 1.4 Future of Jobs Report (World Economic Forum)
   - 1.5 The role of soft skills on our personal and professional life
2. **Communication Skills** **16 Hours**
   - 2.1 Overview of communication skills
     - 2.1.1 Definition
     - 2.1.2 Communication Process
   - 2.2 Basic types of communication
     - 2.2.1 Listening
     - 2.2.2 Speaking / Oral
     - 2.2.3 Reading

2.2.4 Writing

2.3 Written communication

2.3.1 7'Cs of Communication

2.3.2 Business letters and their structure

2.3.3 Different types of business letters

2.3.4 Use of Artificial Intelligence (AI) tools

2.4 Report writing

2.4.1 Definition and purpose

2.4.2 Structure

2.4.3 Use of visuals

2.4.4 Use of AI tools for report writing

2.5 Email writing

2.5.1 Definition and purpose

2.5.2 Structure

2.5.3 Email etiquette

2.6 Verbal & Non-Verbal communication

2.6.1 Verbal communication

2.6.2 Non-Verbal communication

2.6.3 Role of body language on verbal and non-verbal communication

2.6.4 7-38-55 Principle

2.7 Impact of communication skills on career growth

3. Presentation Skills 02 Hours

3.1 Definition and importance

3.2 Key elements of a good presentation

3.3 Presentation techniques

3.4 Tools for presentations

3.5 Use of AI tools

4. Formal Communication 04 Hours

4.1 Cover letter

4.2 Resume

4.3 Curriculum Vitae (CV)

4.4 Job search (Online and Offline)

4.5 Use of AI tools

4.6 Interview preparation

5. Professional Ethics 04 Hours

5.1 Definition and importance

5.2 Ethical principles in engineering

5.3 Ethical responsibilities towards society and environment

5.4 Professionalism and code of conduct

5.5 Role of professional bodies (Local & International)

5.6 NTC code of ethics

5.7 IEEE code of ethics

REFERENCE BOOKS:

1. People Skills: How to Assert Yourself, Listen to Others, and Resolve Conflicts by Robert Bolton, Touchstone (Latest Edition)
2. Emotional Intelligence: Why it can matter more than IQ by Daniel Goleman (Latest Edition)
3. The Communication Skills Book by Matthew McKay PhD , Martha Davis PhD, and Patrick Fanning, New Harbinger Publications (Latest Edition)
4. Ethics for Information Age by Michael J, Quinn (Latest Edition)

Instructional Objectives

1. Introduction to Soft Skills

1.1 Definition of Skills.

1.2 Types of Skills,

- 1.2.1 Definition and examples of Hard Skills.
- 1.2.2 Definition and examples of Soft Skills.

1.3 Types of Soft Skills,

- 1.3.1 Explain Decision Making and its process.
- 1.3.2 Explain Problem Solving and its process.
- 1.3.3 Define Emotional Intelligence and its impact on our daily life.
- 1.3.4 Define Leadership and explain leadership styles.
- 1.3.5 Define Teamwork and its importance.
- 1.3.6 Define Critical Thinking.
- 1.3.7 Define Creativity and Innovation.
- 1.3.8 Define Management Skills and their types,
  - 1.3.8.1 Time Management (Organizing, Scheduling, Prioritizing).
  - 1.3.8.2 Planning (Mind Mapping, Brain storming).
  - 1.3.8.3 Financial Management.
  - 1.3.8.4 Stress Management.
  - 1.3.8.5 Conflict Management.
- 1.3.9 Define Communication Skills.

1.4 Describe Future of Jobs Report (World Economic Forum).

1.5 Explain the role of soft skills on our personal and professional life.

2. Communication Skills

2.1 Overview of Communication Skills,

- 2.1.1 Definition.
- 2.1.2 Communication Process (Definitions of Sender, Encoder, Communication Channel, Decoder, Receiver).

2.2 Basic Types of Communication,

- 2.2.1 Listening,
  - 2.2.1.1 Definition.
  - 2.2.1.2 Active and Passive Listening.
  - 2.2.1.3 Techniques for improving: Paraphrasing, summarizing, and asking questions.
- 2.2.2 Speaking / Oral,
  - 2.2.2.1 Definition.
  - 2.2.2.2 Principles (Clarity, tone, volume, and pace).
  - 2.2.2.3 Public Addressing.
  - 2.2.2.4 Tips to improve (Organizing thoughts, using body language, and managing stage fright).
- 2.2.3 Reading,
  - 2.2.3.1 Definition.
  - 2.2.3.2 Types: Skimming, scanning, and in-depth reading.
  - 2.2.3.3 Tips to improve: reading comprehension and speed.
- 2.2.4 Writing,
  - 2.2.4.1 Definition.
  - 2.2.4.2 Discuss basics: Clarity, brevity, coherence, and formal language.

2.2.4.3 Describe common challenges in technical writing.
2.2.4.4 Describe the importance of written communication.

2.3 Written Communication,
- 2.3.1 Explain 7'Cs of Communication.
- 2.3.2 Definition of Business Letters.
- 2.3.3 Describe the structure of business letter (Heading, salutation, body, closing, and signature).
- 2.3.4 Discuss the types of business letters.
- 2.3.5 Write a sample of an Inquiry Letter.
- 2.3.6 Write a sample of a Complaint Letter.
- 2.3.7 Write a sample of an Acknowledgment Letter.
- 2.3.8 Write a sample of a Covering Letter for a job.
- 2.3.9 Describe the Artificial Intelligence (AI) assisted tools to enhance written communication: ChatGPT, Gemini, Perplexity etc. or any latest.).

2.4 Report Writing,
- 2.4.1 Definition and Purpose.
- 2.4.2 Describe the structure (Title, Abstract/Executive Summary, Introduction, Methodology, Findings/Results, Conclusions/Recommendations, References).
- 2.4.3 Describe the use of visuals (charts, graphs etc.).
- 2.4.4 Describe the Artificial Intelligence assisted tools for Report Writing: ChatGPT, Gemini, Perplexity etc. or any latest.).

2.5 Email Writing,
- 2.5.1 Definition and Purpose.
- 2.5.2 Explain the structure (Subject line, greeting, body, and signature)
- 2.5.3 Describe email etiquette.

2.6 Verbal & Non-Verbal Communication,
- 2.6.1 Verbal Communication.
  - 2.6.1.1 Definition and Importance.
  - 2.6.1.2 Describe the techniques for effective verbal communication (Articulation, Tone and Vocabulary).
  - 2.6.1.3 Discuss the role of verbal communication.
- 2.6.2 Non-Verbal Communication,
  - 2.6.2.1 Definition and Importance.
  - 2.6.2.2 Explain the Body Language: Gestures, posture, and facial expressions.
  - 2.6.2.3 Describe the Eye Contact.
  - 2.6.2.4 Describe the Proxemics.
  - 2.6.2.5 Describe the Paralanguage.
  - 2.6.2.6 Describe the use of non-verbal communication in professional interactions.
- 2.6.3 Discuss the role of body language on Verbal and Non-Verbal Communication.
- 2.6.4 Describe the 7-38-55 Principle.

2.7 Describe the impact of Communication Skills on career growth

3. Presentation Skills

3.1 Definition and Importance.

3.2 Describe the key elements of a good presentation (Content Research, Visual Aids, Audience Engagement).

3.3 Describe the presentation techniques (Clarity, Confidence, Preparation, Relaxation Techniques, Audience Connection).
3.4 Discuss the tools for presentations (Presentation Software, Visual Aids)
3.5 Describe the AI assisted tools for Presentations: (Gamma, Slide AI, Design AI etc.)

4. Formal Communication

4.1 Design a cover letter.
4.2 Explain the structure and design a Resume.
4.3 Explain and Design a Curriculum Vitae (CV).
4.4 Describe the methods Job Search (Online and Offline).
4.5 Explain the Interviewing techniques,
- 4.5.1 Pre-interview preparations.
- 4.5.2 Interview Etiquette.
- 4.5.3 Post-interview tips.

5. Professional Ethics

5.1 Definition and its Importance.
5.2 Define Ethical Principles in Engineering & Technology,
- 5.2.1 Honesty.
- 5.2.2 Integrity.
- 5.2.3 Confidentiality.
- 5.2.4 Accountability and Responsibility.
- 5.2.5 Respect for Others.
- 5.2.6 Fairness and Justice.

5.3 Explain Ethical Responsibilities towards Society and Environment.
5.4 Define Professionalism and Code of Conduct.
5.5 Define the role of Professional Bodies (Local & International).
5.6 Explain National Technology Council (NTC) code of ethics.
5.7 Explain Institute of Electrical & Electronics Engineers (IEEE) code of ethics.

ELTR-323 Equipment Maintenance & Servicing

Total Contact Hours

		T	P	C
Theory	32			
Practical	192	1	6	3

Learning outcomes: After completion of this subject, the student will be able to

Be proficient in diagnosing and fixing electronic equipment issues.
Develop comprehensive documentation and reporting skills.
Be prepared to enter the workforce in roles such as a maintenance technician or electronics repair specialist.
Acquire skill to maintain, service and troubleshoot electronics equipment.

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COURSE CONTENTS

1. Solar Power System (05 Hours)

1.1 Introduction to Solar Panel
1.2 Industrial and domestic use of solar panel
1.3 Introduction of ON and OFF Grid
1.4 Introduction to Solar Inverter
1.5 Load Calculation
1.6 Troubleshooting & Maintenance

2. UPS (Un-interruptible Power Supply) (03 Hours)

2.1 Construction of UPS
2.2 Types of UPS
2.3 Installation and Maintenance Practices
2.4 Troubleshooting

3. TV (08 Hours)

3.1 Android TV
- 3.1.1 Introduction
- 3.1.2 Installation & Setup
- 3.1.3 Maintenance Procedures
- 3.1.4 Troubleshooting & Repair

3.2 Introduction to CCTV systems
- 3.2.1 Overview
- 3.2.2 Types
- 3.2.3 Applications
- 3.2.4 CCTV System Installation & Configuration
- 3.2.5 Troubleshooting & Maintenance

3.3 Components of CCTV Systems
- 3.3.1 Cameras
- 3.3.2 Recording Devices
- 3.3.3 Displays
- 3.3.4 Cable & Connectors
- 3.3.5 Power Supply
- 3.3.6 Troubleshooting and Maintenance

3.4 IP camera system
- 3.4.1 Introduction
- 3.4.2 Types

3.4.3 Features
3.4.4 Troubleshooting and Maintenance

4. Displays **4 hours**

4.1 LCD Displays
- 4.1.1 LCD Display Technology and its Applications
- 4.1.2 Technical Specifications and Features
- 4.1.3 Installation and Configuration
- 4.1.4 Troubleshooting and Maintenance

4.2 Plasma Displays
- 4.2.1 Plasma Display Technology and its Applications
- 4.2.2 Technical Specifications and Features
- 4.2.3 Installation and Configuration
- 4.2.4 Troubleshooting and Maintenance

4.3 Large Screen
- 4.3.1 Large Screen Display Technology and its Application
- 4.3.2 Technical Specifications and Features
- 4.3.3 Installation and Configuration
- 4.3.4 Troubleshooting and Maintenance

5. Equipment Calibration and Testing (1 Hour)

5.1 Calibration Standards
- 5.1.1 Importance of calibration and traceability.

5.2 Testing Procedures:
- 5.2.1 Performance testing for repaired equipment
- 5.2.2 Quality assurance protocols

6 . Microwave Oven (02 Hours)

6.1 Introduction to Microwave oven
6.2 Block Diagram of Microwave Oven
6.3 Features of Microwave Oven
6.4 Faults & Troubleshooting
6.5 Preventive Maintenance

7. AC Inverter/VFD (3 Hours)

7.1 Introduction to AC Inverters (VFD)
7.2 Inverter Installation & Configuration
7.3 Troubleshooting & Diagnostics

8. Cellular Phone (05 Hours)

8.1 Introduction
8.2 Maintenance Procedure
8.3 Repairing/Troubleshooting
8.4 Software Servicing

9. Introduction to Equipment Maintenance (1 Hour)

9.1 Types of Maintenance
9.2 Importance of Maintenance

Reference / Text Books

1. Consumer Electronics, by J.S. Chitode, latest edition, Technical Publications Pune, India
2. Troubleshooting Electronic Equipment: A Practical Guide by R.S. Khandpur, Latest Edition
3. Electronic Troubleshooting and Repair Handbook" by Homer L. Davidson, Latest Edition

4. Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers" by Chetan Singh Solanki, Latest Edition
5. Modern Television Practice: Principles, Technology and Servicing" by R.R. Gulati, Latest Edition
6. CCTV Surveillance: Troubleshooting & Design – Vlado Damjanovski Latest Edition
7. Power Electronics Handbook – Muhammad H. Rashid- Latest Edition

Instructional Objectives

1. Solar Power System

1.1 Introduction to Solar Panel

1.1.1 Explain the working principle of solar panels and photovoltaic (PV) technology

1.1.2 Discuss the Difference between types of solar panels (monocrystalline, polycrystalline, thin- film, etc)

1.1.3 Discuss the advantages and limitations of solar energy in different applications

1.2 Industrial and domestic use of solar panel

1.2.1 Explain common household uses of solar panels (lighting, water heating, appliances, etc.)

1.2.2 Explain the components of a residential solar power system (PV modules, inverter, charge controller, batteries, net metering, etc.).

1.2.3 Discuss the benefits of solar energy for homes, including cost savings and energy independence.

1.2.4 Discuss the installation process of a domestic solar system

1.2.5 Describe how solar panels are used in industries for power generation

1.2.6 Discuss large-scale solar power plants and grid-tied solar systems

1.2.7 Explain industrial uses such as:

- Running heavy machinery
- Powering telecommunications equipment
- Operating remote monitoring and control systems
- Agricultural applications (solar irrigation, greenhouse heating, etc.)

1.3 Introduction of ON and OFF Grid

1.3.1 Explain the difference between grid-tied (ON-Grid), off-grid, and hybrid solar power systems

1.3.2 Discuss how net metering works in grid-connected systems

1.3.3 Discuss battery storage solutions for off-grid applications

1.4 Introduction to Solar Inverter

1.4.1 Define solar inverter and explain its role in a solar power system

1.4.2 Describe the basic working principle of a solar inverter

1.4.3 Discuss different types of solar inverters (e.g., string inverters, microinverters, hybrid inverters)

1.4.4 Understand the efficiency ratings and performance parameters of solar inverters

1.5 Load Calculation

1.5.1 Explain the fundamental concepts of solar power generation and energy consumption

1.5.2 Explain the key components involved in a solar panel system

1.5.3 Discuss the relationship between power (W), voltage (V), current (A), and energy consumption (Wh).

1.5.4 Explain daily energy consumption based on different load requirements

1.5.5 Explain the how to determine the total wattage of appliances

1.5.6 Perform step-by-step load calculations using real-world examples

1.5.7 Discuss how to select the appropriate solar panel capacity based on the calculated load

1.5.8 Analyse the efficiency and performance of solar panels
1.5.9 Demonstrate the use of online tools or software for solar load calculation

1.6 Troubleshooting & Maintenance
1.6.1 Discuss the basic maintenance procedures for solar panels in homes and industries
1.6.2 Discuss how to identify common issues affecting solar panel efficiency and how to resolve
1.6.3 Understand the lifespan and degradation factors of solar panels

2. UPS (Un-interruptible Power Supply)

2.1 Construction of UPS
2.1.1 Explain the key components of a UPS, such as rectifiers, inverters, static bypass switches, and batteries
2.1.2 Explain the design considerations for selecting appropriate UPS systems based on load requirements and application.

2.2 Types of UPS
2.2.1 Explain the difference between various types of UPS systems, including Offline/Standby, Line-Interactive, and Online/Double-Conversion UPS.
2.2.2 Discuss the operational principles, advantages, and limitations of each UPS type

2.3 Installation and Maintenance Practices
2.3.1 Demonstrate proper installation procedures for UPS systems with safety standards and manufacturer guidelines
2.3.2 Discuss maintenance schedules and perform routine checks to ensure optimal performance and longevity of UPS units

2.4 Troubleshooting
2.4.1 Discuss common issues that may arise in UPS operations and employ systematic approaches to troubleshoot and resolve
2.4.2 Discuss how to utilize diagnostic tools and software to monitor UPS performance and detect potential faults

3. TV

3.1 Android TV

3.1.1 Introduction
3.1.1.1 Discuss the key components and features of an Android TV (display panel, motherboard, power supply, ports, remote control, etc.).
3.1.1.2 Explain the function of each hardware component and connectivity options (HDMI, USB, Wi-Fi, Bluetooth)
3.1.1.3 Discuss different display technologies (LED, OLED, QLED) and their impact on performance

3.1.2 Installation & Setup
3.1.2.1 Demonstrate proper installation and initial setup of an Android TV
3.1.2.2 Demonstrate how to configure network connections (Wi-Fi, Ethernet) and account synchronization
3.1.2.3 Demonstrate the process of Installation and update apps through the Google Play Store

3.1.3 Maintenance Procedures
3.1.3.1 Discuss how to perform routine cleaning and maintenance of the screen and hardware components
3.1.3.2 Discuss how to identify and prevent overheating issues using proper ventilation techniques
3.1.3.3 Ensure firmware and software updates are applied for optimal performance

3.1.4 Troubleshooting & Repair

3.1.4.1 Diagnose and resolve common hardware issues (no power, screen flickering, sound failure, port malfunctions)
3.1.4.2 Use diagnostic tools to identify and fix software-related issues (boot loops, app crashes, system lag)
3.1.4.3 Replace and repair faulty components such as power supply boards, T-Con boards, and backlight assemblies

3.2 Introduction to CCTV systems
3.2.1 Overview
3.2.1.1 Explain the fundamental purpose and importance of CCTV systems
3.2.1.2 Describe the key components of a CCTV system (cameras, DVR/NVR, cables, power supply, storage)
3.2.1.3 Discuss the difference between analog and digital CCTV systems
3.2.2 Types
3.2.2.1 Identify and compare various types of CCTV cameras (Dome, Bullet, PTZ, Thermal, IP, Wireless)
3.2.2.2 Explain the differences between DVR (Digital Video Recorder) and NVR (Network Video Recorder) systems
3.2.2.3 Understand different video transmission technologies (Coaxial, Ethernet, Wireless)
3.2.3 Applications
3.2.3.1 Describe the role of CCTV in security, surveillance, traffic monitoring, and industrial applications
3.2.3.2 Identify industry-specific use cases (Retail, Banking, Healthcare, Public Safety)
3.2.3.3 Understand legal and ethical considerations in CCTV deployment
3.2.4 CCTV System Installation & Configuration
3.2.4.1 Demonstrate the step-by-step process of installing a CCTV system
3.2.4.2 Configure camera angles, resolution, and recording settings for optimal performance
3.2.4.3 Set up remote access and mobile viewing through applications
3.2.5 Troubleshooting & Maintenance
3.2.5.1 Identify common CCTV issues (blurry video, no signal, power failures, storage errors)
3.2.5.2 Perform basic troubleshooting techniques for connectivity, power, and recording issues
3.2.5.3 Understand the importance of firmware updates and periodic maintenance

3.3 Components of CCTV Systems
3.3.1 Cameras
3.3.1.1 Identify different types of CCTV cameras (Dome, Bullet, PTZ, Thermal, IP, Analog)
3.3.1.2 Explain camera specifications such as resolution, lens type, infrared (IR) capabilities, and field of view
3.3.1.3 Describe factors affecting camera placement and installation
3.3.2 Recording Devices
3.3.2.1 Differentiate between DVR (Digital Video Recorder) and NVR (Network Video Recorder)
3.3.2.2 Understand storage options and video compression technologies (H.264, H.265)
3.3.2.3 Configure recording settings, playback, and remote access
3.3.3 Displays
3.3.3.1 Explain the role of monitors in a CCTV system
3.3.3.2 Understand resolution compatibility between cameras and displays

3.3.3.3 Demonstrate how to set up multi-channel monitoring and video wall configurations

3.3.4 Cable & Connectors

3.3.4.1 Identify different types of CCTV cables (Coaxial, Ethernet, Fiber Optic, Power Cables)

3.3.4.2 Understand the role of connectors (BNC, RJ45, HDMI, VGA) in CCTV systems

3.3.4.3 Explain best practices for cable management and interference reduction

3.3.5 Power Supply

3.3.5.1 Explain the power requirements of CCTV systems

3.3.5.2 Discuss the difference between PoE (Power over Ethernet) and traditional power supply methods

3.3.5.3 Describe the importance of UPS (Uninterruptible Power Supply) and backup power solutions

3.3.6 Troubleshooting & Maintenance

3.3.6.1 Discuss how to diagnose and fix common CCTV issues (no video signal, power failures, blurry images)

3.3.6.2 Perform basic troubleshooting for cameras, recording devices, and connectivity issues.

3.3.6.3 Explain routine maintenance practices to extend the lifespan of CCTV systems

3.4 IP camera system

3.4.1 Introduction

3.4.1.1 Explain the concept and advantages of IP camera systems over analog CCTV

3.4.1.2 Describe the working principle of an IP camera system and its key components

3.4.1.3 Understand the role of network connectivity in IP camera functionality

3.4.2 Types

3.4.2.1 Identify and differentiate various types of IP cameras (Fixed, Dome, Bullet, PTZ, Thermal, Fisheye, Wireless)

3.4.2.2 Explain the suitable applications for each type of IP camera

3.4.2.3 Compare wired and wireless IP cameras in terms of performance and reliability

3.4.3 Features

3.4.3.1 Understand key features such as resolution, frame rate, night vision, motion detection, and two-way audio

3.4.3.2 Explain advanced technologies like AI-based analytics, facial recognition, and cloud storage

3.4.3.3 Configure video compression standards (H.264, H.265, MJPEG) for efficient storage and streaming

3.4.4 Troubleshooting and Maintenance

3.4.4.1 Identify and resolve common issues like no video feed, network disconnection, and poor image quality

3.4.4.2 Perform basic troubleshooting for IP address conflicts, bandwidth limitations, and firmware issues

3.4.4.3 Explain best practices for securing IP cameras against cyber threats (password protection, encryption, firewall settings)

4. Displays

4.2 LCD Displays

4.2.1 LCD Display Technology and its Applications

4.1.1.1 Explain the basic working principles of Liquid Crystal Display (LCD) technology

4.1.1.2 Discuss and Compare LCD displays with other display technologies (Plasma, LED, OLED) in terms of efficiency, clarity, and performance

4.1.1.3 Discuss various applications of LCD displays in industries such as business, education, healthcare, and digital signage

4.2.2 Technical Specifications and Features

4.1.2.1 Discuss the key specifications of LCD displays, including resolution, brightness, contrast ratio, refresh rate, and response time

4.1.2.2 Explain the advantages of LCD displays, such as energy efficiency, reduced glare, and long lifespan

4.1.3 Installation and Configuration

4.1.3.1 Explain the correct installation of LCD displays for various applications (wall-mounted, desktop, video walls)

4.1.3.2 Configure display settings for optimal image quality, including brightness, contrast, and color calibration

4.1.3.3 Explain the different input and output interfaces (HDMI, DisplayPort, VGA, USB, wireless connectivity)

4.1.3.4 Discuss LCD displays with computers, media players, and other external devices

4.1.4 Troubleshooting and Maintenance

4.1.4.1 Discuss the common LCD display issues, such as dead pixels, backlight failure, and screen flickering and their troubleshooting

4.1.4.2 Discuss proper maintenance practices, including cleaning procedures and firmware updates

4.2 Plasma Displays

4.2.1 Plasma Display Technology and its Applications

4.2.1.1 Discuss the fundamental working principles of plasma display panels (PDPs)

4.2.1.2 Discuss and compare plasma display technology with other display types (LCD, LED, OLED)

4.2.1.3 Discuss common use cases of plasma displays in commercial, industrial, and consumer applications

4.2.2 Technical Specifications and Features

4.2.2.1 Explain the key specification of Plasma Display such as resolution, contrast ratio, and refresh rate

4.2.2.2 Describe the advantages of plasma displays, including color accuracy, response time, and viewing angles

4.2.3 Installation and Configuration

4.2.3.1 Demonstrate the correct installation and mounting of a plasma display

4.2.3.2 Configure input sources and optimize display settings for various environments

4.2.4 Troubleshooting and Maintenance

4.2.4.1 Discuss common plasma display issues (burn-in, power failures, dead pixels) and their solutions

4.2.4.2 Discuss proper maintenance procedures to extend display lifespan

4.3 Large Screen

4.3.1 Large Screen Display Technology and its Application

4.3.1.1 Discuss the working principles behind large screen display technologies (LCD, LED, OLED, and projection)

4.3.1.2 Discuss and compare different types of large screen displays based on resolution, brightness, and energy efficiency
4.3.1.3 Discuss the primary applications of large screen displays in business, education, entertainment, and public spaces

4.3.2 Technical Specifications and Features
4.3.2.1 Discuss the key specifications of large screen displays, such as size, resolution, aspect ratio, and refresh rate
4.3.2.2 Discuss the benefits of large screen displays, including high visibility, scalability, and interactive capabilities

4.3.3 Installation and Configuration
4.3.3.1 Discuss proper installation methods for wall-mounted, freestanding, and ceiling-mounted large screen displays
4.3.3.2 Configure display settings for optimal performance in different environments (indoor, outdoor, conference rooms, digital signage)
4.3.3.3 Discuss the process of Connecting and integrating large screen displays with various input sources (HDMI, VGA, wireless streaming, networked systems)
4.3.3.4 Discuss built-in smart features, control interfaces, and remote management tools

4.3.4 Troubleshooting and Maintenance
4.3.4.1 Discuss common issues and their trouble shooting such as screen flickering, connectivity problems, and overheating
4.3.4.2 Discuss best practices for maintaining display longevity, including cleaning, ventilation, and software updates

5. Equipment Calibration and Testing

5.1 Calibration Principles
5.1.1 Define calibration and its importance in electronic equipment.
5.1.2 Explain traceability and standards used in calibration

5.2 Testing Procedures
5.2.1 Explain Performance testing for repaired equipment
5.2.2 Define Quality assurance protocols

6. Microwave Oven

6.1 Introduction to Microwave oven
6.1.1 Explain the working principle
6.1.2 Demonstrate the key components (magnetron, high-voltage transformer, cavity, waveguide, turntable, ventilation and control panel)

6.2 Block Diagram of Microwave Oven
6.2.1 Draw the block diagram

6.3 Features of Microwave Oven
6.3.1 Explain the key features

6.4 Faults & Troubleshooting
6.4.1 Identify common faults in microwave ovens (failure to heat, unusual noises, sparking)
6.4.2 Demonstrate the use of multimeters and diagnostic tools to test components like fuses, capacitors, diodes, and magnetrons
6.4.3 Demonstrate the step-by-step repair techniques for fixing faulty electronic boards, turntable motors, and magnetron circuits

6.5 Preventive Maintenance
6.5.1 Explain routine inspection procedures, including checking for microwave leaks, cleaning the cavity, and testing control functions.
6.5.2 Perform regular checks on door seals, waveguides, and ventilation systems
6.5.3 Explain the importance of cleaning interior surfaces

7. AC Inverter/VFD

7.1 Introduction to AC Inverters (VFD)

- 7.1.1 Explain the fundamental principles of AC inverters and variable frequency drives (VFDs)
- 7.1.2 Discuss the key components and their functions in a VFD
- 7.1.3 Explain the role of VFDs in controlling motor speed and efficiency

7.2 Inverter Installation & Configuration

- 7.2.1 Explain how to install a VFD unit, including power and control wiring
- 7.2.2 Explain how to Configure initial parameters for motor control
- 7.2.3 Explain how adjust motor parameters (voltage, current, frequency, acceleration/deceleration rates)
- 7.2.4 Explain how to implement basic and advanced control modes (V/f, Vector, Torque Control)
- 7.2.5 Explain how to configure protective features like overload, overvoltage, and undervoltage settings

7.3 Troubleshooting & Diagnostics

- 7.3.1 Explain how to perform routine maintenance (filter cleaning, terminal inspections, capacitor checks)
- 7.3.2 Explain how to diagnose and troubleshoot common VFD faults (overcurrent, overheating, phase loss).
- 7.3.3 Explain using diagnostic tools (multimeter, oscilloscope, software) to analyze fault
- 7.3.4 Explain how replace faulty components such as capacitors, IGBTs, and cooling fans

8. Cellular Phone

8.1 Introduction

- 8.1.1 Discuss the key components and features of a cellular phone
- 8.1.2 Explain the function of each hardware component (e.g., battery, display, circuit board, antennas, etc.)
- 8.1.3 Understand different mobile phone technologies (GSM, CDMA, LTE, 5G)

8.2 Maintenance Procedure

- 8.2.1 Demonstrate proper handling and storage of mobile phones to prevent damage
- 8.2.2 Perform routine cleaning and maintenance of mobile phone components
- 8.2.3 Diagnose and replace commonly worn-out parts like batteries, screens, and buttons

8.3 Repairing/Troubleshooting

- 8.3.1 Identify common hardware and software issues in cellular phones
- 8.3.2 Use diagnostic tools (multimeter, oscilloscope, software tools) to detect faults
- 8.3.3 Perform repairs such as replacing screens, fixing charging ports, and re-soldering connections

8.4 Software Servicing

- 8.4.1 Discuss mobile operating systems (Android, iOS) and their troubleshooting
- 8.4.2 Perform software resets, updates, and firmware flashing
- 8.4.3 Unlock and reset security settings when required

9. Introduction to Equipment Maintenance

9.1 Types of maintenance

9.1.1 Explain different types of maintenance techniques like Preventive, Corrective, and Predictive

9.1.2 Explain preventive maintenance: Routine inspections, cleaning, and testing

Schedule development and adherence

9.1.3 Explain corrective maintenance: Fault diagnosis techniques, repair and replacement procedures

9.1.4 Explain predictive maintenance: Vibration analysis, thermal imaging, and condition monitoring

9.2 **Importance of Maintenance**

9.2.1 Explain the Role of maintenance in improving equipment reliability and lifespan

List of Practical

1-2. Introduction to servicing, Methods of servicing, Workshop precautions
3-4 Introduction of tools, equipment and instruments used in servicing process.
5-6 General specifications of tools, equipment and instruments used in servicing process.
7-9 Perform load calculations for solar
10-11. Perform Installation of Solar Mounting Systems
12-13 Perform Electrical Wiring and Connections
14-16 Perform System Commissioning and Testing
17-18. Perform Troubleshooting of faulty solar system
19-21. Servicing faulty Multimeter analog or digital and write report.
22-24 Familiarization and servicing of Tachometer (Stabroscope) and write report
25-26. Familiarization and servicing of Digital Temperature measuring meter and write report.
27-28. Familiarization and servicing of Frequency Counter and write report.
29-30. Familiarization and practice on Hot air Soldering and de-soldering station
32-33. Identify and locate the different sections of LED TV
34-36 Servicing faulty Lab Supply and write a report.
37-39 Servicing faulty Multimedia Projector and write report
40-42. Introduction and location of different stages of color monitor.
43-44 Servicing a faulty color monitor set and write report.
45-46 Familiarization and servicing of Mobile phone and write report.
47-48 Familiarization and servicing of Microwave Oven
49-50 Servicing and repairing of automatic washing machine.
51-52 Configuration of NVR
53-54 Repairing of laptop battery
55-56 Servicing and repairing of UPS.

(ELTR-342) Mobile and Wireless Networks

Total Contact Hours

		T	P	C
Theory	64			
Practical	00	2	0	2

Learning Outcomes:

- To develop a strong foundation in the fundamentals of wireless networks, including signal processing, wave propagation, and multiple access techniques.
- To explore the evolution of cellular networks from 1G to 4G and understand the emerging technologies like 5G, 6G, and Next Generation Networks.
- To familiarize students with advanced topics such as IoT, Wireless Sensor Networks (WSN), and their applications in real-world scenarios.
- To enhance students' knowledge of the future trends and innovations in wireless communication, including MIMO, millimetre waves, RIS, UAV, and AI in wireless networks.

Course Contents

1. The History of Wireless Networks (02 Hours)

1.1 Introduction
1.2 Evolution of Wireless Networks
1.3 Characteristics of Wireless Networks
1.4 Application and Impact of Wireless Networks

2. Fundamentals of Wireless Networks (04 Hours)

2.1 Introduction to Transducers
2.2 Filtration and Amplification
2.3 Modulation
2.4 Signal Transmission to Antennas
2.5 Transmitters and Receivers
2.6 Antennas
2.7 Wave Propagation
2.8 RF Spectrum and Associated Losses
2.9 Multiple Access Techniques

3. Types of Wireless Networks (12 Hours)

3.1 Types of Wireless Communication on the basis of Range
  3.1.1 Short-Range Communication
  3.1.2 Medium-Range Communication
  3.1.3 Long-Range Communication
3.2 Short-Range Wireless Networks
  3.2.1 Bluetooth
  3.2.2 Wi-Fi (IEEE 802.11)
  3.2.3 ZigBee
3.3 Medium-Range Wireless Networks
  3.3.1 AM Radio Networks
  3.3.2 FM Radio Network
  3.3.3 Cellular Networks
3.4 Long-Range Wireless Networks
  3.4.1 Satellite Communication
  3.4.2 Global Positioning System

4. 1G - Advanced Mobile Phone Systems (AMPS) (03 Hours)

- 4.1 Air Interface
- 4.2 The Architecture of AMPS
- 4.3 Nordic Mobile Telephony (NMT) and Total Access Communications System (TACS)
- 4.4 Limitations and Drawbacks of 1G

5. 2G – Global System for Mobile Telecommunication (GSM) 12 Hrs.

- 5.1 Vision of 2G wireless networks
- 5.2 Air Interface of GSM
- 5.3 GSM Architecture
- 5.4 Mobile Station
- 5.5 Functions of Base Transceiver Stations (BTS), Base Station (BS), and Base Station Controller (BSC)
- 5.6 Components and Function of Mobile Switching Center (MSC)
- 5.7 GSM Channels
- 5.8 GSM Handover
- 5.9 Public Switched Telephone Networks (PSTN) to Mobile Call Setup
- 5.10 Mobile Call Setup in GSM
- 5.11 2.5G - Global Packet Radio Service (GPRS)
- 5.12 2.75G Enhanced Data Rate for GPRS Evolution (EDGE)
- 5.13 Wireless quality and optimization parameters
- 5.14 Limitations and Drawbacks of 2G/2.5G/2.75G

6. 3G - Universal Mobile Telecommunications System (UMTS) 04 Hours

- 6.1 Vision of 3G wireless networks
- 6.2 Standardization and 3G Partnership Project (3GPP)
- 6.3 Air Interface of UMTS
- 6.4 3G Architecture
- 6.5 High Speed Downlink Packet Access (HSDPA) protocol
- 6.6 Limitations and Drawbacks of 3G

7. 4G – Long Term Evolution (LTE) (06 Hours)

- 7.1 Vision of 4G wireless networks
- 7.2 Challenges for 4G wireless networks
- 7.3 Air Interface of LTE
- 7.4 4G Architecture
- 7.5 LTE User Equipment (LTE UE)
- 7.6 Evolved UMTS Terrestrial Radio Access Network (E-UTRAN)
- 7.7 Evolved Packet Core (EPC)
- 7.8 LTE Advanced
- 7.9 Voice over IP (VoIP)
- 7.10 Application supported by 4G wireless networks
- 7.11 Limitations and Drawbacks of 4G

8. 5G and beyond - Next Generation Networks (14 Hours)

- 8.1 Vision of 5G wireless networks
- 8.2 Challenges for 5G wireless networks
- 8.3 Air Interface of 5G
- 8.4 5G Architecture
- 8.5 Applications of 5G Networks
- 8.6 Vision of 6G wireless networks
- 8.7 The role of AI in networks
- 8.8 Capabilities of 6G
- 8.9 Application area for 6G networks
- 8.10 Air Interface of 6G

8.11 Concept of Future Device

9. Wireless Sensor Networks (WSN) and Internet of Things (IoT) 7Hr

9.1 Introduction to Wireless Sensor Networks (WSN)
9.2 Architecture and Components of WSN
9.3 Characteristics of WSN
9.4 Applications of WSN
9.5 Internet of Things (IoT)
9.6 Introduction to IoT
9.7 IoT Architecture
9.8 Applications of IoT
9.9 Comparison of WSN and IoT

REFERENCE BOOKS:

1. Wireless Communication Networks and Systems" by William Stallings and Cory Beard (Latest Edition)
2. Wireless Communications and Networks: Recent Advances by A Eksim (Latest Edition)
3. 5G Mobile and Wireless Communications Technology" by Afif Osseiran, Jose F. Monserrat, and Patrick Marsch (Latest Edition)
4. 6G Wireless Communications and Mobile Networking" by Subrat Kar and Pardeep Kumar (Latest Edition)
5. Wireless Sensor Networks: Principles and Practice" by Fei Hu and Xiaojun Cao (Latest Edition)

Instructional Objectives

1. The History of Wireless Networks

- 1.1 Introduction,
- 1.2 Define wireless networks.
- 1.3 Describe the importance of wireless networks.
- 1.4 Brief overview of early communication systems (e.g., optical signals, smoke signals, and semaphore systems).
- 1.5 Evolution of Wireless Networks
  - 1.5.1 1830s: Introduce the invention of the Telegraph by Samuel Morse.
  - 1.5.2 1876: Introduce the invention of the Telephone by Alexander Graham Bell.
  - 1.5.3 1901: Introduce the first Transatlantic Radio Signal by Marconi.
  - 1.5.4 1930s-1940s: Introduce the emergence of Two-Way Radio Communication (e.g., Walkie-Talkies during World War II).
  - 1.5.5 1946: Introduction of the First Mobile Telephone Service (MTS) by AT&T.
  - 1.5.6 1970s: Describe the advent of cellular systems.
- 1.6 Characteristics of Wireless Networks.
- 1.7 Application and Impact of Wireless Networks,
  - 1.7.1 Explain the applications of wireless networks (Personal, Industrial, and Critical).
  - 1.7.2 Describe the Social, Economic, and Technological implications of wireless networks.
  - 1.7.3 Describe the challenges addressed by wireless technologies.

2. Fundamentals of Wireless Networks

- 2.1 Introduction to Transducers,
  - 2.1.1 Describe the role of transducers in converting natural signals to electrical signals.
- 2.2 Amplification and Filtration,
  - 2.2.1 Define the role of amplifiers.
  - 2.2.2 Describe the types and role filters.
- 2.3 The Modulation,
  - 2.3.1 Discuss the importance of modulation.
  - 2.3.2 Overview of analog and digital modulation techniques.
- 2.4 Signal Transmission,
  - 2.4.1 Describe the role of transmission lines and waveguides.
  - 2.4.2 Define the types of transmission lines and waveguides.
- 2.5 Transmitters and Receivers,
  - 2.5.1 Define the Transmitters.
  - 2.5.2 Define the Receivers.
- 2.6 Antennas,
  - 2.6.1 Describe the antenna basics and their function in wireless communication.
  - 2.6.2 Explain the types (with application) of antennas.
- 2.7 Wave Propagation,
  - 2.7.1 Define electromagnetic waves.
  - 2.7.2 Describe the modes of wave propagation: Ground wave, sky wave and line-of-sight propagation.

2.7.3 Define the basic propagation methods (refraction, diffraction, and scattering).
2.7.4 Describe the environmental effects on wave propagation.
2.7.5 Define the Fading in wireless communication.

2.8 RF Spectrum and Associated Losses,
2.8.1 Overview of the RF spectrum and its allocation for communication.
2.8.2 Types of losses: Path loss, absorption loss, and multi-path fading.

2.9 Multiple Access Techniques,
2.9.1 Introduction to the concept of multiple access techniques for resource sharing.
2.9.2 Describe the types of multiple access (FDMA, TDMA, CDMA, OFDMA, SDMA).
2.9.3 Discuss the comparison of different Multiple Access Techniques.

3. Types of Wireless Networks

3.1 Types of Wireless Communication on the basis of Range
3.1.1 Describe the Short-Range Wireless Communication.
3.1.2 Describe the Medium-Range Communication.
3.1.3 Describe the Long-Range Communication.

3.2 Short-Range Wireless Networks,
3.2.1 Bluetooth,
3.2.1.1 Definition.
3.2.1.2 Describe the Architecture (Master, Slave, Star topology).
3.2.1.3 Describe the specifications in terms of Range, Frequency and Applications.
3.2.2 Wi-Fi,
3.2.2.1 Definition.
3.2.2.2 Describe the IEEE and its IEEE 802.11 standard.
3.2.2.3 Explain the architecture (Client, Access Point, and Router).
3.2.2.4 Describe the specifications in terms of Range, Frequency and Applications.
3.2.2.5 Describe the difference between Wi-Fi5.0 and Wi-Fi 6.0
3.2.3 ZigBee,
3.2.3.1 Definition.
3.2.3.2 Explain the architecture (Coordinator, Device, End Device, Mesh / Star Topology).
3.2.3.3 Describe the specifications in terms of Range, Frequency and Applications.

3.3 Medium-Range Wireless Networks,
3.3.1 AM Radio Networks,
3.3.1.1 Definition.
3.3.1.2 Explain the architecture.
3.3.1.3 Describe the specifications in terms of Range, Frequency and Applications.
3.3.2 FM Radio Network,
3.3.2.1 Definition.
3.3.2.2 Explain the architecture.
3.3.2.3 Describe the specifications in terms of Range, Frequency and Applications.
3.3.3 Cellular Networks (1G, 2G, 3G, 4G, 5G and beyond),
3.3.3.1 Define basic Block Diagram of Network Generation (User, Access Network, Core Networks and Public Network).
3.3.3.2 Draw and define basic diagram of Cellular Systems.

3.3.3.3 Definitions of cellular terms (Cell, Cell Structure, Cellular System, Cell Site, Adjacent Cell, Co-Channel cells, Cluster, Cluster Size, Frequency Reuse, Mobile Station, Base Station, Base Transceiver Station / Base Station, Cell Splitting, Sectoring, Forward and Reverse Traffic Channels, Control Channels, and Frequency Hopping).

3.3.3.4 Define Channel Assignment Strategies (FCA - Fixed Channel Assignment, DCA - Dynamic Channel Assignment, and HCA - Hybrid Channel Assignment).

3.4 Long-Range Wireless Networks,

3.4.1 Satellite Communication,

3.4.1.1 Definitions.

3.4.1.2 Describe Earth Orbits for satellite communication.

3.4.1.3 Draw and explain the Block Diagram (Ground Station and Satellite).

3.4.1.4 Describe the specifications in terms of Range, Frequency.

3.4.1.5 Describe the role of Very Small Aperture Terminal (VSAT).

3.4.1.6 Describe Star-link.

3.4.1.7 Describe the applications of satellite communication.

3.4.1.8 Explain the architecture of satellite-based TV channel.

3.4.2 Global Positioning System,

3.4.2.1 Definition.

3.4.2.2 Explain its working.

3.4.2.3 Describe the basic errors that GPS systems face.

3.4.2.4 Specifications (Range, Frequency and Applications).

3.4.2.5 Describe the Virtual Positioning Systems (VPS).

4. 1G - Advanced Mobile Phone Systems (AMPS)

4.1 Air Interface,

4.1.1 Describe frequency spectrum available for 1G.

4.1.2 Definition of Modulation used.

4.1.3 Definition of Multiple Access Technique used.

4.2 The Architecture of AMPS,

4.2.1 Briefly explain the architecture and functions of Mobile Equipment, Base Station and Mobile Switching Center and PSTN network.

4.3 Nordic Mobile Telephony (NMT) and Total Access Communications System (TACS),

4.3.1 Define the origin and operating frequencies of Nordic Mobile Telephony (NMT).

4.3.2 Define the origin and operating frequencies of Total Access Communications Systems (TACS).

4.4 Describe the Limitations and Drawbacks of 1G.

5. 2G – Global System for Mobile Telecommunication (GSM)

5.1 Define the vision of 2G wireless networks.

5.2 Air Interface of GSM,

5.2.1 Define frequency spectrum available for 2G.

5.2.2 Definition of Modulation used.

5.2.3 Definition of Multiple Access Technique used.

5.3 Briefly explain the GSM Architecture.

5.4 Mobile Station,

5.4.1 Define Mobile Station.

5.4.2 Define SIM-Subscriber Identification Module.

5.4.3 Define IMSI-Int. Mobile Sub Identity.

5.4.4 Define LAI-Location Area Identity).

5.5 Functions of Base Transceiver Stations (BTS) / Base Station (BS), and Base Station Controller (BSC),

5.5.1 Define the BS and describe its role.

5.5.2 Define the BSC and describe its role.

5.6 Components and Function of Mobile Switching Center (MSC),

5.6.1 Briefly Explain the Functions of MSC.

5.6.2 Describe the Role of MSC in hands off.

5.6.3 Define the Equipment Identity Register (EIR).

5.6.4 Define the Authentication Center (AuC).

5.6.5 Define the Home Location Register (HLR).

5.6.6 Define the Visitor Location Register (VLR).

5.6.7 Define the concept of Gateway MSC (GMSC).

5.7 GSM Channels,

5.7.1 Define Physical Channel.

5.7.2 Define Logical Channel.

5.7.3 Define Traffic Channels (TCH).

5.7.4 Define Control Channels (CCH).

5.8 GSM Handover / Hands-off,

5.8.1 Define Hands-off and its types.

5.8.2 Define Intra BTS / Intra Cell handover.

5.8.3 Define Intra-BSC / Inter Cell handover.

5.8.4 Define Inter-BSC / Intra MSC handover.

5.8.5 Define Inter-MSC handover.

5.9 Wireless quality and optimization parameters,

5.9.1 Explain ten important wireless quality parameters.

5.10 Describe the Public Switched Telephone Networks (PSTN) to Mobile Call Setup.

5.11 Describe the Mobile Call Setup in GSM.

5.12 2.5G - Global Packet Radio Service (GPRS),

5.12.1 Definition of GPRS.

5.12.2 Architecture of GPRS.

5.12.3 Define Circuit switched elements.

5.12.4 Define packet switched elements, Serving GPRS Support Node (SGSN), and Gateway GPRS Support Node (GGSN).

5.12.5 Describe the Role of Packet Control Unit (PCU).

5.12.6 Define the terms Mobility Management, Session Management, and Billing.

5.13 2.75G Enhanced Data Rate for GPRS Evolution (EDGE),

5.13.1 Definition of EDGE and Data rates offered by it.

5.14 Describe the Limitations and Drawbacks of 2G.

6. 3G - Universal Mobile Telecommunications System (UMTS)

6.1 Define the vision of 3G wireless networks.

6.2 Standardization and 3G Partnership Project (3GPP),

6.2.1 Describe the importance of standardization.

6.2.2 Describe the role of International Telecommunication Union (ITU).

6.2.3 Define the Introduction of 3GPP.

6.3 Air Interface of UMTS,

6.3.1 Define frequency spectrum available for 3G.

6.3.2 Definition of Modulation used.

6.3.3 Definition of Multiple Access Technique used.

6.4 Briefly Explain the 3G Architecture,

6.4.1 Draw Block Diagram.

6.4.2 Definitions of its elements.
6.4.3 Explain the working of 3G architected.
6.4.4 Describe the Circuit Switched elements.
6.4.5 Describe the Packet Switched elements.
6.5 Define the High-Speed Downlink Packet Access (HSDPA) protocol.
6.6 Describe the Limitations and Drawbacks of 3G.

7. 4G – Long Term Evolution (LTE)

7.1 Describe the Vision of 4G wireless networks.
7.2 Describe the Challenges for 4G wireless networks.
7.3 Air Interface of LTE,
7.3.1 Define frequency spectrum available for 4G.
7.3.2 Definition of Modulation used.
7.3.3 Definition of Multiple Access Technique used.
7.4 Briefly explain the 4G Architecture,
7.4.1 Draw Block Diagram.
7.4.2 Explain the working of 4G.
7.4.3 Describe the concept of user plan and control plan.
7.5 Explain the LTE User Equipment (LTE UE),
7.5.1 Define LTE UE.
7.5.2 Define Mobile Termination (MT).
7.5.3 Define Terminal Equipment (TE).
7.5.4 Define Universal Integrated Circuit Card (UICC).
7.6 Explain the Evolved UMTS Terrestrial Radio Access Network (E-UTRAN),
7.6.1 Define eNodeB or eNB.
7.6.2 Define the function of eNB.
7.6.3 Define serving eNB.
7.6.4 Define S1 and X2 interface.
7.6.5 Define home eNB (HeNB).
7.7 Explain the Evolved Packet Core (EPC),
7.7.1 Definition and role of Mobility Management Entity (MME).
7.7.2 Definition and role of serving gateway (SGW).
7.7.3 Definition and role of Packet Data Network Gateway (PDN GW).
7.7.4 Definition and role of Policy and Charging Rule Function (PCRF).
7.7.5 Definition and role of Home Subscriber Server (HSS).
7.8 Define the LTE Advanced (Multi antenna techniques).
7.9 Define the Voice over IP (VoIP).
7.10 Describe the applications supported by 4G wireless networks (Voice, Multimedia Broadband – MBB).
7.11 Describe the Limitations and Drawbacks of 4G.

8. 5G and beyond - Next Generation Network

8.1 Describe the vision of 5G wireless networks.
8.2 Describe the challenges for Next Generation Networks.
8.3 Air Interface of 5G,
8.3.1 Define frequency spectrum available for 5G (mili-meter waves).
8.3.2 Define the concept of Multiple Input and Multiple Output MIMO).
8.3.3 Define the concept of Beamforming.
8.3.4 Definition of Modulation used.
8.3.5 Definition of Multiple Access Technique used.
8.4 Briefly explain the 5G Architecture,
8.4.1 Define the concept of SBA-Services Based Architecture.
8.4.2 Define the concept of Application-Specific Layers.
8.4.3 Define the concept of network functions virtualization (NFV).

8.4.4 Define the concept of software-defined networking (SDN).
8.4.5 Define the concept of network Slicing.
8.4.6 Draw the Block Diagram.
8.4.7 Define the elements and describe their function.

8.5 Applications of 5G Networks,
8.5.1 Define enhanced Mobile Broadband (eMBB) and describe its applications area.
8.5.2 Define massive Machine Type Communication (mMTC) and describe its applications area.
8.5.3 Define ultra-reliable and Low Latency Communication (uRLLC) and describe its applications area.
8.5.4 Describe the specific applications for Government (Smart Cities, Utilities, Public Safety, Public transport etc.).
8.5.5 Describe the specific applications for Consumers (HD 4k / 8K video streaming, Gaming, Internet of Things-IOT, Wearable application etc.).
8.5.6 Describe the specific application for Enterprise Manufacturing, Logistics, Agriculture, Fintech etc.).

8.6 Describe the vision of 6G wireless networks.

8.7 Explain the role of AI in NGN networks.

8.8 Describe the capabilities of 6G,
8.8.1 Define the concept of "Native AI".
8.8.2 Define the concept of "Networked Sensing".
8.8.3 Define the concept of "Extreme connectivity".
8.8.4 Define the concept of "Integrated Non-Terrestrial Networks (NTNs)".
8.8.5 Define the concept of "Native Trustworthiness".
8.8.6 Define the concept of "Sustainability".

8.9 Explain the Application area for 6G networks,
8.9.1 Describe enhanced Mobile Broad-Band plus (eMBB+),
8.9.1.1 Define the applications of Extended Reality (Virtual Reality – VR and Augmented Reality -AR).
8.9.1.2 Define the application and concept of Haptic and multi-sensory communication.
8.9.1.3 Define the application and concept of glass free 3D and holographic displays.
8.9.2 Describe Ultra-Reliable Low-Latency Communications plus (uRLLC+) ,
8.9.2.1 Define the concept of Factory of the future.
8.9.2.2 Define the concept of collaborative robots in groups.
8.9.2.3 Define the concept of level 5 Autonomous Vehicles.
8.9.2.4 Define the concept of Edge Computing.
8.9.2.5 Define the concept of Cloud Computing.
8.9.2.6 Describe the concept of Image Processing.
8.9.3 Describe massive Machine Type Communication (mTC+),
8.9.3.1 Define the concept of smart buildings.
8.9.3.2 Define the concept of smart Health Care.
8.9.3.3 Define the applications of UAVs in future networks.
8.9.4 Describe the term "Sensing",
8.9.4.1 Define the concept of simultaneously imaging, mapping and localization.
8.9.4.2 Define the concept of Virtual Positioning System (VPS).

8.9.4.3 Define the concept of Augmented Human Senses (Human 2.0).

8.9.4.4 Define the concept of gesture and activity recognition.

8.9.5 Define Artificial Intelligence (AI).

8.9.5.1 Define the concept of AI based network automation.

8.9.5.2 Define the concept of AI as a Service for data management.

8.10 Describe the Air Interface of 6G,

8.10.1 Define frequency spectrum available for 6G (Tera-Hertz frequency).

8.10.2 Define the concept of AI based Beamforming and MIMO.

8.10.3 Define the role of Unmanned Aerial Vehicles (UAVs) in 6G networks.

8.10.4 Describe the comparison of 5G and 6G Air Interface.

8.11 Explain the concept of Future Device,

8.11.1 Describe the Four trends of future device (Smarter, Versatile, Diversified and Cloudified).

8.11.2 Describe four capabilities of future devices (Intelligence, Ambient Sensing, Multi-Modal Human Machine Interface and Energy Harvesting).

9. Wireless Sensor Networks (WSN) and Internet of Things (IoT)

9.1 Introduction to Wireless Sensor Networks (WSN),

9.1.1 Definition of WSN.

9.1.2 Describe the importance of WSN.

9.2 Architecture and Components of WSN,

9.2.1 Define Sensors and Actuators for WSN.

9.2.2 Describe structure of Nodes.

9.2.3 Describe the terms Gateway and Base Station.

9.3 Describe the characteristics of WSN.

9.4 Explain the applications of WSN.

9.5 Internet of Things (IoT),

9.5.1 Definition of IOT.

9.5.2 Describe the Importance of IOT.

9.6 Explain the IoT Architecture,

9.6.1 Define the role of Perception Layer.

9.6.2 Define the role of Network Layer.

9.6.3 Define the role of Processing Layer.

9.6.4 Define the role of Application Layer.

9.7 Explain the applications of IoT.

9.8 Comparison of WSN and IoT.

Proposed Visits for better Understanding:-

1. A field visit to wireless service provider to examine the existing architecture.
2. A field visit to Network Operation Centre (NOC)

ELTR-373 Industrial Electronics

Total Contact Hours

		T	P	C
Theory	64			
Practical	96	2	3	3

Learning Outcomes:

After studying this subject, the students will be able to:

- Understand process automation and control.
- Operate industrial plants, equipped with a solid awareness of industrial processes
- Exhibit competence to contribute effectively in professional settings.

Course Contents

1. REVIEW OF SWITCHING Circuits, PHOTO DEVICES AND TIMERS (05 Hours)

1.1. UJT ratings and UJT relaxation oscillator
1.2 SCR ratings and SCR power control circuits
1.3 Diac and Triac ratings and their use in power control
1.4 Photo devices, phototransistor, LDR and LASCR
1.5 LED, LED array, LCD and solar cell
1.6 Opto-Couples
1.7 Sequential and long duration timer and their application
1.8 Types and application of Solar Cell
1.9 Introduction of ON/OFF Grid System

2. VOLTAGE REGULATORS AND MOTOR SPEED CONTROL (05 Hours)

2.1 Voltage regulation of electric generators
2.2 Working of DOL (Direct Online) starter
2.3 Speed Control of DC motor and light dimmers
2.4 Speed control of a 3-phase induction motor
2.5 Three phase motor control with VFD

3. SENSORS AND TRANSDUCERS (10 Hours)

3.1 Introduction of Sensors
3.2 Strain Gauge
3.3 Displacement Transducers
  3.3.1. Potentiometric Transducer
  3.3.2. Capacitive Transducer
  3.3.3. Inductive Transducer
  3.3.4. LVDT
3.4 Thermal Sensors
  3.4.1. Resistance Temperature Detector
  3.4.2. Thermistor
  3.4.3. Thermocouple
  3.4.4. IC Temperature Sensor
  3.4.5 Pyrometer
3.5 Optical Transducer

3.6 Piezo-Electric Transducer
3.7 Hall Effect Sensors

4. CONTROL SYSTEMS. (16 Hours)

4.1 Fundamentals of Control System

4.1.1 Control variables
4.1.2 Open loop control system.
4.1.3 Closed loop control system.
4.1.4 Final control element
4.1.5 On-off control.

4.2 PI, PD and PID Controllers

4.2.1 Fundamentals of PI and PD Controller
4.2.2 Proportional Band of PI and PD controller
4.2.3 Application of PI and PD Controller
4.2.4 Basic Principle of PID Controller
4.2.5 Calibration and application of PID Controller
4.4.6 Characteristics of PID Controller

4.3 Servo System

4.3.1 Loop presentation
4.3.2 Armature and field controls
4.3.3 Servo Block characteristics
4.3.4 Synchro's, transmitter and transformer
4.3.5 Transient response
4.3.6 Automatic voltage stabilizer (servo type)

5. PROGRAMMABLE LOGIC CONTROLLER (PLC) (10 Hours)

5.1 Introduction of PLC
5.2 Advantages and disadvantages of PLCs
5.3 PLC System Block Diagram
5.4 Structure of PLC system
5.5 Input and output modules
5.6 PLC Programming

5.6.1 Ladder diagram
5.6.2 Semantics of PLC Programming
5.6.3 Boolean Logics (OR, AND, NOT, NOR, NAND)
5.6.4 Timers
5.6.5 Counters
5.5.6 PLC Program

6. ADVANCE SYSTEM CONTROLLERS (04 Hours)

6.1 Introduction of HMI (Human Machine Interface)
6.2 Introduction to DCS Control System, Basic structure, Advantages and disadvantages of DCS Control System
6.5 Introduction to SCADA System, Basic structure, Advantages and disadvantages of SCADA System
6.8 Comparison between PLC, DCS and SCADA
6.8 Introduction to BMS (Building Management System)
6.9 Basic structure of BMS
6.10 Advantages and disadvantages of BMS

7. INTRODUCTION TO ROBOTICS (04 Hours)

7.1 Introduction of robotics
7.2 Types of robots
7.3 Programming robots
7.4 Application of Robotics in Industry.

8. INDUSTRIAL INSTRUMENTATION (10 Hours)

8.1 Introduction of Industrial Instrumentation.

8.2 Introduction of Industrial Transmitters
8.3 Temperature Transmitters, Types and Applications
8.4 Pressure Transmitters, Types and Applications
8.5 Flow Transmitters, Types and Applications
8.6 Level Transmitters, Types and Applications
8.7 Gauges/Indicators and Types
8.8 Industrial Valves, Types and Applications
8.9 Speed of Signal
8.10 Standard supplies (Electronic and pneumatic)
8.11 Standard Signals
8.12 Signal Transmission and reception
8.13 Accuracy and precision
8.14 Analog and Digital Instruments

REFERENCE BOOKS

1. Sensors, Actuators and Their Interfaces- Nathan Ida (Latest edition)
2. Modern Industrial Electronics, by Timothy J. Maloney, Prentice Hall, (Latest edition).
3. Industrial Electronics by Frank D. Petruzella, (Latest edition), McGraw-Hill
4. Programmable Logic Controllers, Author Frand D. Petruzella, (Latest edition), McGraw-Hill

Instructional objectives:

1. REVIEW OF SWITCHING, PHOTO DEVICES AND TIMERS

1.1. UJT ratings and UJT relaxation oscillator

1.1.1 State the operation of UJT relaxation oscillator and the terms V_{BB}, ηV_E and standoff ratio

1.2 SCR ratings and SCR power control circuits

1.2.1 State the rating & power control characteristics of SCR (V_{AK}, V_{BR}, I_H, I_A, I_{GT})

1.3 Diac and Triac ratings and their use in power control

1.3.1 Explain the applications of Diac & Triac in power control circuit

1.4 Photo devices, phototransistor, LDR and LASCR

1.4.1 Explain the applications of photo diode, photo transistor, LDR & LASCR.

1.5 LED, LED array, LCD and Opto-Couples

1.5.1 State the applications of LED, LED array, LCD and Opto-coupler

1.6 Sequential and long duration timer and their application

1.6.1 Explain the operation of sequential and long duration timer and list their applications

1.7 Types and application of Solar Cell

1.7.1 State the types of Solar Cell, Advantages and Dis-Advantages

1.7.2 State the Applications of Solar Cell

1.8 Introduction of ON/OFF Grid System

2. VOLTAGE REGULATORS AND MOTOR SPEED CONTROL

2.1 Voltage regulation of electric generators

2.1.1 Draw the schematic diagram for basic voltage regulator for electrical generator using a transistor and Zener diode (forming a closed loop).

2.1.2 Explain the working of the simple voltage regulator circuit.

2.2 Working of DOL (Direct Online) starter

2.2.1 Explain the working of DOL (Direct Online) starter with block diagram

2.3 Speed Control of DC motor and light dimmers

2.3.1 Draw the circuit diagram of electronic speed control of D.C. motor using SCR.

2.3.2 Explain the operation of the circuit of D.C. motor speed control.

2.3.3 Describe the voltage regulator method of speed control of a motor

2.3.4 Explain the operation of light dimmer with circuit diagram using

(i) SCR with a bridge rectifier.

(ii) Diac and Triac.

2.4 Speed control of a 3-phase induction motor

2.4.1 Describe the working of three-phase SCR speed variator.

2.4.2 Describe the working of adjustable frequency inverter for AC motor drive.

2.5 Three phase motor control with VFD

2.5.1 Explain the three phase motor control by Variable Frequency drive (VFD) with block diagram

3. SENSORS AND TRANSDUCERS

3.1 **Introduction of Sensors**

3.1.1 Define the sensor

3.1.2 Discuss basic types of sensors and their working principle

3.2 **Strain Gauge**

3.2.1 Discuss construction, working and applications of Strain Gauge

3.3 **Displacement transducers and types**

3.3.1 Explain construction and working of Displacement Transducers

3.3.2 Potentiometric Transducer

Discuss construction, working and applications of Potentiometric Transducer

3.3.3 Capacitive Transducer

Discuss construction, working and applications of Capacitive Transducer

3.3.3 Inductive Transducer

Discuss construction, working and applications of Inductive Transducer

3.3.4 LVDT

Discuss construction, working and applications of LVDT

3.4 **Thermal Sensors and its Types**

Explain Construction and working of Thermal Sensors

3.4.1. Resistance Temperature Detector

Discuss construction, working and applications of Resistance Temperature Detectors.

3.4.2. Thermistor

Discuss construction, working and applications of Thermistor

3.4.3. Thermocouple

Discuss construction, working and applications of Thermocouple

3.4.4. IC Temperature Sensor

Discuss construction, working and applications of IC Temperature Sensor

3.4.5 Pyrometer

Discuss construction, working and applications of Pyrometer

3.5 **Optical Sensor**

Discuss construction, working and applications of Optical Transducers

3.6 **Piezo-Electric Transducer**

Discuss construction, working principal and applications of Pizo-Electric Transducer

3.7 **Hall Effect Sensors**

Discuss construction, working principal and applications of Hall Effect Sensors

4. CONTROL SYSTEMS

4.1 Fundamentals of Control System

4.1.1 Discuss the Basic Control variables

4.1.2 Open loop control system

4.1.2.1 Draw the block diagram of open-loop control system

4.1.2.2 Identify the function of each block of the system

4.1.3.3 Applications of open-loop control system

4.1.3 Closed loop control system

4.1.3.1 Draw the block diagram of closed-loop control system.

4.1.3.2 Identify the function of each block of closed-loop control system

4.1.3.3 Uses of closed-loop control system

4.1.4 Describe the function of final control element
4.1.5 On-off control
4.1.5.1 Draw the diagram of on-off control system.
4.1.5.2 Explain the working of on-off control.

4.2 PI, PD and PID Controllers

4.2.1 Explain the fundamentals of PI and PD controller
4.2.2 Explain the working of PI controller
4.2.3 Explain the differentiation time of PD controller.
4.2.5 Discuss the Proportional Band of PI and PD controller
4.2.3 Application of PI and PD Controller
4.2.4 Basic Principle of PID Controller
4.2.4.1 Explain the characteristics of PI controller
4.2.4.2 Explain the characteristics of PD controller
4.2.4.3 Describe proportional Integral derivative (PID) controller
4.2.5 Calibration of PID Controller
4.2.5.1 Explain the calibration of PID controller
4.4.6 Characteristics of PID Controller
4.4.7 Discuss the application of PID controller

4.3 Servo System

4.3.1 Explain the loop presentation of servo system
4.3.2 Explain the armature control and field control of servo motor.
4.3.3 Explain the Servo Block characteristics
4.3.4 Transmitter and transformer
4.3.4.1 Explain the operation of transmitter and transformer in servo system.
4.3.5 Explain the transient response in servo system
4.3.6 Automatic voltage stabilizer (servo type)
4.3.6.1 Draw the circuit diagram of Automatic voltage stabilizer (servo motor type).
4.3.6.2 Explain the circuit operation of Automatic voltage stabilizer (servo motor type).

5. PROGRAMMABLE LOGIC CONTROLLER (P L C)

5.1 Introduction of PLC and role of PLC in industry
5.2 Discuss advantages and disadvantages of PLC
5.3 Draw the block diagram of PLC System
5.4 Explain the structure of PLC system
5.5 Discuss input and output modules
5.6 PLC Programming
5.6.1 Understand and develop Ladder diagram
5.6.2 Describe rules and symbols used in PLC Programming
5.6.3 Semantics of PLC Programming
5.6.4 Discuss Boolean Logics (OR, AND, NOT, NOR, NAND)
5.6.5 Describe Timers used in PLC Programming
5.6.6 Describe Counters used in PLC Programming
5.5.7 Develop PLC Programs

6. ADVANCE SYSTEM CONTROLLERS

6.1 Introduction of HMI (Human Machine Interface)
6.2 Introduction to DCS Control System,
6.2.1 Describe basic structure of DCS Control
6.2.2 Discuss advantages and disadvantages of DCS Control.
6.3 Introduction to SCADA System,
6.3.1 Describe basic structure of SCADA

6.3.2 Discuss advantages and disadvantages of SCADA
6.4 Comparison between PLC, DCS and SCADA
6.5 Introduction to BMS (Building Management System)
6.5.1 Describe Basic structure of BMS
6.5.2 Describe Advantages and disadvantages of BMS

7. INTRODUCTION TO ROBOTICS

7.1 Introduction of robotics
7.2 Discuss types of robots
7.3 Describe Programming for robots
7.4 Discuss application of Robotics in Industry.

8. INDUSTRIAL INSTRUMENTATION

8.1 Introduction of Industrial Instrumentation.
8.2 Introduction of Industrial Transmitters
8.3 Define the Temperature Transmitter
8.3.1 Explain the types of temperature transmitter used in industry
8.3.2 Discuss the applications of temperature transmitters
8.4 Define the Pressure Transmitters
8.4.1 Explain the types of pressure transmitters used in industry
8.4.2 Discuss the applications of pressure transmitters
8.5 Define the Flow Transmitters
8.5.1 Explain the types of flow transmitters used in industry
8.5.2 Discuss the applications of flow transmitters
8.6 Define the Level Transmitters
8.6.1 Explain the types of level transmitters used in industry
8.6.2 Discuss the applications of level transmitters
8.7 Define the Gauges/Indicators
8.7.1 Explain the types of gauges/indicators used in industry
8.7.1 Discuss the applications of gauges/indicators
8.8 Define the Industrial Valves
8.8.1 Explain the types of valves used in process industry
8.8.2 Discuss the applications of valves
8.9 Describe Speed of Signal
8.10 Discuss standard supplies (Electronic and Pneumatic)
8.11 Describe Standard Signals
8.12 Explain Signal Transmission and reception
8.13 Discuss accuracy and precision
8.14 Differentiate between Analog and Digital Instruments

LIST OF PRACTICAL: 96 Hours

1. The study the performance of a transistor switching with an inductive load and determine the need of protective diode.
2. To construct a UJT relaxation oscillator, control its frequency
3. Use of UJT in practical circuit such as
   a) Pulse Stretcher b) Temperature resistance heater control
4. Study of SCR data sheet and test of a thyristor
5. To study the Diac and Triac temperature control circuit
6. Use of SCR in practical circuit such as
   a) Light back up circuit
   b) Over voltage protection circuit
   c) Motor speed /temperature control
   d) Inverter control circuit
   e) Uninterrupted power supply (UPS)
7. Use of LED and LASCR in automatic battery charge.
8. Use of LED for seven segment display
9. Use of photo transistor in:
   a) Light interruption alarm b) Optical counting system
10. Use of Photo Darlington in remote and intrusion detector
11. Demonstrate the working of Potentiometer Transducer
12. Demonstrate the working of LVDT
13. Demonstrate the working of resistance thermometer
14. Calibrate a resistance thermometer
17. Demonstrate the working of Pizo-electric Transducer
18. Demonstrate the working of Optical Transducer
19. Demonstrate the closed loop servo control system of a voltage stabilizer
20. Industrial visit to: Demonstrate PI, PD and PDI controllers. Write a visit report
21. PLC Programming: Logic Gates verification
22. PLC Programming: Use of different Timers
23. PLC Programming: Use of different Counter
24. PLC Programming: Motor Control Program
25. PLC Programming: A simple Project
26. Visit of DCS & PLC Control Plant
27. Identification and working of Transmitter and Receivers
28. Calibration of temperature transmitter and verifying the different ranges by HART communicator
29. Calibration of level transmitter and verifying the different ranges by HART communicator
30. Calibration of flow transmitter and verifying the different ranges by HART communicator
31. Calibration of pressure transmitters and verifying the different ranges by HART communicator
32. Calibration of local gauges/indicators through dead weight tester

Eltr-383 Power Electronics

Total Contact Hours

		T	P	C
Theory	64			
Practical	96	2	3	3

Learning Outcomes:

After studying the subject, the student will be able to:

- Understand the operation of Power Devices.
- Understand the working of Power Electronics Circuits.
- Design the different types of inverters

Course Contents

1. Introduction of Power Electronics (04 Hours)

1.1. Applications of Power Electronics
1.2 Power Semiconductor Devices
1.3 Symbols of Power Electronics Devices
1.4 Control Characteristics of Power Devices
1.5 Types of Power Electronics Circuits

2. Power Semiconductor Diodes (10 Hours)

2.1 Characteristics of Power Diode
2.2 Reverse Recovery Characteristics
2.3 Types of Power Diodes
  2.3.1 General Purpose Diode
  2.3.2 Fast Recovery Diode
  2.3.3 Schottky Diode
2.4 Effects of Forward and Reverse Recovery Time
2.5 Series Connected Diode
2.6 Parallel Connected Diode

3. Diode circuits and Rectifiers (10 Hours)

3.1 Rectifier Concepts
3.2 Single Phase Half Wave Diode Rectifiers with resistive load
3.3 Single Phase Full Wave Diode Rectifiers with resistive load
3.4 Three Phase Full- Wave Rectifier

4. Power Thyristors (08 Hours)

4.1 Introduction to Power Thyristors
4.2 Power SCR
4.3 Characteristics of Power SCRs
4.4 Series operation of Power SCRs
4.5 Parallel operation of Power SCRs
4.6 SCR firing circuits

5. Controlled Rectifiers (10 Hours)

5.1 Introduction of controlled rectifiers
5.2 Principles of Phase- Controlled Converter Operation
5.3 Single Phase Semi converters with resistive load
5.4 Single Phase Full Converters with resistive load
5.5 Three Phase Half Wave Converters.
5.6 Three Phase Semi Converters with resistive load
5.7 Three Phase Full Converters with resistive load

6. DC Choppers (10 Hours)

- 6.1 Introduction to DC Choppers
- 6.2 Principle of Step-Down Operation
- 6.3 Step-Down Chopper
- 6.4 Principle of Step-Up Operation
- 6.5 Switching-Mode Regulators
  - 6.5.1 Buck Regulators
  - 6.5.2 Boost Regulators
  - 6.5.3 Buck-Boost Regulators
  - 6.5.4 Cuk Regulators
  - 6.5.5 Limitations of Single-Stage Conversion

7. Inverters (12 Hours)

- 7.1 Introduction to Inverters
- 7.2 Principle of Operation of Inverters
- 7.3 Single Phase Bridge Inverters
- 7.4 Three-Phase Inverters
  - 7.4.1 180-Degree Conduction
  - 7.4.2 120-Degree Conduction
- 7.5 Voltage Control of Single-Phase Inverters
  - 7.5.1 Single-Pulse Width Modulation
  - 7.5.2 Multi-Pulse-Width Modulation
  - 7.5.3 Sinusoidal Pulse-Width Modulation
  - 7.5.4 Modified Sinusoidal Pulse-Width Modulation
  - 7.5.5 Phase-Displacement Control

RECOMENDED BOOKS:-

1. Power Electronics for Technology, by Ashfaq Ahmad, Prentice Hall, (Latest edition)
2. Modern Industrial Electronics, by Timothy J. Maloney, Prentice Hall, (Latest edition).

Instructional Objectives

1. Introduction of Power Electronics

1.1 State the Applications of Power Electronics.
1.2 Describe the Power Semiconductor Devices with their symbols
1.3 Describe the Control Characteristics of Power Devices with diagrams.
1.4 Discuss types of Power Electronics Circuits
1.4.1 State Diode Rectifiers,
1.4.2 State Controlled Rectifiers,
1.4.3 State AC voltage Controllers,
1.4.4 State DC Choppers,
1.4.5 State Inverters,
1.4.6 State Static Switches

2. Power Semiconductor Diodes

2.1 Describe the construction of Power Diode and explain its working with the help of diagrams.
2.1.2 Describe the Characteristics of Power Diode with graphs and equations.
2.2 Explain Reverse Recovery Characteristics with graphs and equations.
2.3 Enlist the Types of Power Diodes.
2.3.1 Describe General Purpose Diode.
2.3.2 Describe Fast Recovery Diode.
2.3.3 Describe Schottky Diode
2.4 Explain Effects of Forward and Reverse Recovery Time with circuit diagram, waveforms and equations.
2.5 State the need of connecting diodes in series with circuit diagrams and Voltage-Current) VI characteristics.
2.6 State the need of connecting diodes in Parallel with circuit diagrams and VI characteristics

3. Diode circuits and Rectifier

3.1 Define Rectification and need of rectifiers with circuit diagram and equations.
3.2 Draw the circuit diagram of Single-Phase Half Wave Diode Rectifiers.
3.2.1 Explain its working with circuit diagram, wave forms and equations with Resistive Load.
3.2.3 State the Applications of Single-Phase Half Wave Diode Rectifiers
3.2.4 Simple calculations.
3.3 Draw the circuit diagram of Single-Phase Full Wave Diode Rectifiers (Bridge and Centre Tape Rectifiers).
3.3.1 Explain its working with circuit diagram, wave forms and equations with Resistive Load.
3.3.3 State the Applications of Single-Phase Full Wave Diode Rectifiers.
3.3.4 Simple calculations.
3.4 Draw the circuit diagram of Three Phase Full- Wave Bridge Rectifier. Explain its working with wave forms and equations.
3.4.1 State the Applications of Three Phase Full- Wave Bridge Rectifier.
3.4.2 Simple Calculations

4. Power Thyristors

4.1 Define the Power Thyristors.
4.1.1 Enlist the types of Power Thyristors.
4.2 Describe the construction of Power SCR with diagrams.
4.2.1 State the working of SCR
4.2.2 Describe the methods to Turn ON the SCR
4.2.3 Describe the methods of Turn OFF the SCR

4.3 State the VI Characteristics of Power SCRs.
4.3.1 Explain the Two Transistor Model.
4.4 State the need of connecting Power SCRs in Series with circuit diagrams and VI characteristics
4.5 State the need of connecting Power SCRs in Parallel with circuit diagrams and VI characteristics.
4.6 Describe need of the SCR firing
4.6.1 State the types of SCR firing methods.

5. Controlled Rectifiers

5.1 Define the controlled rectifiers.
5.1.1 Enlist the types of rectifiers with respect to Supply and their operation
5.2 Explain the operation of Phase- Controlled Converter.
5.3 Define Single Phase Semi converters.
5.3.1 Draw the circuit diagram of Single Phase Semi converter
5.3.2 State the uses of Single Phase Semi Converters.
5.3.3 Simple calculations.
5.4 State Single Phase Full Converters.
5.4.1 Draw the circuit diagram of Single Phase Full converter.
5.4.2 Explain its working with the help of waveforms.
5.4.2 State the uses of Single Phase Semi Converters.
5.4.3 State the uses of Single Phase Full converter.
5.4.4 Simple calculations.
5.5 Explain the working of Three Phase Half Wave Converters.
5.6 Describe the Three Phase Semi converters
5.6.1 Draw the circuit diagram of Three Phase Semi converter.
5.6.2 Explain its working with the help of waveforms.
5.6.3 State the uses of Three Phase Semi converter.
5.6.4 Simple calculations.
5.7 Describe Three Phase Full Converters.
5.7.1 Draw the circuit diagram of Three Phase Full converter.
5.7.2 Explain its working with the help of waveforms.
5.7.3 State the uses of Three Phase Full converter.

6 DC Choppers

6.1 Define DC Choppers.
6.2 Describe the principle of Step-Down Operation.
6.2.1. Draw the circuit diagram of Step- Down chopper with resistive load.
6.2.2. Discuss operation of Step- Down chopper with resistive load.
6.2.3. Discuss constant frequency operation.
6.2.4. Discuss variable frequency operation.
6.3 Describe the operation of Step-Down Chopper.
6.3.1. Draw the circuit diagram of Step- Down chopper.
6.3.2. Discuss operation of Step- Down chopper.
6.4 Describe the principle of Step-Up Operation.
6.5 Explain the principle of Switching-Mode Regulators
6.5.1. Draw the block diagram of Switching-Mode Regulator
6.5.2. Discuss the operation of Switching-Mode Regulator.
6.5.3. List the four basic topologies of Switching-Mode Regulators
6.5.3.1 Discuss the operation of Buck Regulators
6.5.3.2. Discuss the operation of Boost Regulators
6.5.3.3. Discuss the operation of Buck-Boost Regulators
6.5.3.4. Discuss the operation of Cuk Regulators

6.6.4 Discuss the limitations of Single-Stage Conversion

7 Inverters

7.1 Define Inverter.

7.1.1 State Need of Inverters.

7.2 Explain the working Principle of Inverters.

7.2.1 Draw the circuit diagram of Inverters.

7.2.2 Explain the working of Inverter with waveforms.

7.3 Draw the circuit diagram of Single Phase Bridge Inverters.
Explain the working of Single Phase Bridge inverters with waveforms and equations.

7.3.1 Simple calculations of Single Phase Bridge Inverters.

7.4 Explain Three-Phase Inverters

7.4.1 Draw the circuit diagram of Three-Phase Inverters for 180-Degree Conduction

7.4.2 Describe its working with waveforms and equations.

7.4.3 Simple calculations of Three-Phase Inverters for 180-Degree Conduction

7.4.5 Draw the circuit diagram of Three-Phase Inverters for 120-Degree Conduction

7.4.6 Explain its working with waveforms and equations.

7.4.7 Simple calculations of Three-Phase Inverters for 120-Degree Conduction

7.5 Enlist Techniques for Voltage Control of Single-Phase Inverters.

7.5.1 Explain the Single-Pulse Width Modulation to control voltage of Single-Phase Inverters.

7.5.2 Explain the Multi-Pulse-Width Modulation to control voltage of Single-Phase Inverters.

7.5.3 Explain the Sinusoidal Pulse-Width Modulation to control voltage of Single-Phase Inverters.

7.5.4 Explain the Modified Sinusoidal Pulse-Width Modulation to control voltage of Single-Phase Inverters.

7.5.5 Explain the Phase-Displacement Control to control voltage of Single-Phase Inverters.

LIST OF PRACTICAL: 96 Hours

1. Study the characteristics of Power Diode.
2. Use Data book for studying characteristics of different types of power diodes
3. Study the operation of Power diodes in series.
4. Study the operation of Power diodes in parallel.
5. Assemble a Single-Phase Half Wave Diode Rectifiers with resistive load and study its operation.
6. Assemble a Single-Phase Half Wave Diode Rectifiers with inductive load and study its operation.
7. Assemble a Single-Phase Diode-Bridge with resistive load and study its operation.
8. Assemble a Single-Phase Diode-Bridge with inductive load and study its operation.

9-10. Assemble a Three-Phase Diode-Bridge and study its operation.

11. Study the characteristics of Power SCR.
12. Study the operation of Power SCR in series.
13. Study the operation of Power SCR in parallel.
14. Assemble a Single-Phase Semi converter with R Load and study its operation.
15. Study the operation of Single-Phase Full converter with R Load.

16-17. Study the operation of Three-Phase Full converter with R Load.

18. Study the operation of Step-Down (Buck) DC-DC Converters.
19. Study the operation of Step-Up (Boost) DC-DC Converter

20-21. Study the operation of Step-Down/Up (Buck-Boost) DCDC Converter in CCM.

22-23. Study the operation of Step-Down/Up (Buck-Boost) DCDC Converter in DCM.

24-25. Study of Pulse Width Modulation and filter characteristics.

26-27. Assemble a Single-Phase Bridge Inverters and study its operation.

28-29 Study the operation of Three-Phase Inverters.

30. Study the operation of Voltage Control of Single-Phase Inverters.

ELTR-393-Microcontrollers Programming and Applications

Total Contact Hours

		T	P	C
Theory	32			
Practical	192	1	6	3

Learning outcomes:

After this course the student will be able to:

- Understand the fundamental concepts of microprocessor and microcontroller systems.
- Program and interface with microcontrollers using platforms like PIC and Arduino.
- Apply microcontroller-based solutions to solve simple embedded systems problems.
- Explore emerging technologies in the field of embedded systems, including IoT concepts.

1. Introduction (3 Hours)

1.1 Microprocessors and their applications

1.2 Microcontrollers and their applications

1.3 Micro processing Techniques

1.4 Memory and its Types

2. Micro Processing System (3 Hours)

2.1 Buses

2.2 Architecture of a microprocessor

2.3 Peripheral Devices

2.4 Polling/Interrupts

2.5 Parallel and Serial communication

2.6 Shift register

3. PIC Microcontroller (8 Hours)

3.1 Introduction and applications

3.2 Architecture of PIC Microcontroller

3.3 Features and Peripherals of PIC Microcontroller

3.4 Pin description of PIC16F84

3.5 PIC Basic Instruction set

3.6 I/O Ports and Programming in assembly and C

3.7 Introduction to MPLAB software

4. Introduction to Arduino UNO (6 Hours)

4.1 Arduino UNO and its features.

4.2 Components of UNO board.

4.3 Arduino Models

4.4 Steps for setting up of Arduino

4.5 Communicating with Arduino

4.6 Different functions used for Arduino programming:

4.6.1. Pin Mode ()

4.6.2. Digital Write

4.6.3. void setup ()

4.6.4. void Loop ()

4.6.5. Delay ()

4.7 Introduction to Arduino IDE

5. Communication interface , Analog Inputs and Various Buses (4 hours)

5.1 Serial Data transfer

5.2 Arduino Serial

5.3 Analog Input

5.4 Arduino SPI

5.5 Arduino I2C

5.6 Arduino To Arduino I2C Communication

5.7 Arduino to Arduino Serial Communication

5.8 Arduino to Raspberry Pi Communication through Serial USB

6. ESP 32 (6 hours)

6.1 Fundamentals of ESP 32 and Arduino interfacing

6.2 Hardware and software requirements

6.3 Features and Pinout of ESP32 board

6.4 Programming and Coding instruction set

6.5 Troubleshoot and Debugging Techniques

7. Concept of MQTT (2 hours)

7.1 Definition and purpose of MQTT

7.2 MQTT protocol and features

7.3 MQTT client and broker

REFERENCE BOOKS

1. PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18 by Muhammad Ali Mazidi, Rolin McKinlay, and Danny Causey
2. PIC Microcontroller Projects in C: Basic to Advanced by Dogan Ibrahim
3. Arduino beginner guide by Erik Savasgard, Latest Edition
4. Exploring Arduino: Tools and Techniques for Engineering Wizardry by Jeremy Blum, Latest Edition
5. Developing IoT Projects with ESP32 by Vedat Ozan Oner
6. ESP32 Programming for the Internet of Things by Sever Spanulescu

Instructional Objectives

1. Introduction

1.1. Microprocessors

1.1.1. Define microprocessors.

1.1.2. Explain the key characteristics of microprocessors.

1.1.3. Describe the applications of microprocessors in various fields (e.g., computers, embedded systems, consumer electronics).

1.2. Microcontrollers

1.2.1. Define microcontrollers.

1.2.2. Explain the key characteristics of microcontrollers.

1.2.3. Describe the applications of microcontrollers in various fields (e.g., industrial automation, automotive, medical devices).

1.3. Micro processing Techniques

1.3.1. Describe the RISC architecture and its advantages.

1.3.2. Describe the CISC architecture and its advantages.

1.4. Memory

1.4.1. Explain the concept of RAM and its types.

1.4.2. Explain the concept of ROM and its types.

1.4.3. Explain the concept of cache memory and its role in improving system performance.

2. Micro processing System

2.1. Buses

2.1.1. Define and explain the function of data buses.

2.1.2. Define and explain the function of address buses.

2.1.3. Define and explain the function of control buses.

2.2. Microprocessor Architecture

2.2.1. Describe the components of the CPU (Central Processing Unit).

2.2.2. Explain the function of the ALU (Arithmetic Logic Unit).

2.2.3. Explain the role of registers in microprocessor operation.

2.2.4. Describe the function of the control unit.

2.3. Peripheral Devices

2.3.1. Define and explain the function of input devices.

2.3.2. Define and explain the function of output devices.

2.3.3. Explain the role of memory devices in a microprocessor system.

2.4. Input/Output Handling

2.4.1. Explain the polling method for handling input/output operations.

2.4.2. Explain the interrupt-driven method for handling input/output operations.

2.5. Communication

2.5.1. Explain the principles of parallel communication.

2.5.2. Explain the principles of serial communication.

2.6. Shift Register

2.6.1. Explain the operation of a shift register.

2.6.2. Describe applications of shift registers in digital systems.

3. PIC Microcontroller

3.1. Introduction

3.1.1. Define PIC microcontrollers.

3.1.2. Describe the key features and advantages of using PIC microcontrollers.

3.1.3. Explain the applications of PIC microcontrollers in various embedded systems.

3.2. Architecture

3.2.1. Describe the core components of a typical PIC microcontroller.

3.2.2. Explain the role of peripherals in a PIC microcontroller.

3.3. Features and Peripherals

3.3.1. Explain the function of timers in PIC microcontrollers.

3.3.2. Explain the function of counters in PIC microcontrollers.

3.3.3. Explain the function of ADC (Analog-to-Digital Converter) in PIC microcontrollers.

3.3.4. Explain the function of PWM (Pulse Width Modulation) in PIC microcontrollers.

3.4. PIC16F84

3.4.1. Describe the pinout of the PIC16F84 microcontroller.

3.4.2. Explain the function of key pins on the PIC16F84 microcontroller.

3.5. Instruction Set

3.5.1. Explain the concept of assembly language programming for PIC microcontrollers.

3.5.2. Describe common instruction types in the PIC microcontroller instruction set.

3.6. I/O and Programming

3.6.1. Explain how to program I/O ports of PIC microcontrollers.

3.6.2. Explain how to control peripherals of PIC microcontrollers using assembly language and C language.

3.7. MPLAB

3.7.1. Describe the main features of the MPLAB software development environment.

3.7.2. Explain the steps involved in creating and compiling a PIC microcontroller program using MPLAB.

4. Introduction to Arduino UNO

4.1. Arduino UNO

4.1.1. Define Arduino UNO and its significance in the field of electronics and embedded systems.

4.1.2. Explain the key features and capabilities of the Arduino UNO board.

4.2. Components

4.2.1. Identify the microcontroller used in the Arduino UNO board.

4.2.2. Identify other key components of the Arduino UNO board (e.g., memory, connectors, power supply).

4.3. Arduino Models

4.3.1. List and briefly describe different Arduino models available.

4.3.2. Explain the key differences between various Arduino models.

4.4. Setup

4.4.1. Describe the steps involved in installing the Arduino IDE.

4.4.2. Explain how to connect the Arduino UNO board to the computer.

4.5. Communication

4.5.1. Explain the process of serial communication with the Arduino board.

4.5.2. Explain other methods of communicating with the Arduino board (e.g., USB).

4.6. Arduino Functions

4.6.1. Explain the purpose and usage of the pinMode() function.

4.6.2. Explain the purpose and usage of the digitalWrite() function.

4.6.3. Explain the purpose and usage of the void setup() function.

4.6.4. Explain the purpose and usage of the void loop() function.

4.6.5. Explain the purpose and usage of the delay() function.

4.7. Arduino IDE

4.7.1. Describe the main features of the Arduino IDE.

4.7.2. Explain how to write and upload a simple Arduino sketch.

5. Communication Interface, Analog Inputs, and Various Buses

5.1. Serial Data Transfer

5.1.1. Explain the concept of serial data transmission.

5.1.2. Describe the advantages and disadvantages of serial communication compared to parallel communication.

5.2. Arduino Serial

5.2.1. Explain how to use the Arduino Serial library to send data.

5.2.2. Explain how to use the Arduino Serial library to receive data.

5.3. Analog Input

5.3.1. Explain the purpose of analog inputs on the Arduino board.

5.3.2. Describe how to read analog values using the Arduino IDE.

5.4. SPI

5.4.1. Explain the principles of the SPI (Serial Peripheral Interface) communication protocol.

5.4.2. Describe the applications of SPI in embedded systems.

5.5. I2C

5.5.1. Explain the principles of the I2C (Inter-Integrated Circuit) communication protocol.

5.5.2. Describe the applications of I2C in embedded systems.

5.6. Arduino to Arduino I2C

5.6.1. Explain the steps involved in establishing I2C communication between two Arduino boards.

5.6.2. Develop a simple program to demonstrate I2C communication between two Arduino boards.

5.7. Arduino to Arduino Serial

5.7.1. Explain the steps involved in establishing serial communication between two Arduino boards.

5.7.2. Develop a simple program to demonstrate serial communication between two Arduino boards.

5.8. Arduino to Raspberry Pi

5.8.1. Explain the steps involved in establishing serial communication between an Arduino board and a Raspberry Pi.

5.8.2. Develop a simple program to demonstrate serial communication between an Arduino board and a Raspberry Pi.

6. ESP32

6.1. Fundamentals

6.1.1. Define ESP32 and its key features.

6.1.2. Explain the advantages of using ESP32 in IoT applications.

6.2. Hardware and Software

6.2.1. Identify the key components of an ESP32 development board.

6.2.2. Describe the software requirements for developing with ESP32 (e.g., Arduino IDE, ESP32 libraries).

6.3. Features and Pinout

6.3.1. Describe the key features of the ESP32 microcontroller (e.g., Wi-Fi, Bluetooth, dual-core processor).

6.3.2. Explain the significance of important pins on the ESP32 board.

6.4. Programming

6.4.1. Explain how to write basic programs for ESP32 using the Arduino IDE.

6.4.2. Describe common programming tasks for ESP32 (e.g., connecting to Wi-Fi, sending and receiving data over Wi-Fi).

6.5. Troubleshooting

6.5.1. Identify common problems encountered when working with ESP32.

6.5.2. Describe basic troubleshooting techniques for ESP32 projects.

7. Concept of MQTT

7.1. Definition and Purpose

7.1.1. Define the Message Queuing Telemetry Transport (MQTT) protocol.

7.1.2. Explain the key use cases and applications of MQTT in IoT systems.

7.2. MQTT Protocol

7.2.1. Describe the publish-subscribe model used in MQTT.

7.2.2. Explain the key features of the MQTT protocol (e.g., lightweight, low overhead).

7.3. MQTT Client and Broker

7.3.1. Define an MQTT client and its role in the MQTT system.

7.3.2. Define an MQTT broker and its role in the MQTT system.

LIST OF PRACTICAL: 192 Hours

1. Install and set up MPLAB X IDE and necessary drivers for PIC microcontrollers.
2. Interface an LED with PIC and write a program to blink it.
3. Interface a push button with PIC and write a program to toggle an LED.
4. Write a program using PIC to read analog input from a potentiometer.
5. Interface a seven-segment display with PIC and write a program to display numbers.
6. Interface an LCD display with PIC and write a program to display text.
7. Write a program using PIC to generate PWM signals for motor control.
8. Interface a temperature sensor with PIC and write a program to read and display the temperature.
9. Interface a DC motor with PIC and write a program to control its speed and direction.
10. Learn how to write and upload code to an Arduino.
11. Learn how to use Arduino functions for digital input and output.
12. Learn how to use Arduino functions for analog input and output.
13. Write a program using Arduino for measuring temperature with a thermistor.
14. Write a program using Arduino for measuring distance with an ultrasonic sensor.
15. Interface an LCD display with Arduino and display text.
16. Interface a DC motor with Arduino and write a program to change its direction.
17. Write a program using Arduino to control a servo motor.
18. Learn how to use I2C communication with Arduino.
19. Program the Arduino UNO to read the state of a push button.
20. Interface a PIR sensor with Arduino to detect motion.
21. Make a project based on Arduino/ESP32 as assigned by the instructor.

ELTR-302 Final Year Project

Total Contact Hours: 192
Theory: 0
Practical: 192
Credit Hours: 6
Course Code: ELTR-302
Learning Outcomes:
The students will be able to:

- Apply theoretical and practical knowledge in electronics technology.
- Conduct independent surveys to identify industrial or consumer electronics challenges.
- Design, test, and implement electronic circuits and embedded systems.
- Develop innovative and practical solutions for electronics-related problems.
- Create proof-of-concepts or prototypes that align with industry demands.

Final Year Project Instructions:

1. Projects should incorporate advanced concepts in electronics and align with industry needs.
2. Projects must focus on real-world applications and problem-solving.
3. The use of microcontrollers (Arduino, ESP32, PIC, etc.), sensors, and IoT technologies is encouraged.
4. Projects must include hands-on development and hardware implementation.
5. The project should be designed, implemented, and tested in the lab under instructor supervision.

Suggested Fields:

- Embedded Systems and Microcontrollers
- Power Electronics (Inverters, SMPS, Battery Management)
- IoT-Based Electronics Projects
- Robotics and Automation
- Renewable Energy Solutions (Solar, Wind, Hybrid Systems)
- Industrial Electronics and Control Systems
- Home Automation and Smart Devices
- Biomedical Electronics
- Electric Vehicles and Charging Systems
- Sensor-Based Electronics Projects
- Or any other relevant field

Project Selection & Approval:

- Students must choose a project from the suggested fields or propose their own ideas.
- Projects must be approved by the HOD and concerned teacher.

Project Development & Implementation:

- Projects should be completed in college labs during allocated hours.
- Hands-on implementation and functional working models are required.
- Upgradation of previous years' projects is encouraged to improve reliability and efficiency.

Project Report Requirements:

- A comprehensive project report must be submitted, including:
    - Introduction and project objectives
    - Circuit/block diagrams with detailed explanations
    - Hardware and software implementation details
    - Testing and results analysis
    - Future enhancement possibilities

Project Evaluation Criteria:

Sessional (60 Marks) - Evaluated by concerned teacher

- Attendance (10 Marks)
- Project Proposal (10 Marks)
- Comprehensive Project Report (25 Marks)
- Presentation and Demo (15 Marks)

Practical (40 Marks) - Evaluated by External Examiner

- Brief Description of Project (5 Marks)
- Viva (10 Marks)
- Operational & Functional Working (25 Marks)

Grand Total: 100 Marks

(Sessional 60 marks awarded by the concerned teacher, Practical 40 marks awarded by an external examiner from PBTE.)

RELEVANT QUALIFICATION OF INSTRUCTORS / TEACHERS

For Technical Subjects

- MSc. / Ph.D. degree in Electrical / Electronics Engineering or Technology
- Bachelor degree in Electrical / Electronics Engineering preferably with minimum of 1 year Industrial / Teaching experience in the related field.
- Bachelor degree (4-years program) Electrical / Electronics Technology preferably with minimum of 2 years Industrial / Teaching experience in the related field.

Lab. Technician

- DAE in Electronics Technology with 3-4-years Industrial / Teaching experience in the related field

For Subjects pertaining to Humanities / Related Studies /Management / IT

- BS / M.A (16 years or higher) degree in English / Islamiat / Pak Studies with 2 years of teaching experience
- BS / M.Sc. (16 years or higher) degree in IT / CS / SE or BS in Computer Engineering with 2-years of teaching experience
- BS / M.Sc. (16 years or higher) degree in Mathematics / Physics / Chemistry with 2-years of teaching experience
- BBA / MBA (16 years or higher) degree with 2-years of teaching experience

EMPLOYABILITY OF THE PASS-OUTS with Market designations and vertical progression

The students holding DAE qualifications in Electronics Technology can seek employment in firms/companies / industry dealing in any of the following Areas / Sectors:

- Defense sector
- Power sector
- Oil & Gas sector
- Aviation
- Telecommunication
- industrial Automation
- Process Industries
- Renewable Energies
- Home Appliances Industries
- FMCG Industries
- Bio-Medical
- Cyber Security
- Entrepreneurship / Self employment
- Education and Research

Vertical mobility for Private Industry:

Technician→ Senior Technician→Supervisor→Assistant Engineer

Vertical mobility for Government Sector:

Line-Superintendent-II→ Line-Superintendent-I → Assistant Manager / Junior Engineer

Vertical mobility for TVET Sector:

Junior Instructor→ Instructor → Senior Instructor → Chief Instructor