

ELECTRICAL TECHNOLOGY SCHEME OF STUDIES

<u>1ST YEAR</u>			T	P	C
Gen	111	Islamiat/Pakistan Studies	1	0	1
Eng	112	English	2	0	2
Math	123	Applied Mathematics-I	3	0	3
Ch	132	Applied Chemistry	1	3	2
Comp	122(Rev.)	Introduction to Computer Applications	1	3	2
ET	115(Rev.)	Principles of Electrical Engineering	3	6	5
ET	121	Basic Electrical Drawing	0	3	1
ET	146	Workshop Practice-I	1	15	6
	i)	Wiring	1	6	3
	ii)	Metal Work	0	3	1
	iii)	Wood Work	0	3	1
	iv)	Welding	0	3	1
Total			12	30	22
<u>2ND YEAR</u>					
Gen	211	Islamiat & Pakistan Studies	1	0	1
Math	233	Applied Mathematics-II	3	0	3
Phy	222	Applied Physics	1	3	2
Mgm	221	Business Management & Industrial Economics	1	0	1
ET	213	D.C. Machines & Batteries	2	3	3
ET	223	Electrical Instruments & Measurements	2	3	3
ET	233(Rev.)	Utilization of Electrical Energy	2	3	3
ET	242	Installation Planning & Estimating	1	3	2
ET	251	Applications of Computers in Elect. Tech.	0	3	1
ET	263(Rev.)	Basic Electronics	2	3	3
ET	271	Workshop Practice-II (Basic Machine Shop)	0	3	1
Total			15	24	23
<u>3RD YEAR</u>					
Gen	311	Islamiat/Pakistan Studies	1	0	1
Mgm	321	Business Communication	1	0	1
Mgm	311	Industrial Management & Human Relations	1	0	1
ET	316(Rev.)	A.C. Machines	4	6	6
ET	322	Power Plant & Energy Conservation	2	0	2
ET	335(Rev.)	Transmission, Distribution and Protection of Electrical Power Systems	4	3	5
ET	343(Rev.)	Telecommunication	2	3	3
ET	353	Repair & Maintenance of Electrical Equipment	1	6	3
ET	364(Rev.)	Digital & Industrial Electronics	3	3	4
Total			19	21	26

اسلامیات / مطالعہ پاکستان

ٹی پی سی	GEN III	حصہ اول اسلامیات
1 0 1		حصہ دوم مطالعہ پاکستان
کل وقت: 20 گھنٹے	سہ ماہی	موضوعات حصہ اول اسلامیات
		کتاب و سنت

(ا) قرآن مجید

- 1- تلواریف قرآن مجید 2- نزول قرآن 3- مکی و مدنی سورتوں کی خصوصیات 4- وحی کی اقسام 5- پندرہ منتخب آیات مع ترجمہ
 - 1.1 تنالوا البر حتی تنفقوا مما تحبون
 - 1.2 واعتصموا بحبل اللہ جمیعاً ولا تفرقوا
 - 1.3 ولا یجر منکم شیئاً قوم علی ان لا تعدلوا
 - 1.4 ان اللہ یامرکم ان تودوا الامانات الی اهلها
 - 1.5 ان اللہ یامر بالعدل والاحسان
 - 1.6 ان الصلواتہ تنہی عن الفحشاء وامنکر
 - 1.7 لقد کان لکم فی رسول اللہ سوة حسنة
 - 1.8 ان اکرمکم عند اللہ اتقاکم
 - 1.9 وما آتاکم الرسول فخرزوا ومانہی عنہوا ننتہوا
 - 1.10 ولو فو بالعباد
 - 1.11 وما شر وہن بالمعروف
 - 1.12 یمحق اللہ الربو ویربب الصمدقات
 - 1.13 واصبر علی ما اصابک
 - 1.14 وقولوا قولا سدیداً
 - 1.15 ان الدین عند اللہ السلام
- (ب) سنت
 - 1- سنت کی اہمیت
 - 2- دس منتخب احادیث مع ترجمہ و تشریح

- 1- اعمالاً عملاً بالنیات
- 2- اہمیت لایتم مکارم الاخلاق
- 3- لا یومن احدکم حق یحب الا خیرہ ما یحب لنفسه
- 4- لعسلم من سلم المسلمون من سبب المسلمون من لسانہ ویدہ
- 5- فی امنت باللہ سلم استقم
- 6- حیر کم خیر کم ذالہ
- 7- سبب المسلم فسوق وقتالہ کفر
- 8- المؤمن اخو المؤمن
- 9- کان المسلم عسی المسلم حیر لم یبعہ و مالہ و فرقہ
- 10- ایتہ العنلق ثلاث اذا حدیث کذب و قاتل من خان و انا و فنا خلف

دین اسلام

2.1 ہمنام کے بنیادی مقصد کن وضاحت اور انسان کی اخروی و دنیوی زندگی پر ان کے اثرات

- 1- توبہ
- 2- رسالت
- 3- آخرت
- 4- ملاکے
- 5- اسلمی شب
- 7.2 عبادات

1- نماز 2- روزہ 3- حج 4- زکوٰۃ

مدرجہ بالا عبادات کی اہمیت و فضیلت، مکمل اور انسان کی اخروی و معاشرتی زندگی پر ان کے اثرات

مدرسی مقاصد

۱۔ قرآن مجید

- عمومی مقصد: طالب علم یہ سمجھنے کے قابل ہو کہ اسلام کی تعلیمت کا اصل سرپوشہ قرآن مجید ہے
 خصوصاً مقصد: طالب علم اس قابل ہو جائے گا کہ
- ۱۰ قرآن مجید کی تعریف کر سکے گا
- ۱۱ قرآن مجید کے نزول کی صورت بیان کر سکے
- ۱۲ قرآن مجید کی آئی دینی سورتوں کی پہچان کر سکے
- ۱۳ منتخب آیات کا ترجمہ و تشریح کر سکے
- عمومی مقصد: یہ سمجھنے کے قابل ہو جائے گا کہ منتخب قرآنی آیات کے ذریعے اسلامی اقدار کا مفہوم کیا ہے
 قرآنی آیات کا ترجمہ تشریح کر سکے
- ۱۴ قرآنی تعلیمت کی روشنی میں اپنی اور معاشرتی اصلاح کر سکے

۲۔ سنت

- عمومی مقصد: طالب علم سنت نبوی کی اہمیت اور ضرورت کو اچھی طرح سمجھنے کے قابل ہو جائے گا
 خصوصاً مقصد:
- ۱۵ سنت کی تعریف بیان کر سکے
- ۱۶ سنت کی اہمیت و ضرورت کی وضاحت کر سکے
- ۱۷ سنت کی روشنی میں مسوئیت پر عمل کر سکے
- ۱۸ منتخب احادیث پر عمل
- عمومی مقصد: احادیث کی روشنی میں اخلاقی اقدار سے سمجھنے حاصل کر سکے
 خصوصاً مقصد: احادیث کا ترجمہ و تشریح کر سکے
- ۱۹ رسول اللہ ﷺ کے مسوئیت کے احادیث کا ترجمہ و تشریح کر سکے

دین اسلام
عمومی مقاصد: دین اسلامی کے بنیادی مقاصد اور عبادت کے بارے میں جان سکنے اور بیان کر سکنے
خصوصی مقاصد
لفظ دین اسلام کے لغوی اور اصطلاحی معنی بیان کر سکنے
اسلام کے بنیادی مقاصد کی اہمیت بیان کر سکنے
اسلام کے بنیادی مقاصد سے انسان کی انفرادی و اجتماعی زندگی پر پڑنے والے اثرات بیان کر سکنے
عبادت کے لفظی و اصطلاحی معنی بیان کر سکنے
عقیدے اور عبادت کا فرق بیان کر سکنے
عبادت (نماز روزہ حج زکوٰۃ) کے فوری احکامات اور نسلی زندگی پر ان کی اثرات بیان کر سکنے
اسلامی مقاصد و عبادت کے مطابق اپنی زندگی ڈھل کر ایک اچھا مسلمان بن سکنے

انجیر مسلم طلباء کے لئے

GEN III

موضوعات

نئی نئی
1 0 1
کل وقت - 20 گھنٹے

نصاب اختلاقیات سائنسوں
حصہ دوم ملاحظہ پاکستان

اختلاقیات کی تعریف اور اہمیت
اختلاقیات کا معیار (آلون: عقل، العی، حب)
سندرجہ اہل الخلق کی وضاحت

- ☆ دولت اور شاہ
- ☆ وقار و باری
- ☆ نظم و ضبط
- ☆ راست گوئی
- ☆ صبر و استقلال
- ☆ حوصلہ مندگی
- ☆ وقت کی پابندی
- ☆ سفاکی
- ☆ استقامت
- ☆ پابندی احرام
- ☆ مصلحت

نصاب اخلاقیات (سین لورن)

تعریسی مقاصد

- عمومی مقاصد: اعلیٰ تعلقات کی وجہ سے اپنی ترقی میں تامل قدر لٹاندہ کر سکے
- خصوصی مقاصد: طالب ہنس علم سے اوسا تہلر ہو گا کہ
- موضوعات کا مطلب بیان کر سکے ☆
- عملی زندگی سے مشابہت کی نشاندہی کر سکے ☆
- اپنی شخصیت اور معاشرے پر موضوعات کے مثبت اثرات پیدا کرنے کے طریقے بیان کر سکے ☆
- روایت داری کی اہمیت بیان کر سکے ☆
- وفا داری کی اہمیت بیان کر سکے ☆
- لکھ و ضبط کی اہمیت بیان کر سکے ☆
- صدق بیان کی ضرورت بیان کر سکے ☆
- حوصلہ مندی کے فوائد بیان کر سکتے ☆
- وقت کی پابندی کے فوائد بیان کر سکے ☆
- صفا کی اور باہمی اختیار سے حسن کلر کی کو بیان کر سکے ☆
- مصلحت کے فوائد بیان کر سکے ☆

DAE Technology

حصہ دوم	نصابہ: سال اول (Gen III)	کل وقت 12 گھنٹے
ب	صحت نظر: سسٹم قوم میں آزادی فکری تاریخ مساعفوں میں سیاسی آزادی کی اہمیت اور ضرورت۔ ذاتی و جملاتی غلامی کے تعلقات	
ب	نظریہ پاکستان	
ب	قیام پاکستان کی اساس (دین اسلام) قیام پاکستان کی غرض اہمیت نظریہ پاکستان کی وضاحت۔ نظریہ پاکستان اور صدر اقبال اور قائد اعظم کے ارشادات کی مدہنی میں	
ب	نظریہ پاکستان کا تاریخی پسو	
ب	مہرین قاسم کی آء۔ مجید تلف مہنی اور شہ اہل اللہ کی تبلیغی خدمت سید احمد شہید کی تحریک مجاہدین	
ب	قاسم کی تحریکیں	
ب	علی گڑھ - دعوت احمدیہ - (بیروت - مدرسہ للاطام - (سندھ) اسلامیہ کلج (پٹنور) انجمن حملت اسلام (الہور)	

مطالعہ پاکستان (حصہ دوم)
تدریسی مقاصد
حریت فکر:

- عمومی مقصد
- طالب علم یہ جان لے کہ اسلام میں اور مسلمان قوم میں آزادی فکری کیا اہمیت ہے
- خصوصی مقاصد
- ☆ حریت فکر کا معنی و مفہوم بیان کر سکے
- ☆ آزادی فکری 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
- ☆ بدسلطانی غلامی قومی سطح پر نقصانات بیان کر سکے
- نظریہ پاکستان
- عمومی مقصد:
- نظریہ پاکستان (دوین 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 قائد اعظم کے فرمودات کی روشنی میں نظریہ پاکستان بیان کر سکے
- نظریہ پاکستان کا تاریخی پس منظر
- عمومی مقصد
- ☆ نظریہ پاکستان کے تاریخی پس منظر سے واقفیت حاصل کر سکے
- خصوصی مقاصد:
- ☆ محمد بن قاسم کے بارے میں بیان کر سکے

- ۶۱۔ محمد بن قاسم کے ہندوستان پر حملہ کی وجہ بیان کر سکتے
- ۶۲۔ محمد بن قاسم کے ہندوستان پر حملہ کے اثرات بیان کر سکتے
- ۶۳۔ بیان کر سکتے کہ ہندوستان میں ہندو مسلم دو تومی نظریہ کا نکتہ آغاز کیا ہے
- ۶۴۔ محمد الف ثانی کی علمی خدمات بیان کر سکتے
- ۶۵۔ شہد ولی اللہ کی علمی خدمات بیان کر سکتے
- ۶۶۔ محمد الف ثانی اور شہد ولی اللہ نے جو تبلیغ دین اور مسلمانوں میں سیاسی شعور پیدا کیا اسے بیان کر سکتے

علمی تحریکیں

- ۶۷۔ علمی مقصد
- ۶۸۔ برصغیر کی علمی تحریکوں سے آگاہی حاصل کر سکتے
- ۶۹۔ خصوصاً مقصد:
- ۷۰۔ ملی گز - دیوبند - تحریک العلماء مدرسہ الاسلام، اسلامیہ کالج - انجمن حنیفہ اسلام کے ذریعہ سیاسی شعور مسلمانوں میں پیدا کیا اسے بیان کر سکتے
- ۷۱۔ آرزوی ہند کے سلسلہ میں تحریک مہندین کی خدمات بیان کر سکتے

Eng-112 ENGLISH

Total contact hours

Theory	64	T	P	C
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.
- 4 hours**

5. TRANSLATION

6 hours

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

RECOMMENDED TEXT BOOK

1. 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

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. APPLIES 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

Total Contact Hours		T	P	C
Theory	96	3	0	3
Practical	Nil			

AIMS After completing the course, the students will be able to solve problems of Algebra, Trigonometry, Vectors, Boolean Algebra, Complex numbers and Analytic Geometry, develop skills in the use of mathematical instruments and 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 and 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 and circular system

4.5	Relation between length of a circular arc and 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 and 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	6 hours
7.1	The law of Sines	
7.2	The law of Cosines	
7.3	Measurement of heights and 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 product of sums
 - 10.3 Binary, decimals and octals, presentation of decimal numbers in BCD
 - 10.4 Interconversion of numbers
 - 10.5 OR Gates and AND Gates
 - 10.6 Logical Expressions and their simplification
 - 10.7 Demorgan's theorems
 - 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 Ratio 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 equation.
 - 13.2 General form of equation.
 - 13.3 Radius and coordinates of center.
 - 13.4 Problems

RECOMMENDED TEXT BOOK

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

INSTRUCTIONAL OBJECTIVES

1.2 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 tripple 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.

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.

RECOMMENDED 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.

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.

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 viscometer.
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 the scheme of IV group radicals.
20. To detect and confirm An^{++} and Mn^{++} radicals of IV group.
21. To detect and confirm 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.

RECOMMENDED BOOKS

1. Text Book of Intermediate Chemistry (Part I and II)
2. Sh. Atta Mohammad, Ilmi Applied Science.
3. J.N. Reddy, Polytechnic Chemistry, Tata Mc-Graw Hill Co., New Delhi.
4. Qammar Iqbal, Chemistry for Engineers and Technologists.

Comp 122 (Rev.) INTRODUCTION TO COMPUTER APPLICATIONS

Total contact hours

Theory	32 Hours	T	P	C
Practicals	96 Hours	1	3	2

AIMS This subject will enable the student to be familiar with the operational activities of Micro-computer. He will also learn computer application and other information according to profession at elementary level.

COURSE CONTENTS

1. ELECTRONIC DATA PROCESSING (EDP) AND FUNDAMENTAL OF INFORMATION TECHNOLOGY.

4 Hours

- 1.1 Basics of computers
- 1.2 Classification of computers
- 1.3 Block diagram of a computer system
- 1.4 Binary number system
- 1.5 BIT, BYTE, RAM, ROM, EROM, EPROM, EEPROM, FLASH ROM
- 1.6 Input and output devices
- 1.7 Secondary storage media details
- 1.8 Processors and types
- 1.9 Using computer for system software
- 1.10 Using computers for application software.
- 1.11 Common types of software and their application.
- 1.12 Networking (LAN, WAN, Network, Internet, Browsing and Surfing)

2. OPERATING SYSTEMS

4+6 Hours

- 2.1 Disk Operating System (DOS)
 - 2.1.1 Internal commands
 - 2.1.2 External commands
 - 2.1.3 Batch files with advance features
- 2.2. WINDOWS 2007 OR XP
 - 2.2.1 Introduction
 - 2.2.2 Installation
 - 2.2.3 Creation of new files & folders
 - 2.2.4 Manipulation of files & folders
 - 2.2.5 Configuration

- 3. LANGUAGE C++** **06 Hours**
- 3.1 Introduction to high level languages
 - 3.2 Introduction to C++
 - 3.3 Arithmetical operations
 - 3.4 Logical operations
 - 3.5 Assignment statements
 - 3.6 Input statements
 - 3.7 Simple mathematical calculations (addition, subtraction, multiplication, division etc)
 - 3.8 Looping
 - 3.9 Running a C++ Programme
 - 3.10 Saving and Retrieving a Programme
- 4. WORD PROCESSING** **7 Hours**
- 4.1 Starting word processor session
 - 4.2 Opening a document
 - 4.3 Saving a document
 - 4.4 Ending word processor session (Temporarily)
 - 4.5 Retrieving a document
 - 4.6 Spell check
 - 4.7 Margins and tab setting
 - 4.8 Aligning Paragraph
 - 4.9 Printing a document
 - 4.10 M.S. Excel
- 5. COMPUTER POWER POINT PRESENTATIONS** **3 hours**
- 5.1 Introduction to Power Point Presentation
 - 5.2 Text Formulation
 - 5.3 Shapes and colours

RECOMMENDED BOOKS

- 1. C++ how to program by deitel & deitel
- 2. ABC'S of DOS (latest release).
- 3. Judd Robbins, Mastering DOS 6.0 and 6.2
- 4. User Guides for Windows 2007, XP, and MS Office 2003, 2007 by Microsoft Corporation

INSTRUCTIONAL OBJECTIVES

1. UNDERSTAND ELECTRONIC DATA PROCESSING (EDP).

- 1.1 To know basics of computers.
- 1.2 Understand classification of computers.
- 1.3 Be able to block diagram of a computer system.
- 1.4 Understand the binary number system.0
- 1.5 Know some general terms used in computers.
- 1.6 To aware input and output devices.
- 1.7 To know secondary storage media.
- 1.8 Explain processor and its types.
- 1.9 Understand the use of computer for system software.
- 1.10 Know use of computers for application software.
- 1.11 Explain commonly used application of softwares
- 1.12 Understand the networking, browsing and surfing

2. UNDERSTAND OPERATING SYSTEMS

2.1 DISK OPERATING SYSTEM (DOS).

- 2.1.1. Know internal command of DOS.
- 2.1.2. Know external commands of DOS.
- 2.1.3. Describe batch files with advanced features

2.2. WINDOWS 2007, XP

- 2.2.1 To know about Windows 2000 environment (Desk Top area and different icons over it)
- 2.2.2 To understand about the creation of new files & folders.
- 2.2.3 Ability to perform Manipulation of files & folders.
- 2.2.4 To able installation of windows
- 2.2.5 Configuration of windows

3. UNDERSTAND LANGUAGE C++.

- 3.1 Elaborate high level languages.
- 3.2 Explain the advantages of C++ language.
- 3.3 Describe Hash (#) statement
- 3.4 Write C++ program for arithmetic operations (addition, multiplication, subtraction, division etc)
- 3.5 Write C++ program using loop statement
- 3.6 Write C++ program for logical operations (AND, OR, NOT, Shift, Equal to etc)
- 3.7 Write C++ program Using incremental statement.

4. UNDERSTAND WORD PROCESSING SESSION

- 4.1. Describe word-processing
- 4.2. Name command to be entered on Dos-prompt to load word-processor
- 4.3. Identify initial screen
- 4.4. Describe the command to open a document
- 4.5. Describe the procedure for naming the document
- 4.6. Explain importance of giving extension to a document
- 4.7. Describe saving and retrieving a document
- 4.8. Explain importance of auto save
- 4.9. State temporarily Ending word-processing session & document retrieval
- 4.10. State procedure to re-enter word processor
- 4.11. State procedure to re-open the document and editing
- 4.12. Describe spell-check facility
- 4.13. Describe Margins & Tab Setting
- 4.14. Describe to align paragraph
- 4.15. Describe Re-editing techniques
- 4.16. Describe procedure to set-up printer
- 4.17. Describe command for printouts
- 4.18. Explain multiple-copy printout procedure
- 4.19. Explain some advance features
- 4.20. Describe procedure of condensed printing
- 4.21. Describe procedure for change of fonts

5. HOW TO USE POWER POINT FOR TEXT BASED AND GRAPHIC BASED PRESENTATIONS.

- 5.1. Introduction to Power Point
- 5.2. Make a Power Point presentation using Text Based Slides.
- 5.3. Make a Power Point presentation using graphic Based Slides.
- 5.4. How to present Power Point slides Using Multimedia.

LIST OF PRACTICALS

96 hours

DOS & Windows 2007 XP

- 1 Identify key board, mouse, CPU, drives, disks, monitor & printer, speakers, microphone, scanner, digital camera, card reader, DSL Modem and other magnetic elements.
- 2 Practice for booting up of a computer system with DOS, Windows system.
- 3 Practice for CLS, VER, VOL, DATE & TIME commands
- 4 Practice for COPY, REN commands
- 5 Practice for DEL, TYPE, PATH, PROMPT, COPY CON, MD, CD, RD command
- 6 Practice for FORMAT command with /s, /4, /u switches
- 7 Practice for DISKCOPY, DISKCOMP commands
- 8 Practice for SCANDISK, XCOPY, DELTREE, TREE, LABEL commands
- 9 Practice for PRINT, UNDELETE commands
- 10 Practice for creating a batch file
11. Creating a folder at hard disk
12. Copying the files in folder at hard disk and use of external devices for storage (USB, External HDD etc)
13. Moving the files from one folder to an other folder
14. Creating a shortcut at desktop
15. Changing the icon of shortcut.
16. Deleting a file and restoring from Recycle bin.
17. Deleting a folder and restoring from Recycle bin.

C++

- 3.4 Practice on C++ for addition, multiplication, subtraction, division etc.
- 3.5 Practice on C++ using loop statements.
- 3.6 Practice on C++ using logical operations (AND, OR, NOT, Shift, Equal to etc)
- 3.7 Practice on C++ using incremental statement.

WORD PROCESSING

- 1 Practice for installation of word processor
- 2 Creating document & saving it
- 3 Spell-check facility of the word-processor
- 4 Editing an existing document

- 5 Various word-processing Menu Options
- 6 Printing a document
- 7 Margin and TAB setting and document alignment
- 8 Networking, browsing, surfing, internet
- 9 Power Point Presentation through multimedia.

Total Contact Hours:		T	P	C
Theory:	96	3	6	5
Practicals:	192			

AIMS Understanding electricity involves the sound familiarity with the established laws and concepts, and their application in different situations. Thus solving problems also forms part of the cognition of these concepts.

This course aims at providing a strong foundation in these basic concepts and laws of electricity, alongwith an appreciation of the magnitudes of the quantities involved or to be guessed, through solving numerical problems. The concepts are further strengthened through extensive Laboratory work.

COURSE CONTENTS

UNIT-I D.C. FUNDAMENTAL (37 Hrs.)

1. ELECTRIC CURRENT AND OHM'S LAW

- 1.1 Electron Theory.
- 1.2 Conductor, Insulator, semiconductor.
- 1.3 Resistance, conductance, electrical current, potential difference.
- 1.4 Ohm's Law.
- 1.5 Laws of Resistance
- 1.6 Effect of temperature on Resistance.
- 1.7 Temperature coefficient of resistance.
- 1.8 Series and parallel circuits
- 1.9 Resistances in series and parallel.
- 1.10 Division of voltage in series circuit.
- 1.11 Division of current in parallel circuit.
- 1.12 Equivalent resistance of complex network.

2. NETWORK THEOREMS

- 2.1 Kirchhoff's law I - current law.
- 2.2 Kirchhoff's law II-voltage law.
- 2.3 Active & Passive circuits, node, branch, and loop in Electrical circuits.
- 2.4 Application of Kirchhoff's laws.
- 2.5 Problem solving with Kirchhoff's Laws in D.C. circuit. (Simple problems)
- 2.6 Superposition theorem.
- 2.7 Maximum power transfer theorem.
- 2.8 Thevenin's theorem.

3. WORK, POWER AND ENERGY

- 3.1 Heating effect of current.
- 3.2 Joule's Law.
- 3.3 Thermal efficiency.
- 3.4 Conversion of electrical energy into Mechanical energy.
- 3.5 Energy billing.
- 3.6 Problem solving on above

4. MAGNETIC EFFECT OF ELECTRIC CURRENT

- 4.1 Laws of magnetic force.
- 4.2 Absolute and relative permeability.
- 4.3 Magnetic field due to a straight current carrying conductor.
- 4.4 Magnetic field of coil
- 4.5 Cork-Screw rule.
- 4.6 Effect of iron core in a coil.
- 4.7 Fleming's right and left hand rules.
- 4.8 Mechanical force on a current carrying conductor in a magnetic field.

5. ELECTROMAGNETIC INDUCTION

- 5.1 Faraday's Laws of electromagnetic Induction.
- 5.2 Dynamically and statically induced EMF.
- 5.3 Lenz's Law.
- 5.4 Concept of self and mutual induction.
- 5.5 Unit of Inductance

6. ELECTROSTATICS

- 6.1 Static Electricity.
- 6.2 Absolute and relative permeability of a medium.
- 6.3 Laws of Electrostatic.
- 6.4 Capacitor, capacitance.
- 6.5 Types of capacitors.
- 6.6 Capacitors in series and parallel.
- 6.7 Charging of a capacitor.
- 6.8 Equation of charging of a capacitor.
- 6.9 Discharging of a capacitor and its equations.

UNIT-II A.C FUNDAMENTALS.

(12 HRS.)

7. FUNDAMENTALS OF A.C

- 7.1 Definition of Alternating current & voltage.
- 7.2 Working principle of Alternating current generator.
- 7.3 Simple loop Alternator, Relationship between Speed, poles and frequency.
- 7.4 Sinusoidal Emf Equation, other wave forms, triangular, square wave etc.
- 7.5 Cycle, period, Frequency, amplitude, instantaneous value.

- 7.6 Average value, Effective value. R.M.S value. Form factor. Peak factor.
- 7.7 Representation of A.C. through vectors.
- 7.8 Phasor Diagrams, Phase difference, Polar form of A.C quantities.
- 7.9 j Notation

8. SINGLE PHASE A.C. CIRCUIT (22 HRS.)

- 8.1 A.C through pure Resistance and Vector Diagram.
- 8.2 A.C through pure Inductance and Vector Diagram.
- 8.3 A.C through pure Capacitance and Vector Diagram.
- 8.4 A.C through pure Resistance & Inductance in series including wave forms and Phasor diagram.
- 8.5 A.C through Resistance and Capacitance connected in series including wave forms and phaser diagram.
- 8.6 Voltage, current and power relation in A.C. R/L and R/C Circuits.
- 8.7 R.L.C series circuit.
- 8.8 Impedance Triangle, Phase angle, power factor.
- 8.9 Active and Reactive component. Actual power, Apparent Power, Reactive Power, relationship.
- 8.10 Parallel A.C circuits.
- 8.11 Solution of Parallel circuits by vector and admittance method.
- 8.12 Solution of simple problems with Phasor Algebra.
- 8.13 Power factor improvement with static capacitor.
- 8.14 Solving problems involving power factor improvement.
- 8.15 Resonance circuit.
- 8.16 Series, parallel resonance circuit.
- 8.17 Problems on resonant circuit.

UNIT-III POLY-PHASE FUNDAMENTALS (25 HRS.)

9. POLY-PHASE A.C. CIRCUIT

- 9.1 Generation of two Phase, three Phase emf.
- 9.2 Advantages of Poly Phase system.
- 9.3 Current in Neutral in a 3 Phase circuit.
- 9.4 Power Equation.
- 9.5 Star & Delta connection, Relation ship between line and Phase values.
- 9.6 Comparison of Star and Delta connections, their uses, and conversion.
- 9.7 Power in a three Phase Balanced load.
- 9.8 Vector diagram of a Star and Delta connected load.
- 9.9 Measurement of power with one watt meter without the use of Neutral wire.
- 9.10 Measurement of power with two watt meters and its vector diagram.
- 9.11 Measurement of Power with three watt meters and its vector diagram.
- 9.12 Measurement of Reactive power in a three Phase circuit.
- 9.13 Calculation of P.F. with Active and reactive power.

- 9.14 Phase sequence.
- 9.15 Power factor improvement and problems solving.
- 9.16 Advantages of 3 Phase supply over single Phase supply.
- 9.17 Problem solving on 3 Phase circuits.

INSTRUCTIONAL OBJECTIVES

TIME SCHEDULE

S.NO.	MAJOR TOPICS	NO. OF PERIODS	NO. OF QUESTIONS IN Q. PAPER
1.	D.C. fundamentals	35+2	
	a. Electric current, ohm's law, & Kirchhoff's laws.		1
	b. Work, Power & Energy.		1
	c. Electromagnetic induction & Electrostatic.		½
2.	A.C. fundamentals	10+2	1½
3.	Single phase A.C. circuits	20+2	1½
4.	Poly phase A.C. circuits	25	1½
	Total:	96	7

UNIT-I: D.C. FUNDAMENTALS.**1. UNDERSTAND BASIC CONCEPTS OF ELECTRICITY**

- 1.1 State Electron theory.
- 1.2 Compare conductor, Insulator & semi-conductor.
- 1.3 Define Resistance, conductance and state units.
- 1.4 Define electrical current and state its unit.
- 1.5 Define potential difference and state its unit.
- 1.6 State Ohm's law.
- 1.7 Explain laws of resistance and calculations.
- 1.8 State effects of temperature on Resistance.
- 1.9 Calculate temperature co-efficient of Resistance.
- 1.10 Define series and parallel circuits with their properties.
- 1.11 Determine total resistances in series & parallel circuits.
- 1.12 Calculate division of voltage in series circuits.
- 1.13 Calculate division of current in parallel circuits.
- 1.14 Draw equivalent circuits of complex networks.

- 2. UNDERSTAND KIRCHHOFF'S LAWS**
 - 2.1 State Kirchhoff's 1st Law - (current Law).
 - 2.2 State Kirchhoff's 2nd Law - (voltage Law).
 - 2.3 Define active circuit, passive circuit, node, branch & loop circuit.
 - 2.4 Give examples for applications of Kirchhoff's Laws.
 - 2.5 Solve simple problems on Kirchhoff's Laws in D.C.circuits.
 - 2.6 State superposition theorem.
 - 2.7 State Maximum power transfer theorem.
 - 2.8 Solve circuits through Thevenin's Theorem.

- 3. UNDERSTAND WORK, POWER & ENERGY**
 - 3.1 Define work, electrical power, mechanical power and energy with their units.
 - 3.2 State formula for conversion of Electrical Energy to Mechanical Energy.
 - 3.3 Calculate Energy billing of an installation.
 - 3.4 Explain heating effect of current.
 - 3.5 State Joule's Law of current.
 - 3.6 Define thermal efficiency.
 - 3.7 Solve problems on Thermal Efficiency.

- 4. UNDERSTAND MAGNETIC EFFECTS OF ELECTRIC CURRENT**
 - 4.1 Explain Laws of Magnetic force.
 - 4.2 Define Absolute & Relative permeability.
 - 4.3 Describe Magnetic field of a straight current carrying conductor.
 - 4.4 Determine Magnetic field of a coil.
 - 4.5 State cork-screw rule.
 - 4.6 Describe effect of iron core in a coil.
 - 4.7 State Fleming's Right hand & Left hand rules.
 - 4.8 Explain mechanical force on a current carrying conductor in a magnetic field.

- 5. UNDERSTAND ELECTROMAGNETIC INDUCTION**
 - 5.1 State Faraday's Laws of Electromagnetic Induction.
 - 5.2 Define Dynamically & statically induced e.m.f.
 - 5.3 Explain Lenz's Law
 - 5.4 Explain self & Mutual Inductances.
 - 5.5 State units of Inductance.

- 6. UNDERSTAND FUNDAMENTALS OF ELECTROSTATICS**
 - 6.1 Define the term static-electricity.
 - 6.2 Describe Absolute & Relative Permeability of a Medium.
 - 6.3 State Laws of Electrostatics.
 - 6.4 Explain the term capacitance.
 - 6.5 List types of capacitors.
 - 6.6 Solve problems on capacitors in series & Parallel.

- 6.7 Explain charging & Discharging of capacitors along with equations.

UNIT-II: A.C. FUNDAMENTALS.

7. UNDERSTAND A.C. FUNDAMENTALS

- 7.1 Define alternating current & voltage.
- 7.2 Describe principle of working of A.C. Generator.
- 7.3 Explain simple loop Alternator & relationship between speed, poles and frequency.
- 7.4 State sinusoidal E.M.F. equation, triangular, square waves etc.
- 7.5 Define terms cycle, period, frequency, amplitude, & Instantaneous value.
- 7.6 Define the terms average value, Effective value, R.M.S. value, form factor & peak factor.
- 7.7 Explain how AC quantities can be represented by vectors.
- 7.8 Draw phasor diagrams.
- 7.9 Explain the term phase difference.
- 7.10 Describe polar forms of A.C. quantities.
- 7.11 Conversion from R-P form and P-R form.
- 7.12 Simple calculations of j-notation.

8. UNDERSTAND A.C. CIRCUITS (SINGLE PHASE)

- 8.1 Explain the effects of A.C. supply through pure resistance, inductance & Capacitance with their vector diagrams.
- 8.2 Describe the effects of A.C. supply through RL and RC Series circuits with the help of waveforms and vector diagrams.
- 8.3 Derive voltage current & power relation in A.C. circuits.
- 8.4 Solve examples on R.L.C. series circuit.
- 8.5 Define terms Impedance triangle, phase angle & power factor
- 8.6 Describe active & reactive component, Actual power, Apparent power & reactive power with relation ships.
- 8.7 Explain parallel A.C circuits (R.L.C).
- 8.8 Solve problems on parallel A.C. circuits
- 8.9 Explain power factors improvement with static capacitor bank.
- 8.10 Solve simple problems on power factor improving circuits.
- 8.11 Write relationship for V.I.Z. for resonance circuit in series & parallel.
- 8.12 Solve simple problem on resonance circuit.

UNIT-III: POLYPHASE FUNDAMENTALS.

9. UNDERSTAND POLYPHASE A.C. CIRCUITS

- 9.1 Explain generation of two-phase & 3-phase e.m.f.
- 9.2 Explain advantages of A.C. polyphase system.
- 9.3 State value of current in neutral in a 3-phase balanced circuit.

- 9.4 State power equation for 3-phase system.
- 9.5 Draw & explain star & delta connections.
- 9.6 Calculate relationship between line & phase values in star/delta.
- 9.7 Compare star & delta connections with their uses.
- 9.8 Draw vector diagrams of star & delta connected loads.
- 9.9 Calculate power in 3-phase balanced load.
- 9.10 Solve problems on 3-phase balanced load.
- 9.11 Explain Measurements of power with one wattmeter without the use of neutral wire.
- 9.12 Describe Measurement of power with two watt meters along with its vector diagram.
- 9.13 Calculate power with three watt-meters along with vector diagrams.
- 9.14 Describe Measurement of Reactive power in a three phase circuit.
- 9.15 Solve problems on P.F with active & reactive power.
- 9.16 Explain phase sequence meter.
- 9.17 Explain power factor improvement methods.
- 9.18 Solve problems on power factor improvements.
- 9.19 Explain advantages of 3-phase supply over single phase supply.
- 9.20 Solve problems on 3-phase circuits.(Balanced load)

LIST OF PRACTICALS

Note: Students should demonstrate concern for personal and equipment safety while working in Electrical Labs

1. Study of simple Electrical Instruments (Ammeter, Voltmeter etc, etc).
2. Determination of the resistances of
 - a) Sliding Rheostat.
 - b) Voltmeter.
 - c) Incandescent lamp.
3. Determination of resistance of a wire by micrometer.
4. Determination of temperature co-efficient of copper by ammeter-voltmeter methods.
5. Verification of ohm's law.
6. Verification of laws of combination of resistances.
7. Study of various types of resistors and determination of resistance by color coding.
8. Measurement of power by Voltmeter-ammeter method and watt meter.
9. Study of connections of thermal relay.
10. Measurement of energy by energy meter.
11. Verification of Kirchhoff's Laws.
12. Determination of the efficiency of an electric Kettle.
13. Make an electromagnet.
14. Study of the force on a current-carrying conductor in magnetic field.
15. Verification of Faraday's laws of electromagnet induction.
16. Study of Generator and Transformer.
17. Study the production of e.m.f in coupled coils by changing current in one coil.
18. Problem solving session.
19. Study of self-induction of a coil and effect of introducing iron core in it.
20. Study of various types of capacitors and Inductors.
21. Determination of the capacity of capacitors by colour coding.
22. Verification of the laws of the combination of capacitors.
23. Determination of breakdown voltage of a low-voltage capacitor.
24. Test week: Every student should be given independent different practicals and teacher should count its performance towards sessional marks.
25. Study of C.R.O. and measurement of sine wave.
26. Determination of average and R.M.S values and sine wave (on graph paper)
27. Determination of inductance of a choke coil using ammeter and voltmeter method.
28. Determination of impedance of a resistive-inductive series circuit.
29. Study of phase displacement by C.R.O.
30. Determination of power consumed by a fan/choke by 3-ammeter method.
31. Vector Diagrams practice.
32. Determination of power-factor of a single phase circuit using voltmeter, ammeter and

- watt meter.
33. Measurement of power factor of a single phase circuit using a power factor meter.
 34. Determination of resonance frequency of a series circuit using variable frequency oscillator.
 35. Study of the effects of capacitors on the power of an inductive circuit.
 36. Study of an elementary poly phase generator.
 37. Verification of the line and phase relationship in star and delta connections.
 38. Study of 3-Phase, 4-wire distribution network.
 39. Measurement of power of a 3-phase load by 3-wattmeter method.
 40. Measurement of power of a 3-phase load by 2-wattmeter method.
 41. Measurement of 3-phase power by one watt meter method.
 42. Determination of phase sequence by phase sequence meter.
 43. Measurement of reactive power, in a 3-phase balanced circuit.
 44. Measurement of power in 3 phase circuit using phase angle meter.
 45. Measurements of 3-Phase load energy using C.T. & P.T.
 46. Improvement of power factor of an inductive load using capacitors and its verification.
 47. Determination of current in neutral wire in balanced & unbalanced load.
 48. Visit to local / college sub-station.

Each student must conduct one practical for evaluation for final test.

** Students must prepare theory and practical note books and get it checked weekly by the concerned teacher. He should produce it to external examiner for sessional work/marking check up at the time of final exam.

Books Recommended:

1. New Electric Library Vol III by Frank Graham.
2. Electrical Engineering by C.L Dawes.
3. Examples of Electrical Calculation Admiralty.
4. Electrical Technology by B.L Teraja.
5. Reeds Basic Electro-Technology for Marine Engineers by E.G. Krall.
6. Fundamentals of Electrical Engineering by M.Kuzmetsov Moscow.
7. Theory & Problems of Electrical Circuit by Schaum's out line series.
8. Electrical Technology by Edward Huges.
9. Practical Electricity by T.Croft.
10. Industrial Electric Circuits by Herbert W.Jackson.

ET-121 BASIC ELECTRICAL DRAWING

Total contact hours	T	P	C
Practical 96 Hrs.	0	3	1

AIM To provide basic skills in the use of drawing tools and to enable the students to prepare Orthographic, pictorial, free hand sketching for electrical drawings

COURSE CONTENTS

(SHOP TALK ONLY)

1. USES AND APPLICATION OF TECHNICAL DRAWING

- 1.1 Importance of Technical drawing and Techniques/Engineer's language.
- 1.2 Uses of technical drawing, tools and equipments.
- 1.3 Types of drawings and their uses.

2. DRAWING TOOLS AND MATERIALS

- 2.1 Classification of drawing pencils and uses
- 2.2 Types of drawing papers and sizes
- 2.3 Drawing instruments and uses.
- 2.4 Types and use of erasers.
- 2.5 Care & maintenance of drawing tools.

3. BASIC DIMENSIONING

- 3.1 Definition of dimensioning.
- 3.2 Two types of dimensioning.
- 3.3 Elements in dimensioning.
- 3.4 Dimensioning pictorials.
- 3.5 Dimensioning Multi Views.
- 3.6 Dimensioning Holes and arcs.
- 3.7 Dimensioning Angles.

4. MULTI VIEW DRAWING/ORTHOGRAPHIC DRAWING

- 4.1 Definition and concept.
- 4.2 Six principle views.
- 4.3 Visualization glass box technique.
- 4.4 Principal planes of projections.
- 4.5 Projection lines.
- 4.6 Arrangement of views.
- 4.7 Multi view drawing, 1st angle and 3rd angle projection of simple objects.

5. INTRODUCTION TO PICTORIAL DRAWING

- 5.1 Three types of pictorials

- 5.2 Uses of pictorial views.
- 5.3 Isometric sketching of Rectangular Block and simple objects.
- 5.4 Oblique sketching of rectangular block and simple objects.
- 5.5 Proportions in pictorial drawing.

6. SYMBOLS

- 6.1 Building Material symbols.
- 6.2 Metal symbols.
- 6.3 Electrical symbols.
- 6.4 Importance and uses.

7. ELECTRICAL DRAWING

- 7.1 Drawing wiring circuits.
 - 7.1.1 Single line diagram.
 - 7.1.2 Wiring diagram.
 - 7.1.3 Layout diagram.
 - 7.1.4 Schematic diagram.
 - 7.1.5 Circuit diagram.

8. LINE SKETCHING

- 8.1 Introduction to sketching techniques.
- 8.2 Sketching Horizontal, vertical, inclined lines.
- 8.3 Sketching of parallel (Horizontal, vertical, inclined lines).
- 8.4 Sketching arcs and circles.
- 8.5 Sketching squares, Rectangles, ellipses and simple objects.
- 8.6 Proportion in sketching.

ET-121 BASIC ELECTRICAL DRAWING

INSTRUCTIONAL OBJECTIVES

UNIT-1:

- 1. A. UNDERSTAND THE IMPORTANCE OF TECHNICAL DRAWING AND CONSTRUCT GEOMETRICAL SHAPES.**
- B. APPRECIATE THE POWER OF DRAWING AS A TOOL OF COMMUNICATING IDEAS.**
- 1.1 Define importance of technical drawing/engineer's language.
- 1.2 Use drawing equipment, board, sheet, pencil, T-square, set square, compass, divider, protractor, French curves etc.
- 1.3 Draw different types of lines.
- 1.4 Show skill in lettering and dimension
- 1.5 Divide a line in two and more than two parts.
- 1.6 Draw different angles and bisect.
- 1.7 Draw square, rectangle, triangles, circle, hexagon, ellipses.

UNIT-2:

- 2. UNDERSTAND ORTHOGRAPHIC DRAWING/MULTI-VIEW DRAWING AND PICTORIAL DRAWING**
- 2.1 Prepare 1st angle drawings.
- 2.2 Prepare drawings according to 3rd angle projection.
- 2.3 Draw surface development of simple objects.
- 2.4 Draw oblique and pictorial view of simple shapes and objects.

UNIT-3:

- 3. UNDERSTAND ELECTRICAL SYMBOLS, RESIDENTIAL, AND POWER WIRING, AND DIFFERENT POWER CIRCUITS/DRAWINGS**
- 3.1 Draw electrical symbols.
- 3.2 Draw single phase wiring circuits.
- 3.3 Draw wiring circuit diagram of house wiring alongwith point position of single room and double room houses on given building layouts.
- 3.4 Draw wiring diagrams of motors.
- 3.5 Draw different industrial wiring circuits.
- 3.6 Draw three phase wiring circuits layout.

UNIT-4:

- 4. SHOW SKILL IN FREE HAND SKETCHING**
- 4.1 Sketch free hand horizontal, vertical, and inclined lines.
- 4.2 Sketch free hand rectangles, triangles, circles, arcs, ellipse.
- 4.3 Sketch free hand, oblique and isometric views of simple regular objects.

ET-121 BASIC ELECTRICAL DRAWING

LIST OF PRACTICALS

1. Prepare the title block.
2. Draw the different lines according to rules (Horizontal and vertical lines) etc.
3. Draw square, rectangle, triangles, circle, hexagon, ellipse (atleast 3 sheets).
4. Practice of lettering and dimensioning.
5. Draw first and third angle drawing of single parts, i.e. prism, stepped block, V-block, gland etc. (at least 5 sheets).
6. Draw isometric projection and oblique projection of rectangular prism, stepped block, v-block, angle block etc. (at least 5 sheets).
7. Draw the surface development of prism, cylinder, cone, square, pyramid (at least 3 sheets).
8. Draw the section diagram of a bolt and nuts.
9. Draw building materials, metals and electrical symbols(3 sheets).
10. Draw the single line diagram of a grid-station switch-yard.
11. Draw the wiring circuit diagram of house wiring and house wiring layout alongwith point position on given house layout single/double room (2 sheets).
12. Wiring diagram of a single phase motor with starter.
13. Circuit diagram of 3-phase motor with magnetic contractor and star delta starters.
14. Draw layout of earthing for a simple house (Earth Wire, Earth lead, Earthing Electrode).
15. Draw layout of earthing circuit for a shop or a factory.
16. Draw Single line power wiring diagram of a shop of a factory.
17. Draw single line power wiring of power lab of a technical college.
18. Schematic diagram of power control panel of power lab of a technical college.
19. Study Drawing of a multi room house with electrical wiring.
20. Detailed drawing of a small house with front elevation.
21. Draw circuit diagram of six lines intercom-network.
22. Sketch free hand horizontal lines, vertical and inclined lines, rectangle, triangle, circle & ellipse (at least 3 sheets).
23. Sketch simple objects i.e. try square, switch plate, bulb holder, etc.
24. Sketch isometric view of a commutator.
25. Sketch sectional view of cable, single core cable, 3 core cable.
26. Sketch electrical tower.
27. Sketch insulators.
28. Draw a commutator.
29. Draw schematic diagram of a power supply/power house.

Note:- Students should prepare at least twenty drawings in college and thirty as home assignment.

They should get it checked weekly by the concerned teacher. They should also produce all these drawings to the external examiner for marking/sectional work checkup at the time of final examination.

RECOMMENDED BOOKS

1. Interior Electrical Wiring & Estimating (Residential) by Uhl-Dunlap-Flynn.

2. Interior Electrical Wiring & Estimating by Graham.
3. Engineering Drawing by Muhammad Iqbal (Prescribed by S.B.T.E).
4. How to Read Electrical Blue Prints by Heine-Dunlap.
5. Power Wiring by Audels.
6. Elementary Engineering Drawing by N.D.Bhat.
7. Elementary Engineering Drawing by A.T. Parkinson.
8. Technical Drawing by Niaz. M. Mirza.

- 2 ELECTRICITY RULES AND REGULATIONS. (5 Hrs.)**
- 2.1 Pakistan electricity rules 1973.**
- 2.1.1 Condition of supply by license (rule no. 25, 28, 29, 32, 40, 46).
 - 2.1.2 General precaution for safety of public (Rule 49,51,52,57,58).
 - 2.1.3 Electrical supply line and apparatus (Rule 60, 61, 62, 64).
- 2.2 I.E.E Regulation for Building installation. (5 Hrs.)**
(Institute of Electrical Engineers, London).
- 2.2.1 (Section-A).
Regulation No. and its brief description.
 - A-1 Control of supply to consumer's Installation.
 - A-3 Excess current protection.
 - A-26 Final Sub-circuits of rating exceeding 15 A
 - 2.2.2 Section B.
 - B-4 Type of flexible cables and flexible cords.
 - B-12 Choice of types of insulation and protective covering of flexible conductor sizes.
 - 2.2.3 Section C
 - C-4 Selection for situation.
 - C-6 Damp situation.
 - 2.2.4 Section D
 - D-1 Methods of protection.
 - D-22 Protection by fuse and current circuit Breaker for excess current.
- 3 FACTORY ACT. (2 Hrs.)**
- 3.1 Workers compensation act.**
- 3.1.1 Report of Fatal Accidents.
 - 3.1.2 Medical Exam.
 - 3.1.3 Injury and diseases.
 - 3.1.4 Amount of Compensation payable to workman.
- 3.2 Safety. (5 Hrs.)**
- 3.2.1 Fire causes and its prevention, classes of fire.
 - 3.2.2 Safety in electrical shops (Safety Belt, Gloves, clothing and shoes).
 - 3.2.3 General safety precaution (Machine Guards, tools & ladders).
 - 3.2.4 Electric shock its prevention and treatment.
- 4 METAL WORK 96 Hrs**
- 4.1. Shop orientation.**
- 4.1.1. Shop policy, rules and regulation.
 - 4.1.2 Introduction to shop machines.

4.2. Workshop safety practices.

- 4.2.1 Measuring tools.
- 4.2.2 Cutting tools.
- 4.2.3 Marking tools.
- 4.2.4 Layout tools.
- 4.2.5 Grinding tools.
- 4.2.6 Stocking tools.
- 4.2.7 Stakes.

4.3. Bench Work.

- 4.3.1 Metal sawing.
- 4.3.2 Metal filing.
- 4.3.3 Metal fitting.
- 4.3.4. Metal drilling.
- 4.3.5 Pipe cutting/threading
- 4.3.6 Sheet metal work.
- 4.3.7 Riveting.

List of Practical

1.	Preparation of name plate	9 Hrs.
2.	Sawing exercise	9 Hrs.
3.	Preparation of inside calliper	9 Hrs.
4.	Preparation of bottle opener	9 Hrs.
5.	Preparation of dove-tail joint	12 Hrs.
6.	Preparation of small size try-square	6 Hrs.
7.	Preparation of coat hook	6 Hrs.
8.	Preparation of funnel (sheet)	6 Hrs.
9.	Preparation of pin tray (sheet)	6 Hrs.
10.	Preparation of drawer handle	6 Hrs.
11.	Preparation of bevel square	9 Hrs.
12.	Preparation of spanner (small size)	9 Hrs.

5 WOOD WORK 96 Hrs

5.1. Shop Orientation

- 5.1.1 Shop policies, rules and regulation.
- 5.1.2 Introduction to shop machines.
- 5.1.3 Workshop Safety practice.

5.2. Introduction to wood working hand tools

- 5.2.1 Hand saws.
- 5.2.2 Planers.
- 5.2.3 Marking tools.
- 5.2.4 Chisels.

- 5.2.5 Boring tools.
- 5.2.6 Hammers.
- 5.2.7 Sharpening tools.
- 5.3. Miscellaneous.
 - 5.3.1 Nails and screws.
 - 5.3.2 Wood used in electrical work, seasoning of wood
 - 5.3.3 Sand and Glass paper.

List of Practicals (Wood Work)

96 Hrs.

1. Safety precautions in wood working shop
2. Assembly and disassembly of jack-plane
3. Using of various wood working panes. (Tool exercise)
4. Planning and squaring to dimensions. (job-1)
5. Sharpening plane-iron
6. Introducing different wood working, layout and measuring tools.
7. Sawing exercise (job-2)
8. Identifying different types of `handsaws' and making sketches of all saws.
9. Sharpening `bandsaws'
10. Wood chiseling (chipping)
11. Making `mortise & tannon joint. (job-3)
12. Sharpening wood chisel
13. Making dado-joint (job-4)
14. Making cross-lap joint. (job-5)
15. Observing wood structure
16. Identifying and comparing soft and hard wood
17. Spirit polishing (preparing wood surface for polishing, staining and lacquering)
18. Boring process, making holes of different diameters in wood. (job-6)
19. Nailing and wood screwing process. (job-7+8)
20. Making middle half cross-lap joint. (job-9)
21. Making dove-tail joint. (job-10)

6 WELDING.

96 Hrs

- 6.1. Shop orientation.
 - 6.1.1 Shop policies, shop rules and regulation.
 - 6.1.2 Workshop safety practices.
- 6.2. Introduction to welding process and welding equipments.
 - 6.2.1 Welding process.
 - 6.2.2 Welding torches.
 - 6.2.3 Gas cylinders.
 - 6.2.4 Pressure gauges.

- 6.2.5 Welding flames.
- 6.2.6 Arc welding and related equipments.
- 6.2.7 Fluxes.
- 6.2.8 Soldering.

List of Practicals

(Gas Welding)

- | | | |
|-----|----------------------------------|--------|
| 1. | Flame making practice. | 3 Hrs. |
| 2. | Pool making. | 3 Hrs. |
| 3. | Bead making. | 3 Hrs. |
| 4. | Butt joint. | 6 Hrs. |
| 5. | Lap joint. | 6 Hrs. |
| 6. | Corner joint without filler rod. | 6 Hrs. |
| 7. | Corner joint with filler rod. | 6 Hrs. |
| 8. | T. joint. | 6 Hrs. |
| 9. | Edge joint. | 6 Hrs. |
| 10. | Brazing practice. | 6 Hrs. |

(ARC Welding)

- | | | |
|-----|---|--------|
| 11. | ARC making/current setting/polarity selection | 6 Hrs. |
| 12. | Bead making | 3 Hrs. |
| 13. | Butt joint | 6 Hrs. |
| 14. | Lap joint | 3 Hrs. |
| 15. | Corner joint | 3 Hrs. |
| 16. | T. joint | 3 Hrs. |
| 17. | V. Butt joint | 3 Hrs. |
| 18. | Square corner joint | 3 Hrs. |
| 19. | Bevel butt joint | 3 Hrs. |
| 20. | Spot Welding | 3 Hrs. |

BOOKS RECOMMENDED:

1. Wiring Manual by Pakistan Cable.
2. Electrical Wiring-A.I.O.U Islamabad.
3. A.G.E wiring cables & Tables A.G.E ind. Ltd.
4. El. Wiring Guide by Audels.
5. Electricity Rules (Pakistan).
6. National electrical code 1985 USA.
7. I.E.E. Regulations London UK.

INSTRUCTIONAL OBJECTIVES

TIME SCHEDULE

S.NO.	MAJOR TOPICS	NO. OF PERIODS	NO. OF QUESTIONS IN Q. PAPER
1.	House wiring	10	2
2.	Industrial & commercial wiring	5	1
3.	Pakistan electricity rules	5	½
4.	I.E.E. regulations	5	½
5.	Factory Act.	2	¼
6.	Safety.	5	1
	TOTAL:	32	5

WIRING

- 1. UNDERSTAND ABOUT THE TYPES & SIZES OF COMMON CABLES USED IN DOMESTIC WIRING.**
 - 1.1 Classify cables with respect to insulation, core, voltage grade & current carrying capacity.
 - 1.2 Explain different systems for calculation of cable size.
 - 1.3 Calculate size of cable for a given load

- 2. UNDERSTAND THE WIRING SYSTEMS (PVC CONDUIT, CHANNEL AND CABLE WIRING).**
 - 2.1 Distinguish between different wiring systems
 - 2.2 Name of necessary materials required for each type of wiring.
 - 2.3 Explain the uses of each type of wiring.

- 3. UNDERSTAND THE NEED FOR PROTECTION OF HOUSE WIRING AND KNOW DIFFERENT PROTECTIVE DEVICES FOR HOUSE WIRING.**
 - 3.1 Define fuse, miniature circuit breaker.
 - 3.2 Distinguish between fuse and miniature circuit breaker.
 - 3.3 List the parts of fuse & M.C.B.
 - 3.4 Compare the advantages & disadvantages of fuse & M.C.B.

- 4. UNDERSTAND THE EARTHING SYSTEM USED IN HOUSE WIRING.**
 - 4.1 Name components of earthing system.
 - 4.2 Define earth electrode, earth continuity conductor & earthing lead.
 - 4.3 Draw the earthing circuit.
 - 4.4 Explain the earth fault current.
 - 4.5 Calculate size of earth continuity conductor, earthing lead & earth electrodes.

- 4.6 Draw scheme of earthing system.
- 5. UNDERSTAND THE CONSTRUCTION, NEED & APPLICATION OF DISTRIBUTION BOARDS.**
- 5.1 Define distribution board.
 - 5.2 Types of D.B. w.r.t. size, current rating, voltage, No. of C.Bs and phases etc.
 - 5.3 Name/Label parts of distribution board.
 - 5.4 Prepare the distribution board.
- 6. UNDERSTAND THE WIRING TESTS & TEST INSTRUMENT (CONTINUITY TESTERS, TEST LAMP, MEGGER).**
- 6.1 Name different wiring tests.
 - 6.2 Explain the procedure of test.
 - 6.3 Enlist the results of test.
- 7. KNOW ABOUT THE WIRING ACCESSORIES (SWITCHES, SOCKET OUTLETS, CEILING ROSE, LAMP HOLDERS ETC).**
- 7.1 Enlist wiring accessories
 - 7.2 State purpose of each accessory.
 - 7.3 Connect accessories according to the circuit diagram.
- 8. UNDERSTAND THE PROCEDURE OF JOINTING AND SOLDERING - MAKE A JOINT AND SOLDER IT.**
- 8.1 Make the cable joints (Britannia, straight, Tee) on single core single strand, single core multistrand and multicore cables
 - 8.2 Solder the joint.
 - 8.3 Describe the correct procedure of jointing & soldering.
 - 8.4 Explain the composition of solder and soldering flux.
- 9. UNDERSTAND THE LIGHTING CIRCUITS - CONNECT DIFFERENT CIRCUITS.**
- 9.1 Connect one lamp with one way switch
 - 9.2 Connect staircase circuit.
 - 9.3 Connect lamps in series and parallel with switches.
 - 9.4 Label parts of fluorescent lamp (e.g. choke and starter) and its circuit.
 - 9.5 Connect fluorescent lamp in different fashions.
 - 9.6 Draw the circuit diagram of each circuit.
 - 9.7 Discuss to read the wiring diagrams, layout diagram and current path diagram.
- 10. INSTALL A DOMESTIC WIRING (CHANNEL WIRING & P.V.C AND STEEL, CLEAT, BATTEN, CASING, CAPPING, CONDUIT WIRING, CABLE WIRING).**
- 10.1 Select the material for wiring.
 - 10.2 Design the layout.

- 10.3 Draw the circuit.
- 10.4 Select the tools.
- 10.5 Install the wiring.
- 10.6 Test the wiring.
- 10.7 Commission the wiring.
- 10.8 Locate & rectify the faults.

11. CONSTRUCT ELECTRICIAN TEST BOARD & SWITCH BOARD.

- 11.1 Select material & accessories
- 11.2 Fix the accessories on board according to the circuit diagram.
- 11.3 Connect the accessories.
- 11.4 Test the function of circuit.

INDUSTRIAL & COMMERCIAL WIRING

1. UNDERSTAND POWER WIRING SYSTEMS (STEEL CONDUIT, TRUNKING & DUCTING, CATENARY, OVERHEAD BUSBAR, TROUGH SHEATHED SYSTEM).

- 1.1 Describe procedure of each wiring system.
- 1.2 Identify the material used in each wiring.
- 1.3 Explain the uses of each of the wiring systems.

2. UNDERSTAND L.T POWER CABLES - KNOW SPECIAL PURPOSE CABLES (HEAT RESISTANT, FIRE RETARDING, WELDING CABLES).

- 2.1 Describe the construction of different types of L.T. power cables.
- 2.2 State the uses of special purpose cables.
- 2.3 Designate sizes of cables.
- 2.4 Give specifications of cables.

3. UNDERSTAND MULTISTORY DISTRIBUTION SYSTEM.

- 3.1 Describe electrical distribution system in multistory buildings.
- 3.2 Illustrate a typical distribution system in a multistory building.
- 3.3 Draw the wiring diagram of multistory building.

4. APPLY THE TECHNIQUES OF JOINTING POWER CABLES.

- 4.1 Identify the jointing tools.
- 4.2 Differentiate jointing material for copper conductors & aluminium conductors.
- 4.3 Narrate jointing technique & procedure for jointing copper & aluminum conductor power cables.

5. ACQUIRE THE SKILL IN INSTALLING POWER WIRING.

- 5.1 Install steel conduit wiring.
- 5.2 Install P.V.C.conduit wiring.
- 5.3 Install motor with D.O.L, 3 point & star-Delta starter.

- 5.4 Dismantle & assemble I-ph and 3-ph motors.
- 5.5 Construct & level motor foundation.
- 5.6 Locate & rectify faults in power wiring.

SAFETY AND REGULATION:

- 1. UNDERSTAND THE HAZARDS TO LIFE AND EQUIPMENT FROM ELECTRICITY, ELECTRICAL & RELATED EQUIPMENTS - UNDERSTAND PRECAUTIONS WITH PREVENTIVE METHODS.**
 - 1.1 State hazards to life from electric rotating machines.
 - 1.2 Explain preventive methods.
 - 1.3 Describe fire and its types.
 - 1.4 Describe fire fighting equipments.
 - 1.5 Describe the principles of fire fighting.

- 2. UNDERSTAND I.E.E. REGULATION FOR ELECTRICAL EQUIPMENTS OF BUILDING AND ELECTRICITY RULES OF PAKISTAN, FACTORY COMPENSATION ACT.**
 - 1.1 Define the following I.E.E. regulations (A1,A3,A-26,B-4,B-12, B-23, C-4,C-1,C-8, D-1,D-20)
 - 1.2 Explain the regulations (relevant) electricity
 - 1.3 Explain rules of Pakistan (R.No's 25, 28, 29, 32, 40, 49, 51, 52, 58, 60, 62, 64)
 - 1.4 Describe Factory act (compensation only)

- 3. UNDERSTAND THE PROCEDURE FOR CLAIMING COMPENSATION FOR WORKERS AFFECTED DUE TO ACCIDENT.**
 - 3.1 Prepare report of fatal accidents on the relevant forms for the concerned authorities.
 - 3.2 State the procedure for medical examination of the personnel affected due to accidents.
 - 3.3 Describe the procedure for reporting injuries and acquired diseases due to nature of work.
 - 3.4 Describe the method and amount of compensation payable to workmen due to accidents.

METAL WORK (SHOP TALK ONLY)-NO THEORY PAPER:

- 1. BE FAMILIAR WITH THE SHOP AREA POLICIES AND DIFFERENT TOOLS & EQUIPMENT SUPPORTIVE TO BENCH WORK. SHOW CONCERN FOR SAFETY.**
 - 1.1 Classify the tools and equipment which supports bench work.
 - 1.2 Identify the different parts and functions of the support machines.

- 1.3 Follow proper operating procedure, care and maintenance of different tools and support machines.
- 1.4 Observe shop safety practice.

2. APPLY THE VARIOUS KNOWLEDGE AND MANIPULATE SKILLS ACQUIRED IN BENCH WORK PROCESS.

- 2.1 Identify various tools and equipment used in bench work.
- 2.2 Perform various bench work processes.
- 2.3 Demonstrate proper use, care and maintenance of various hand tools.
- 2.4 Select proper tools.
- 2.5 Identify parts and functions of hand tools.
- 2.6 Solve shop problems related to bench work.
- 2.7 Observe safety rules applied to bench work processes.

WOOD WORK.(SHOP TALK ONLY)-NO THEORY PAPER:

1. KNOW AND USE WOOD WORKING HAND TOOLS.

- 1.1 Identify wood working hand tools.
- 1.2 Classify wood working hand tools w.r.t. function.
- 1.3 Observe proper care and maintenance of hand tools.
- 1.4 Observe safety regulations.

2. MAKE WOOD JOINTS AND PRACTICE DIFFERENT OPERATIONS.

- 2.1 Perform the operation of sawing, planing, drilling and jointing.
- 2.2 Identify wood fastening devices.
- 2.3 Select correct fastening devices for a particular work.
- 2.4 Make different wood joints.
- 2.5 Finish the wood surface.

3. KNOW SHARPENING TOOLS AND SHARPENING PROCEDURE.

- 3.1 Identify different sharpening tools.
- 3.2 Use sharpening tools.
- 3.3 Practice of sharpening hand saw, chisel and plane blades.

WELDING.(SHOP TALK ONLY)-NO THEORY PAPER:

1. UNDERSTAND TOOLS AND EQUIPMENT USED IN GAS WELDING, ARC WELDING AND SOLDERING - KNOW AND APPLY THE WELDING AND SOLDERING PROCESSES.

- 1.1 Identify the tools and equipment used in basic welding (Gas, Arc) and soldering processes.
- 1.2 Select proper tools and material.
- 1.3 Weld common joints.
- 1.4 Solder joints.

- 1.5 Follow proper procedure.
- 1.6 Observe safety practice

ET-146: WORKSHOP PRACTICE-I

GUIDELINES FOR CONDUCT OF PRACTICALS

Following guidelines are suggested for the teachers before/while conducting or supervising lab/shop activities.

The teacher should:

- 1 Draw project circuit diagrams and explain the main concept(s).
- 2 Demonstrate/identify safety precautions to be taken while conducting practicals.
- 3 Discuss the procedure for the conduct of exercise by the students.
- 4 Identify key points to be specially observed/noted by the students while conducting the experiment.
- 5 Help students select tools, equipment and other material for the practical specially in the context of ratings & sizes.
- 6 Guide students in drawing conclusion/results.
- 7 Arrange a general discussion session at the end of practical to summarize the experiment.
8. Try to ensure and inculcate safety habits in the students

LIST OF PRACTICALS (ELECTRICAL WIRING)

1. To study wiring accessories.
2. To study tools used in wiring.
3. To study types of cables.
4. Demonstration of treatment against electric shock.
5. To control one lamp with a single way switch.
6. To control Two lamps individually by 1-way switches.
7. To control Three lamps individually by 3 one way switches & install a fuse.
8. To control Two lamps individually by 2-way switch.
9. To control One lamp from 2 different places.(Stair case circuit).
10. To control One lamp from 3 different places.
11. To control Three lamps in series and measure voltage drop across each lamp.
12. To construct a test board.
13. To construct fuse indication circuit.
14. To control Two lamps by two 2-way switches both in series, both in parallel and individual control.
15. To control a bell through indicator by push button.
16. To prepare Bell-indicator circuit (Hotelling circuit).
17. To prepare Godown circuit.
18. Study of wiring boxes and sealing.
19. To prepare single twist joint.
20. To prepare married joint.
21. To prepare duplex joint.
22. To prepare rat-tail joint.
23. To prepare a Britannia joint.
24. Study of low power cables.

25. Study of medium power cables.
26. Jointing of low voltage cables.
27. Jointing of medium voltage cables.
28. Jointing of paper cables.
29. To prepare wiring switch board with 4 switches, one fan regulator, one socket and a lamp.
30. Study of various protective devices.
31. To control One lamp in channel wiring.
32. To control Two lamps in channel wiring.
33. To control Three lamps in channel wiring.
34. Bell indicator circuit in channel wiring.
35. Godown circuit in channel wiring.
36. To install 1-phase energy meter, main switch and distribution fuse board.
37. To Control One lamp in P.V.C. conduit wiring by making circuit at serial No.9.
38. To control Two lamps in P.V.C. conduit wiring by making circuit at serial No.10.
39. To control three lamps in P.V.C. conduit wiring by making circuit at serial No.14.
40. Stair case circuit in P.V.C. by making circuit at serial No.16.
41. Tunnel light circuit in P.V.C. wiring.
42. To control three lamps individually in steel conduit.
43. Stair case circuit in steel conduit.
44. Bell indicator circuit in steel conduit.
45. Flourescent lamp parts and its connection.
46. To study & connect starterless fluourescent lamp.
47. Wiring 3-phase motor contractor, push button starter and thermal relay.
48. Wiring 3-phase motor as above but controlled from more than one place.
49. Study of the various AC and DC motor starters.
50. Wiring 3-phase motor with 3 position starter. (forward, stop, reverse)
51. Typical commercial wiring in conduit, having distributed light and power circuit.
52. Demonstration of electric shock treatment.
53. Study of different fire extinguisher.
54. House wiring test (Short circuit, leakage current, polarity and continuity test).
55. Location of fault and rectification in wiring.
56. Measurement of earth resistance by earth tester.
57. Measurement of earth loop resistance by Ammeter and volt meter method.
58. Insulation test of 3-phase motors by megger.
59. Designing Protective Multiple Earth System for industrial installation.
60. Study of Pakistan Electricity Rules (R.No. 65,66,67,69,72,73,74).

PROJECT: (ELECTRICAL WIRING)

- Two room house wiring in P.V.C. conduit.
- Batten wiring for four rooms.
- Making motor foundation and its levelling.

Note: Students must prepare theory and practical note books and got it checked weekly by the concerned teacher. They should produce these to external examiner for sessional work/marking check up at the time of final exam.

اسلامیات / مطالعہ پاکستان

GEN 211

مضب (اسل دوئم)

تعداد کول اسلامیات

حصہ دوم - سلاحہ پاکستان

موضوعات

ٹن ٹی ٹی
1 0 1
کل وقت: 20 گھنٹے

- 1- سورة المؤمن آیت تا آیدہ آیات کا مع ترجمہ
- 2- دن تخبہ مصلحت مع زمرہ و تفریح
- 3- خیار کم من تعسیم القرآن و علمہ
- 4- لا ایمان لمن لا امانتہ له ولا دین لمن لا عہدہ
- 5- وراکم و لظن ان الظن اکرب الحدیث
- 6- من احدث فی امرنا بئنا ما لیس متہ فہو رد
- 7- من حمل علیہ السلاح فلیس منا
- 8- لادوکافل البیتیم فی الجنۃ
- 9- لا ضرور ولا ضرار فی السلام
- 10- کلکم راع و کلکم راع و کلکم مسؤول عن رعیتہ
- 11- سیرۃ طیبہ
- 12- کی زندگی و ارثہ بختہ اجرت
- 13- خلی زندگیا - موافقت - مشق دروغ - کد (اسباب و نتائج)
- 14- حضور ﷺ بحیثیت
- 15- قطبہ حجتہ الامراء
- 16- معبر کل سریر کو تائدان
- 17- اسلامی معاشرہ
- 18- کلام تعلیم اور اس کے مقاصد عدس و انصاف امر بالمعروف نہی عن المنکر
- 19- جملہ کتب طالب - سچہ الکتب (فضیلت)
- 20- انہی ریاست کی تعریف - انہی ریاست کی خصوصیات - انہی حکومت کے فرائض - اسلامی طرز حکومت

اسلامیات

تدریس مقاصد

عمومی مقاصد بطالعلم یہ جان سکے کہ آیات قرآنی کی روشنی میں مومن کے اوصاف کیا ہیں
قرآن مجید

فصوصی مقاصد:

- ☆ قرآنی آیات کا ترجمہ بیان کر سکے
 - ☆ قرآنی آیات کی تشریح کر سکے
 - ☆ 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 نبویہ
- ☆ عمومی مقصد احادیث کی روشنی میں اسلامی اخلاقی اقدار (انفرادی و اجتماعی) سے آگاہ ہو سکے
- فصوصی مقاصد:
- ☆ احادیث کا ترجمہ بیان کر سکے
 - ☆ احادیث کی تشریح کر سکے
 - ☆ احادیث کی روشنی میں اسلام کی اخلاقی اقدار کی وضاحت کر سکے
 - ☆ فقہ احادیث کی دی گئی تعلیمات کے مطابق اپنی زندگی گزار سکے
- سیرت طیبہ
- ☆ عمومی مقصد: حضور ﷺ کی سیرت طیبہ کے بارے میں جان سکے
- فصوصی مقاصد:
- ☆ حضور ﷺ کی ابتدائی زندگی اختصار کے ساتھ بیان کر سکے
 - ☆ حضور ﷺ کی ہجرت کا واقعہ بیان کر سکے
 - ☆ حضور ﷺ کی مدنی زندگی اختصار سے بیان کر سکے
 - ☆ حضور ﷺ کی بطور معلم خصوصیات بیان کر سکے

- ☆ حضورِ نبوی ﷺ کی بطور سربراہ خاندان بیان کر سکے
اسلامی معاشرہ
- ☆ عمومی مقصد: اسلامی معاشرہ کی خصوصیات سے آگاہی حاصل کر سکے
خصوصی مقاصد:
- ☆ اسلامی معاشرہ کا معنی و مفہوم بیان کر سکے
- ☆ اسلامی معاشرہ کی امتیازی خصوصیات بیان کر سکے
- ☆ اسلامی معاشرہ میں عدل و احسان کی اہمیت بیان کر سکے
- ☆ تبلیغ کے لغوی معنی بیان کر سکے
- ☆ تبلیغ کی اہمیت و ضرورت بیان کر سکے
- ☆ جہلوں کے لفظی و اصطلاحی معنی بیان کر سکے
- ☆ جہلوں کی اہمیت بیان کر سکے
- ☆ جہلوں اور فتنوں میں فرق بیان کر سکے
- ☆ جہلوں کی مختلف اقسام بیان کر سکے
- ☆ اقطاب مسجد کی تعریف کر سکے
- ☆ مسجد کی سابقہ حیثیت کو بحال کرنے کے بارہ میں اقدامات کو 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 و مقاصد بیان کر سکے
- ☆ اسلامی ریاست کے قیام کیلئے جدوجہد کر سکے

نصاب مطالعہ پاکستان

نی بی سی
1 0 1
کل وقت: 12 گھنٹے

سلاہ دوم	
حصہ دوم	
موضوعات	
۱۰ قانون نظریہ	☆
تحریک پاکستان	☆
انڈین کانگریس	☆
مسلم لیگ	☆
تفسیر بنگلہ	☆
سینٹس کمیٹی	☆
تحریک خلافت	☆
سندھ تحریک	☆
تجلیز رومی	☆
سورج پورٹ	☆
قائمہ اعظم کے چودہ نکات	☆
خلیفہ آلہ آباد	☆
انقلابیت 1938 اور اشعل ہندوستان	☆
قراردادوں پاکستان	☆

حصہ دوم

سزاخہ پاکستان

تدریس مقاصد

تحریک پاکستان

عمومی مقصد: قیام پاکستان کے اسباب و محرکات کو بیان کر سکے

خصوصی مقاصد:

☆ قومیت کے مفہوم کو بیان کر سکے

☆ دو قومی نظریہ کی تعریف و توضیح کر سکے

☆ دو قومی نظریہ اہمیت بیان کر سکے

☆ ہندوستانی مسلمانوں کی محرومیوں کو بیان کر سکے

☆ قومی تشخص کو بحال رکھنے کے لئے مسلمان ہند کی مساوی بیان کر سکے

☆ آزادی ہند اور قیام پاکستان علامہ اقبال اور قائد اعظم کی مساوی بیان کر سکے

☆ قیام پاکستان سے مستقبل اسلامی مملکت کے قیام کے لئے مسلم عوام کی کوششوں کو بیان کر سکے

☆ مسلم لیگ کے قیام پاکستان کے لئے جدوجہد بیان کر سکے

(غیر مسلم طلباء کے لئے)

ٹی ڈی اے
1 0 1
کل وقت: 20 منٹ

نصاب امتلاقیات
سال دوم

موضوعات

معاشرتی قدر اہلکار، ایم۔ قوم۔ قوی سطح۔ شہری سطح۔ صنعتی اربوروں کی سطح۔ ضروریات۔ درجہ

- ☆ حقوق و فرائض
- ☆ قوت پرورش
- ☆ قوت ارلوی
- ☆ لگن و جذبہ
- ☆ وسیع النظری
- ☆ بے غرضی
- ☆ مسئلہ دوستی
- ☆ سخاوتی شعور
- ☆ پاس آزلوی
- ☆ کامل اچھی
- ☆ تعمیرات کو قبول کرنا
- ☆ خود شناسی

نسبہ اخلاقیات

سال ۱۰م

تدریس مقاصد

عمومی مقاصد:

طالب علم: اخلاقیات کی اہمیت و ضرورت سے سمجھ ہو سکے اور بیان کر سکے

خصوصی مقاصد: طالب علم اس قدر قابل ہو کہ

موضوعات کا مطلب بیان کر سکے

عملی زندگی سے مثالوں کی نشاندہی کر سکے

اپنی شخصیت اور حاشیے پر موضوعات کے متعلق مثبت اثرات پیدا کرنے کے طریقے بیان کر سکے

اعلیٰ بنحیثی قدر میں سے

توبت برداشت۔ قوت ارادی۔ نکتہ جذبہ۔ وسیع انگیزی۔ بے غرض۔ انسانی دوستی خالص۔ شعور۔ پس سزاوی۔

کمال اعلیٰ اور ذوا شناسی کی اہمیت بیان کر سکے

اخلاقیات سے متعلق ہر کوئی خدمت بہتر طور پر انجام دے سکے

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 Formulas	
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 EQUATIONS	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 TRANSFORMATIONS	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	9 hours
13.1	Concept of mean, median and mode	
13.2	Standard Deviation	
13.3	Laws of probability	

RECOMMENDED 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.

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 $\sec x$, $\operatorname{cosec} x$, $\cot x$.
 - 4.3 Find derivatives of inverse trigonometric 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

Phy-222 APPLIED PHYSICS

Total Contact Hours

Theory	32	T	P	C
Practicals	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 WAVE MOTION. 5 Hours**
 - 3.1 Review Hooke's law of elasticity
 - 3.2 Motion under an elastic restoring force
 - 3.3 Characteristics of simple harmonic motion
 - 3.4 S.H.M. and circular motion
 - 3.5 Simple pendulum
 - 3.6 Wave form of S.H.M.
 - 3.7 Resonance
 - 3.8 Transverse vibration of a stretched string

- 4 SOUND. 5 Hrs**
 - 4.1 Longitudinal waves
 - 4.2 Intensity, loudness, pitch and quality of sound
 - 4.3 Units of Intensity of level and frequency response of ear
 - 4.4 Interference of sound waves silence zones, beats
 - 4.5 Acoustics
 - 4.6 Doppler effect.

- 5 LIGHT. 5 Hours**
 - 5.1 Review laws of reflection and refraction
 - 5.2 Image formation by mirrors and lenses
 - 5.3 Optical instruments
 - 5.4 Wave theory of light
 - 5.5 Interference, diffraction, polarization of light waves
 - 5.6 Applications of polarization in sunglasses, optical activity and stress analysis

6	OPTICAL FIBER. 6.1 Optical communication and problems 6.2 Review total internal reflection and critical angle 6.3 Structure of optical fiber 6.4 Fiber material and manufacture 6.5 Optical fiber - uses.	2 Hours
7	LASERS. 7.1 Corpuscular theory of light 7.2 Emission and absorption of light 7.3 Stimulated absorption and emission of light 7.4 Laser principle 7.5 Structure and working of lasers 7.6 Types of lasers with brief description. 7.7 Applications (basic concepts) 7.8 Material processing 7.9 Laser welding 7.10 Laser assisted machining 7.11 Micro machining 7.12 Drilling, scribing and marking 7.13 Printing 7.14 Lasers in medicine	3 Hours
8	HEAT. 8.1 Review of calorimetry and gas laws 8.2 Thermal expansion of solids, liquids and gases 8.3 Heat of fusion, vaporization 8.4 Humidity, absolute and relative 8.5 Law of cooling 8.6 Thermoelectricity 8.7 Thermocouple.	4 hrs.
9	MAGNETIC MATERIALS. 9.1 Magnetism 9.2 Domains theory 9.3 Para, dia and ferromagnetism and magnetic materials 9.4 B.H. curve and hysteresis loop.	2 Hours
10	SEMI CONDUCTOR MATERIALS. 10.1 Crystalline structure of solids 10.2 Conductors, semiconductors, insulators 10.3 P-type and N-type materials 10.4 P-N junction 10.5 P-N junction as a diode 10.6 Photovoltaic cell (solar cell)	2 Hours

RECOMMENDED 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
- 7 M. Aslam Khan and M. Akram Sandhu, Experimental Physics Note Book

Phy-222 APPLIED PHYSICS

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 CONCEPTS OF WAVE MOTION IN SOLVING RELEVANT PROBLEMS.**
 - 3.1 Explain Hooke's Law of Elasticity
 - 3.2 Derive formula for Motion under an elastic restoring force
 - 3.3 Derive formulae for simple harmonic motion and simple pendulum
 - 3.4 Explain wave form with reference to S.H.M. and circular motion
 - 3.5 Explain Resonance
 - 3.6 Explain Transverse vibration of a stretched string
 - 3.7 Use the above concepts and formulae of S.H.M. to solve relevant problems.

- 4 UNDERSTAND CONCEPTS OF SOUND.**
 - 4.1 Describe longitudinal wave and its propagation
 - 4.2 Explain the concepts: Intensity, loudness, pitch and quality of sound
 - 4.3 Explain units of Intensity of level and frequency response of ear
 - 4.4 Explain phenomena of silence zones, beats
 - 4.5 Explain Acoustics of buildings
 - 4.6 Explain Doppler effect giving mathematical expressions.

- 5 USE THE CONCEPTS OF GEOMETRICAL OPTICS TO MIRRORS and LENSES.**
 - 5.1 Explain laws of reflection and refraction
 - 5.2 Use mirror formula to solve problems
 - 5.3 Use the concepts of image formation by mirrors and lenses to describe working of optical instruments, e.g. microscopes, telescopes, camera and sextant.

- 6 UNDERSTAND WAVE THEORY OF LIGHT**
 - 6.1 Explain wave theory of light
 - 6.2 Explain phenomena of interference, diffraction, polarization of light waves
 - 6.3 Describe uses of polarization given in the course contents.

- 7 UNDERSTAND THE STRUCTURE, WORKING AND USES OF OPTICAL FIBER.**
 - 7.1 Explain the structure of the Optical Fiber
 - 7.2 Explain its principle of working

- 7.3 Describe use of optical fiber in industry and medicine.
- 8 UNDERSTAND THE STRUCTURE, WORKING AND USES OF LASERS.**
- 8.1 Explain the stimulated emission of radiation
 - 8.2 Explain the laser principle
 - 8.3 Describe the structure and working of lasers
 - 8.4 Distinguish between types of lasers
 - 8.5 Describe the applications of lasers in the fields mentioned in the course contents.
- 9 UNDERSTAND TYPES AND USES OF ARTIFICIAL SATELLITES.**
- 9.1 Explain escape velocity
 - 9.2 Explain orbital velocity
 - 9.3 Distinguish between geosynchronous and geostationary satellites
 - 9.4 Describe uses of artificial satellites in data communication.
- 10 UNDERSTAND BASIC CONCEPTS AND CLASSIFICATION OF MAGNETIC MATERIALS.**
- 10.1 Explain domains theory of magnetism
 - 10.2 Distinguish between para, dia and ferromagnetism and magnetic materials
 - 10.3 Distinguish between B and H
 - 10.4 Describe B.H. Curve
 - 10.5 Describe hysteresis loop.
- 11 UNDERSTAND BASIC CONCEPTS OF SEMI-CONDUCTOR MATERIALS AND THEIR USES.**
- 11.1 Explain crystalline structure of solids
 - 11.2 Distinguish between conductors, semiconductors and insulators
 - 11.3 Describe semiconductors giving examples with reference to their structure
 - 11.4 Distinguish between P-type and N-type materials
 - 11.5 Explain working of P-N junction as a diode
 - 11.6 Explain working of solar cell.

Phy-222 APPLIED PHYSICS

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.

Mgm 221 BUSINESS MANAGEMENT AND INDUSTRIAL ECONOMICS

Total Contact Hours

Theory	32	T	P	C	
Practical	0		1	0	1

AIMS The students will be able to develop management skills, get acquainted the learner with the principles of management and economic relations and develop commercial/economic approach to solve the problems in the industrial set-up.

COURSE CONTENTS

- 1. ECONOMICS 2 Hours**
 - 1.1 Definition: Adam Smith, Alfred Marshall, Prof. Robins.
 - 1.2 Nature and scope
 - 1.3 Importance for technicians
 - 1.4 Micro and Macro Economics.

- 2. BASIC CONCEPTS OF ECONOMICS 1 Hour**
 - 2.1 Utility
 - 2.2 Income
 - 2.3 Wealth
 - 2.4 Saving
 - 2.5 Investment
 - 2.6 Value.

- 3. DEMAND AND SUPPLY. 2 Hours**
 - 3.1 Definition of demand.
 - 3.2 Law of demand.
 - 3.3 Definition of supply.
 - 3.4 Law of supply.

- 4. FACTORS OF PRODUCTION. 2 Hours**
 - 4.1 Land
 - 4.2 Labour
 - 4.3 Capital
 - 4.4 Organization.

- 5. BUSINESS ORGANIZATION. 3 Hours**
 - 5.1 Sole proprietorship.
 - 5.2 Partnership
 - 5.3 Joint stock company.

6.	ENTREPRENEURIAL SKILLS	4 Hours
6.1	Preparing, planning, establishing, managing, operating and evaluating relevant resources in small business.	
6.2	Business opportunities, goal setting.	
6.3	Organizing, evaluating and analyzing opportunity and risk tasks.	
7.	SCALE OF PRODUCTION.	2 Hours
7.1	Meaning and its determination.	
7.2	Large scale production.	
7.3	Small scale production.	
8.	ECONOMIC SYSTEM	3 Hours
8.1	Free economic system.	
8.2	Centrally planned economy.	
8.3	Mixed economic system.	
9.	MONEY.	1 Hour
9.1	Barter system and its inconveniences.	
9.2	Definition of money and its functions.	
10.	BANK.	1 Hour
10.1	Definition	
10.2	Functions of a commercial bank.	
10.3	Central bank and its functions.	
11.	CHEQUE	1 Hour
11.1	Definition	
11.2	Characteristics and kinds of cheque.	
11.3	Dishonour of cheque.	
12.	FINANCIAL INSTITUTIONS	2 Hours
12.1	IMF	
12.2	IDBP	
12.3	PIDC	
13.	TRADE UNION	2 Hours
13.1	Introduction and brief history.	
13.2	Objectives, merits and demerits.	
13.3	Problems of industrial labour.	
14.	INTERNATIONAL TRADE.	2 Hours
14.1	Introduction	
14.2	Advantages and disadvantages.	
15.	MANAGEMENT	1 Hour
15.1	Meaning	
15.2	Functions	

- 16. ADVERTISEMENT** **2 Hour**
- 16.1 The concept, benefits and draw-backs.
 - 16.2 Principal media used in business world.
- 17. ECONOMY OF PAKISTAN** **1 Hour**
- 17.1 Introduction
 - 17.2 Economic problems and remedies.

BOOKS RECOMMENDED

1. Nisar-ud-Din, Business Organization, Aziz Publisher, Lahore
2. M. Saeed Nasir, Introduction to Business, Ilmi Kitab Khana, Lahore.
3. S.M. Akhtar, An Introduction to Modern Economics, United Limited, Lahore.

INSTRUCTIONAL OBJECTIVES

- 1. UNDERSTAND THE IMPORTANCE OF ECONOMICS.**
 - 1.1 State definition of economics given by Adam Smith, Alfred Marshall and Professor Robins.
 - 1.2 Explain nature and scope of economics.
 - 1.3 Describe importance of study of economics for technicians.
 - 1.4 Distinguish between Micro and Macro Economics
- 2. UNDERSTAND BASIC TERMS USED IN ECONOMICS.**
 - 2.1 Define basic terms, utility, income, wealth, saving, investment and value.
 - 2.2 Explain the basic terms with examples
- 3. UNDERSTAND LAW OF DEMAND AND LAW OF SUPPLY.**
 - 3.1 Define Demand.
 - 3.2 Explain law of demand with the help of schedule and diagram.
 - 3.3 State assumptions and limitation of law of demand.
 - 3.4 Define Supply.
 - 3.5 Explain law of Supply with the help of schedule and diagram.
 - 3.6 State assumptions and limitation of law of supply.
- 4. UNDERSTAND THE FACTORS OF PRODUCTION**
 - 4.1 Define the four factors of production.
 - 4.2 Explain labour and its features.
 - 4.3 Describe capital and its peculiarities.
- 5. UNDERSTAND FORMS OF BUSINESS ORGANIZATION.**
 - 5.1 Describe sole proprietorship, its merits and demerits.
 - 5.2 Explain partnership, its advantages and disadvantages.
 - 5.3 Describe joint stock company, its merits and demerits.
 - 5.4 Distinguish public limited company and private limited company.
 - 5.5 Difference between proprietorship, partnership and joint stock company
- 6. UNDERSTAND ENTERPRENEURIAL SKILLS**
 - 6.1 Explain preparing, planning, establishing and managing small business set up
 - 6.2 Explain evaluating all relevant resources
 - 6.3 Describe organizing analyzing and innovation of risk of task
- 7. UNDERSTAND SCALE OF PRODUCTION.**
 - 7.1 Explain scale of production and its determination.
 - 7.2 Describe large scale production and it merits.
 - 7.3 Explain small scale of production and its advantages and disadvantages.
- 8. UNDERSTAND DIFFERENT ECONOMIC SYSTEMS.**
 - 8.1 Describe free and centrally planned economic system and its characteristics.
 - 8.2 Merits and demerits of economic system.
- 9. UNDERSTAND WHAT IS MONEY**
 - 9.1 Define money
 - 9.2 Explain barter system and its inconveniences.
 - 9.3 Explain functions of money.
- 10. UNDERSTAND BANK AND ITS FUNCTIONS.**
 - 10.1 Define bank.

- 10.2 Describe commercial bank and its functions.
- 10.3 State central bank and its functions.
- 10.4 Kind of accounts which are opened into a bank.
- 11. UNDERSTAND CHEQUE AND DISHONOR OF CHEQUE.**
 - 11.1 Define cheque.
 - 11.2 Enlist the characteristics of cheque.
 - 11.3 Identify the kinds of cheque.
 - 11.4 Describe the causes of dishonor of a cheque.
- 12. UNDERSTAND FINANCIAL INSTITUTIONS.**
 - 12.1 Explain IMF and its objectives.
 - 12.2 Explain organisational set up and objectives of IDBP.
 - 12.3 Explain organisational set up and objectives of PIDC.
 - 12.4 Explain function of SBP.
- 13. UNDERSTAND TRADE UNION, ITS BACKGROUND AND FUNCTIONS.**
 - 13.1 Describe brief history of trade union.
 - 13.2 State functions of trade union.
 - 13.3 Explain objectives, merits and demerits of trade unions.
 - 13.4 Enlist problems of industrial labour.
- 14. UNDERSTAND INTERNATIONAL TRADE.**
 - 14.1 Explain international trade.
 - 14.2 Enlist its merits and demerits.
- 15. UNDERSTAND MANAGEMENT**
 - 15.1 Explain meaning of management.
 - 15.2 Describe functions of management.
 - 15.3 Identify the problems of business management.
- 16. UNDERSTAND ADVERTISEMENT.**
 - 16.1 Explain the concept of advertisement.
 - 16.2 Enlist benefits and drawbacks of advertisement.
 - 16.3 Describe principal media of advertisement used in business world.
- 17. UNDERSTAND THE ECONOMIC PROBLEMS OF PAKISTAN.**
 - 17.1 Describe economy of Pakistan.
 - 17.2 Explain economic problems of Pakistan
 - 17.3 Explain remedial measures for economic problems of Pakistan.

ET-213: D.C. MACHINES AND BATTERIES.

Total Contact Hours:

Theory:	64	T	P	C
Practical:	96	2	3	3

AIM To enable students understand basic principles, construction, working and control techniques of DC machines. Also understand types, working and charging of secondary cells/batteries.

- 1. D.C. MACHINES FUNDAMENTALS 6 Hrs.**
 - 1.1 Review of Faraday's Laws of Electromagnetic Induction, Fleming's right hand rule, Lenz's Law, and force on a current carrying conductor.
 - 1.2 Parts of D.C Machines, body, yoke, field, poles, armature, commutator, etc.
 - 1.3 Armature winding, single layer, double layer, simplex, duplex, lap and wave.

- 2. D.C MACHINE AS D.C. GENERATOR 20 Hrs.**
 - 2.1 Principle of working of elementary D.C generator.
 - 2.2 E.M.F equation of D.C generator and problem solving.
 - 2.3 Types of Generator, separately excited, self excited, shunt, series and compound.
 - 2.4 No load characteristics of separately and self excited shunt generator, critical resistance solving problems.
 - 2.5 On load, internal, external characteristics & problem solving of generators voltage regulation, method of compounding, degree of compounding.
 - 2.6 Armature reaction & commutation.
 - 2.7 Interpoles or composites.
 - 2.8 Power stages, losses and efficiency, condition for maximum efficiency.
 - 2.9 Parallel operation of shunt & compound generator, load sharing.
 - 2.10 Safety while working on generators

- 3. D.C. MACHINES AS D.C. MOTOR 26 Hrs.**
 - 3.1 Principle & working of elementary D.C motor.
 - 3.2 Back e.m.f and torque development in D.C motors, torque equation.
 - 3.3 Electrical, Mechanical, V/I_a characteristics of series, shunt, compound (Differential) motors.
 - 3.4 Comparison of D.C motors, and their applications.
 - 3.5 Power stages, losses, BHP and efficiency of D.C. motors.
 - 3.6 Speed control of D.C motor by changing field flux, armature current and voltage.
 - 3.7 Merits and demerits of different speed controlling methods.
 - 3.8 Necessity and Design of Motor Starter, 3 & 4 points starter.
 - 3.9 Controllers, manual, automatic magnetic, semi-automatic.
 - 3.10 Testing of D.C machines, Dynamometer, Hopkinson tests.
 - 3.11 Safety while working on motors.

- 4. BATTERIES 12 Hrs.**
 - 4.1 Primary cells, types, construction, dry cell.
 - 4.2 Secondary cells, storage cells.
 - 4.3 Types of storage cells, Lead Acid, Nickel iron, Nickel Cadmium.

- 4.4 Chemical action during charging and discharging of Lead Acid battery.
- 4.5 Construction and working of Lead Acid battery.
- 4.6 Preparation of electrolytes of given specific gravity.
- 4.7 Variation in specific gravity during charging & discharging.
- 4.8 Effect of specific gravity on e.m.f.
- 4.9 Construction & working of Nickel iron cell.
- 4.10 Construction & working of Nickel-Cadmium Cell.
- 4.11 Safety in preparation of electrolytes and handling acids.
- 4.12 Safe disposal of chemicals

ET-213: D.C. MACHINES & BATTERIES**INSTRUCTIONAL OBJECTIVES****TIME SCHEDULE**

S.NO.	MAJOR TOPICS	NO. OF PERIODS	NO. OF QUESTIONS IN Q. PAPER.
1.	D.C. Machine Fundamentals	6	1
2.	D.C. Generator	20	2
3.	D.C. Motor	26	2
4.	Batteries	12	1
	Total:	64	6

1. UNDERSTAND THE FUNDAMENTALS OF D.C. MACHINES

- 1.1. State Faraday's Laws of Electromagnetic induction
- 1.2. Derive $e=di/dt$ equation
- 1.3. State Flemings right hand rule.
- 1.4. State Lenz's Law.
- 1.5. Explain force developed on a current carrying conductor lying in magnetic field.
- 1.6. State parts of D.C. machine, body, yoke, field poles and winding, commutators, armature
- 1.7. Draw Armature winding, lap, wave, single layer, double layer, simplex and duplex.
- 1.8. Calculate and develop given armature winding for lap & wave duplex winding.

2. UNDERSTAND THE WORKING OF D.C. MACHINES AS D.C. GENERATORS

- 2.1 Explain principle of single loop D.C. generator.
- 2.2 Derive EMF equation of a D.C. generator and solve related problems.
- 2.3 List types of D.C. generator depending upon excitation (self and separately excited).
- 2.4 List types of D.C. generator showing their connections (Shunt, series, compound).
- 2.5 Draw no load characteristics of separately and self-excited shunt generators.
- 2.6 Evaluate critical resistance from O.C.C for a given machine.
- 2.7 Solve problems relating to o.c.c critical resistance, emf and speed.
- 2.8 Draw on-load internal, external characteristics for series, shunt and compound generators.
- 2.9 Solve problems relating to load characteristics.
- 2.10 State levels of compounding of compound generator, as under & over compounding.
- 2.11 Explain armature reaction.
- 2.12 Define commutation.
- 2.13 Explain purpose of Inter-poles
- 2.14 Express power stages in D.C. generators and its efficiency.
- 2.15 Solve problems on power stages and efficiency of D.C. generator.
- 2.16 State conditions for maximum efficiency of a D.C. generator.
- 2.17 Solve problems on efficiency of D.C. generator.
- 2.18 Explain parallel operation of series shunt and compound generators.

3. UNDERSTAND CONSTRUCTION, TYPES AND USES OF D.C MOTORS

- 3.1 Explain working principle of an elementary D.C. motor.
- 3.2 State back e.m.f produced in motor armature.
- 3.3 Explain development of torque due to back e.m.f.
- 3.4 Derive motor torque equation.
- 3.5 Draw electrical, mechanical, N/I_a characteristics of series, shunt and compound (Differential/commulative) motors.
- 3.6 Classify dc motors (Series, shunt, compound).
- 3.7 State application of motors depending upon their characteristics.
- 3.8 Explain power stages in D.C. motors, BHP, losses, efficiency.
- 3.9 Solve problems on power stages of DC motors.
- 3.10 Describe speed control of dc motors, by changing field flux, armature current and voltage.
- 3.11 Compare different speed control methods
- 3.12 Explain controllers, manual, automatic and semi-automatic.
- 3.13 Describe importance of testing of dc machines.
- 3.14 Explain dynamometer, Hopkinson & Swinburn tests.

4. UNDERSTAND CONSTRUCTION, TYPES AND CHARGING OF BATTERIES

- 4.1 Define primary cell.
- 4.2 State type of cells
- 4.3 Describe working of primary cells.
- 4.4 State uses of Dry cell
- 4.5 Explain working of dry cell.
- 4.6 Explain the working of secondary cell and battery (Storage cell, accumulator, lead acid, and alkaline).
- 4.7 Sketch construction of lead acid battery.
- 4.8 Discuss chemical process in lead acid battery on charging and discharging.
- 4.9 State method of preparation of electrolyte for a given specific gravity.
- 4.10 State the effects of charging and discharging on the specific gravity of the electrolyte.
- 4.11 Draw sketch of Nickel iron cell
- 4.12 Describe working of Nickel iron battery.
- 4.13 Draw sketch of Nickel Cadmium battery.

ET-213: D.C. MACHINES AND BATTERIES

LIST OF PRACTICALS:

Note: Students should demonstrate concern for personal and equipment safety while working in Lab.

1. Study of constructional features of D.C machine.
2. Identification of terminals, polarity, determination of resistance of field and armature windings.
3. Developing Lap winding diagram for a given armature.
4. Develop wave winding diagram for a given armature.
5. Calculating winding factor, and develop winding diagram lap and wave for a given armature.
6. Rewinding an armature, session I.
7. Rewinding armature, session II.
8. Rewinding armature, session III (last).
9. Connecting and operating D.C machine as separately excited generator and to plot its O.C.C.
10. Connecting and operating D.C machine as self excited shunt generator and to plot its O.C.C. and to find critical resistance.
11. Operate a series generator and draw its external characteristics.
12. Operate a shunt generator and draw its external characteristics.
13. Plot external characteristics of compound generator for level, under and over compounding.
14. Parallel operation of two shunt generators.
15. Determination of copper, iron & friction losses by actual loading.
16. Study of starting and controlling equipment.
17. Connecting starter and controlling circuit with a shunt motor.
18. Connecting a machine as series motor (operation of fractional H.P series motor).
19. Determination of motor efficiency by direct loading.
20. Experimentally plot speed-torque characteristics of a shunt motor.
21. Plotting speed-current characteristics from data of a shunt motor.
22. Plotting Torque-current characteristics from experimental data of a shunt motor.
23. Plot torque-current characteristic of a series motor from experimental data.
24. Draw speed-torque characteristics of a series motor from experimental data.
25. Plot speed-current characteristic of compounded motor.
26. Draw Torque-current characteristics of compound motor.
27. Controlling speed of a shunt motor by changing field current & armature current.
28. Controlling speed of a series motor by armature and field diverter.
29. Determination of B.H.P of motor by brake test.
30. Determination of efficiency of motor by Swinburn test.
31. Determination of torque and efficiency by dynamo meter.
32. Regenerative or Hopkinsons test.
33. Study constructional features of lead acid battery.
34. Preparation of electrolyte (H_2SO_4) of a given specific gravity and charging lead acid battery.

** Students must prepare practical journal and get it checked weekly by the concerned teacher. He should produce it to external examiner for sessional work/marking check up at the time of final examination.

TEXT/REFERENCE BOOKS

1. A Course in Electrical Engineering Vol.I By Dawes, L. Chester.
2. Audel's Electric motor guide.
3. A Text Book of Electrical Technology by B.L. Theraja.
4. D.C Machines by Audel's.
5. Electrical Generator By Kates-Stafford.
6. Direct Current Motors & Generators by M.C. Mongal-Keth-Rouson.

ET-223: ELECTRICAL INSTRUMENTS AND MEASUREMENTS

Total Contact Hours:

Theory:	64	T	P	C	
Practical:	96		2	3	3

AIM: To enable students understand fundamental forces acting in electrical measuring instruments, and the construction, working & applications of the whole range of measuring instruments. This range includes special purpose and electronic instruments. This course also provides information on measuring bridges in common use.

- 1. CLASSIFICATION OF INSTRUMENTS** **6 Hrs.**
 - 1.1. Absolute instruments.
 - 1.2. Secondary instruments.
 - 1.3. Indicating instruments.
 - 1.4. Recording instruments.
 - 1.5. Integrating instruments.
 - 1.6. Digital instruments.
 - 1.7. Analog instruments.

- 2. EFFECTS UTILIZED IN MEASURING INSTRUMENTS**
 - 2.1. Magnetic effect.
 - 2.2. Heating effect
 - 2.3. Chemical effect.
 - 2.4. Electrostatic effect.
 - 2.5. Electromagnetic effect.

- 3. FORCES ACTING IN AN INSTRUMENT**
 - 3.1. Deflecting force.
 - 3.2. Controlling force.
 - 3.3. Damping force.

- 4. TANGENT GALVANOMETER**
 - 4.1. Theory of Tangent galvanometer.
 - 4.2. Parts of tangent galvanometer.

- 5. DISTINCTION BETWEEN INDICATING AND RECORDING INSTRUMENT**
 - 5.1. Construction, distinction.
 - 5.2. Working distinction

- 6. DEFLECTING FORCE ACTING IN THE INSTRUMENT** **6 Hrs.**
 - 6.1. Calculation of Force/Torques.

- 7. CONTROLLING/RESTORING FORCES**
 - 7.1. Gravity control.
 - 7.2. Spring control.

- 8. DAMPING FORCES AND THEIR NECESSITY**
- 8.1 Air damping.
 - 8.2 Fluid damping.
 - 8.3 Eddy current damping.
- 9. BALANCING OF MOVING PARTS**
- 9.1 Torque/weight ratio calculation.
 - 9.2 Balancing weight.
- 10. CONSTRUCTIONAL FEATURES OF ANALOG INSTRUMENT**
- 10.1 Construction of scales.
 - 10.2 Reading of scales.
 - 10.3 Types of Pointer and methods of their mounting.
 - 10.4 Types of springs.
 - 10.5 Mounting of springs.
 - 10.6 Types of bearings and their role in an instrument.
 - 10.7 Types of casing of an instrument.
- 11. PERMANENT MAGNET MOVING COIL INSTRUMENT 3 Hrs.**
- 11.1 Working Principle.
 - 11.2 Construction.
 - 11.3 Application.
- 12. SHUNTS 8 Hrs.**
- 12.1 Construction of shunts purpose.
 - 12.2 Calculation and application.
 - 12.3 Material used for shunts.
- 13. MULTIPLIER**
- 13.1 Purpose of multiplier and calculations.
 - 13.2 Construction
 - 13.3 Material used for multipliers.
- 14. MOVING IRON ATTRACTION TYPE INSTRUMENT**
- 14.1 Working principle.
 - 14.2 Construction
 - 14.3 Application
- 15. MOVING IRON REPULSION TYPE INSTRUMENT**
- 15.1 Working principle.
 - 15.2 Construction
 - 15.3 Application.
- 16. ERRORS IN AM-METERS AND VOLTMETERS**
- 16.1 Causes of error.
 - 16.2 Removing error.
 - 16.3 Calibration.
- 17. BI METALLIC TYPE INSTRUMENT 6 Hrs.**

- 17.1 Working principle.
- 17.2 Construction
- 17.3 Application.

- 18. THERMOCOUPLE TYPE INSTRUMENT**
 - 18.1 Types of Thermocouples.
 - 18.2 Working principle.
 - 18.3 Application.

- 19. TEMPERATURE MEASUREMENT DEVICES**
 - 19.1 Types (resistance, thermocouple, Radiation Pyrometers).
 - 19.2 Working principle.
 - 19.3 Application.

- 20. MOVING COIL DYNAMOMETER INSTRUMENT**
 - 20.1 Working Principles.
 - 20.2 Construction as Am-meter
 - 20.3 Construction as Voltmeter.
 - 20.4 Construction as Wattmeter.
 - 20.5 Errors and their remedies.
 - 20.6 Advantages and disadvantages over other types.

- 21. SHADED POLE TYPE INSTRUMENT** **2 Hrs.**
 - 21.1 Working Principle
 - 21.2 Construction.
 - 21.3 Application.

- 22. ENERGY METER SINGLE PHASE** **9 Hrs.**
 - 22.1 Types.
 - 22.2 Construction of single phase Energy meter (induction type).
 - 22.3 Working Principle.
 - 22.4 Types of scales in use and reading the scale.
 - 22.5 Errors in energy meter.
 - 22.6 Calibration of Energy meter.

- 23. THREE PHASE ENERGY METER**
 - 23.1 Construction of induction type.
 - 23.2 Working Principle.
 - 23.3 Application.

- 24. MAXIMUM DEMAND INDICATOR**
 - 24.1 Construction.
 - 24.2 Working Principle.
 - 24.3 Application & reading.

- 25. OHM METER**
 - 25.1 Working Principle.
 - 25.2 Construction.

- 25.3 Application.
- 26. A.V.O. METER**
- 26.1 Construction.
- 26.2 Scale reading.
- 26.3 Application.
- 27. MEAGER (INSULATION TESTER)**
- 27.1 Working principle.
- 27.2 Construction.
- 27.3 Application.
- 28. EARTH RESISTANCE TESTER**
- 28.1 Constructions.
- 28.2 Operations.
- 28.3 Application.
- 29. RESISTANCE MEASURING BRIDGES (WHEAT STONE & KELVIN'S DOUBLE BRIDGE)**
- 29.1 Construction.
- 29.2 Working Principle.
- 29.3 Uses.
- 30. MURRAY LOOP TEST**
- 30.1 Working Principle.
- 30.2 Application.
- 31. BLAVIER & EARTH LOOP TEST**
- 31.1 Working principle.
- 31.2 Application.
- 32. INSTRUMENT TRANSFORMERS** **10 Hrs.**
- 32.1 Types (C.T & P.T).
- 32.2 Working and advantages.
- 32.3 Vector diagram.
- 32.4 Theory of C.T & P.T
- 32.5 Phase angle.
- 32.6 Standard ratios, rating, burden.
- 32.7 Error reducing methods.
- 33. POWER FACTOR METERS**
- 33.1 Types according to supply.
- 33.2 Types according to construction.
- 33.3 Working principle of each.
- 34. DIGITAL METERS** **8 Hrs.**
- 34.1 Types.
- 34.2 Uses.
- 34.3 Explanation with the aid of block diagram.
- 34.4 Error.

- 35. F.E.T & TRANSISTOR VOLTMETER** **6 Hrs.**
 35.1 Working (Block diagram).
 35.2 Application.
- 36. OSCILLOSCOPE**
 36.1 Types
 36.2 Construction.
 36.3 Operation.
- 37. SIGNAL GENERATORS** **4 Hrs.**
 37.1 Types (AF & RF)
 37.2 Working Principle.
 37.3 Construction.
 37.4 Application.
- 38. MEASUREMENT OF CAPACITANCE & INDUCTANCE**
 38.1 Measuring Inductance
 38.2 Measuring Capacitance.
- 39. FREQUENCY METER**
 39.1 Types (Resonance and Weston, Digital).
 39.2 Construction.
 39.3 Working Principle.
 39.4 Application.
- 40. LUX METERS**
 40.1 Types.
 40.2 Working principle.
 40.3 Applications.
- 41. SYNCHRONOSCOPES**
 41.1 Types.
 41.2 Construction.
 41.3 Working principle.
 41.4 Uses.
- 42. TACHOMETERS** **6 Hrs.**
 42.1 Types (Mechanical-Electrical & Electronic).
 42.2 Construction.
 42.3 Application.

ET-223: ELECTRICAL INSTRUMENTS AND MEASUREMENTS**INSTRUCTIONAL OBJECTIVES****TIME SCHEDULE**

S.NO.	MAJOR TOPICS	NO. OF PERIODS	NO. OF QUESTIONS IN Q. PAPER
1.	Classification, effect of current indicating, recording and integrating instruments. (1-5)	6	½
2.	Deflecting forces, controlling & damping. General constructions. (6-14)	6	½
3.	Permanent magnet moving coil & moving iron instruments (15-17) Cost estimation - Labour cost estimation	6	½
4.	Bi-Metal, thermocouple, dynamometer, shaded pole and rectifier instruments (18-22)	6	½
5.	Shunts, multipliers, Avo, Meager as insulation tester & Earth resistant tester (23-28)	8	1
6.	Energy meters and their errors. (29-31)	4	½
7.	Digital meters, frequency meter, resistance measuring bridges & their applications (32-36)	8	½
8.	Instrument transformers, power factor meters, temp. measurement & LUX meter (37-40)	8	1
9.	FET meter, C.R.O., VTVM & Synchronoscope (41-43)	6	½
10.	Tacho-meter, M.D.I., signal generator & capacitance measurement (44-47)	6	½
Total:		64	6

1. UNDERSTAND THE DIFFERENCE BETWEEN PRIMARY AND SECONDARY INSTRUMENTS WITH FURTHER CATEGORIES OF SECONDARY INSTRUMENTS

- 1.1 Differentiate between the absolute and secondary instruments.
- 1.2 State the difference among indicating, recording and integrating instruments.
- 1.3 State apparent constructional difference.
- 1.4 Explain the applications of each type.

2. UNDERSTAND THE EFFECTS AND MEASURING INSTRUMENTS

- 2.1 Explain the magnetic effects and its sources.
- 2.2 Explain the heating effects and its sources.
- 2.3 Define the chemical effects and its sources.
- 2.4 Explain electrostatic effects and its sources.
- 2.5 Explain electro magnetic effect and its elements. (Amp-Turn)

3. UNDERSTAND VARIOUS FORCES ACTING IN A MEASURING INSTRUMENT

- 3.1 Explain deflecting force and the methods of providing it.
- 3.2 Explain controlling force and the methods of providing it.

- 3.3 Explain damping force and the methods of providing it.
- 4. KNOW THE WORKING OF TANGENT GALVANOMETER**
- 4.1 State the working principle of Tangent Galvanometer.
- 4.2 State the applications of Tangent Galvanometer.
- 5. UNDERSTAND THE DIFFERENCE BETWEEN INDICATING AND RECORDING INSTRUMENTS**
- 5.1 Explain the construction and use of indicating instrument.
- 5.2 Explain the use of recording instruments.
- 5.3 Write its advantages over indicating instruments.
- 5.4 State common applications of recording instruments.
- 6. UNDERSTAND THE METHOD OF PRODUCING DEFLECTING FORCE/TORQUE**
- 6.1 Explain various methods of producing deflecting force.
- 6.2 Explain difference between force and torque.
- 6.3 Explain the factors on which its strength is based.
- 6.4 Derive formula for moving coil instrument.
- 7. UNDERSTAND THE TYPES OF CONTROLLING/RESTORING FORCES**
- 7.1 Explain Gravity force and its applications in instruments.
- 7.2 Understand spring control.
- 7.3 State types of springs
- 7.4 Explain materials of springs used in instruments.
- 7.5 Explain the method of mounting springs.
- 7.6 State its strength & position controlling system.
- 8. UNDERSTAND DIFFERENT DAMPING FORCES AND TECHNIQUES**
- 8.1 Explain Air, Oil & eddy current damping.
- 8.2 Explain the method of their production.
- 8.3 Draw the sketch of the systems.
- 8.4 Explain under, normal & dead beat damping.
- 9. UNDERSTAND PURPOSE AND TECHNIQUES OF BALANCING MOVING PARTS**
- 9.1 Explain the effect of unbalancing & balancing.
- 9.2 Calculate torque weight ratio
- 9.3 Explain types and weights used and their position.
- 9.4 Describe fixing of balance weight.
- 10. UNDERSTAND METER SCALES, THEIR TYPES AND GRADUATION**
- 10.1 State types of scales (simple, mirror multiscales).
- 10.2 Explain the parallax and its effect in reading.
- 10.3 Explain reason for creeping wide range.
- 10.4 State precautions for reading analog scale readings
- 10.5 Explain why some scales are not uniform.
- 11. UNDERSTAND THE POINTER DESIGN AND MATERIALS USED**
- 11.1 Explain types of pointers in use .

- 11.2 Explain the material used, with reasons.
 - 11.3 Explain their fixing techniques
 - 11.4 Explain the care required in using & repairing pointers.
- 12. UNDERSTAND CONTROL SPRING TYPES, MATERIALS AND THEIR FIXING**
- 12.1 Explain hair & helix spring.
 - 12.2 Explain characteristics of material.
 - 12.3 Explain the method of their fixing on post.
- 13. UNDERSTAND BEARING TYPES, MATERIALS NECESSITY AND LUBRICATION**
- 13.1 Explain need & types of bearing in use.
 - 13.2 Explain material used, their merits & demerits.
 - 13.3 Explain the lubrication techniques & lubricants used,
- 14. UNDERSTAND WORKING OF PERMANENT MAGNET MOVING COIL INSTRUMENT**
- 14.1 Explain the working principle.
 - 14.2 Explain the parts and their role in such instruments.
 - 14.3 Draw sketches of each part.
 - 14.4 Explain difference in winding and sensitivity when used as am-meter, volt meter and Ohm-meter.
- 15. UNDERSTAND THE WORKING PRINCIPLE, PARTS AND USES OF MOVING IRON ATTRACTION TYPE INSTRUMENTS**
- 15.1 Explain the working principle.
 - 15.2 Draw sketches to show the assembly.
 - 15.3 Explain the applications of such instruments.
 - 15.4 State names of parts.
- 16. MOVING IRON REPULSION TYPE INSTRUMENTS**
- 16.1 As above for serial-15 objective.
- 17. KNOW BI-METALLIC INSTRUMENTS**
- 17.1 State the working principle of Bi-metallic instruments and state materials used.
 - 17.2 State the applications of such instruments.
- 18. UNDERSTAND THERMOCOUPLE TYPES OF INSTRUMENTS**
- 18.1 Explain the working principle of thermocouples
 - 18.2 Draw sketch of thermocouples
 - 18.3 State various materials used.
 - 18.4 State the applications.
- 19. UNDERSTAND ELECTRODYNAMIC INSTRUMENT**
- 19.1 Explain the working principle
 - 19.2 Name various parts
 - 19.3 State working of each part.
 - 19.4 Draw internal sketch showing parts.
 - 19.5 State the uses of such instruments.
- 20. UNDERSTAND SHADED POLE TYPE INSTRUMENTS**

- 20.1 Explain the working principle
 - 20.2 State application.
 - 20.3 Name parts of the instrument
 - 20.4 Draw sketch.
 - 20.5 State the merits & demerits of such instruments.
- 21. UNDERSTAND VARIOUS KINDS OF DYNAMOMETER TYPE INSTRUMENTS**
- 21.1 Explain the working principle
 - 21.2 Explain connection as am meter, as voltmeter and as wattmeter.
 - 21.3 Draw sketches in each case.
 - 21.4 Enlist merits and demerits
 - 21.4 Explain errors and their remedies.
- 22. DESIGN SHUNTS FOR RANGE EXTENSION**
- 22.1 Explain purpose of shunt.
 - 22.2 Know kind of materials used.
 - 22.3 Calculate value for shunt resistor for given meter's range extension.
 - 22.4 Design physical dimensions & power rating of shunt.
- 23. DESIGN MULTIPLIER FOR RANGE EXTENSION**
- 23.1 Explain the purpose of multiplier.
 - 23.2 Calculate values for multiplier for given meter's range extension.
 - 23.3 Know the kinds of materials used.
 - 23.4 Design physical dimensions & power rating of multipliers.
- 24. UNDERSTAND OHM METERS**
- 24.1 Explain the working principle of Analog Ohm meter.
 - 24.2 Explain scale reading on different range settings.
 - 24.3 State precautions of using ohm meters.
- 25. UNDERSTAND THE WORKING AND USES OF AVO METER**
- 25.1 State kinds of AVO meter (Multimeters).
 - 25.2 Explain Working principle of analog multimeter
 - 25.3 Explain Working Of Digital type mete, using block diagram.
 - 25.4 Draw scales and state reading techniques.
 - 25.5 Explain use on live circuits as am-meter and voltmeter.
- 26. UNDERSTAND THE WORKING & USE OF MEAGER**
- 26.1 Explain working principle of meager.
 - 26.2 Explain operation for continuity, short circuit and open circuit tests.
 - 26.3 Explain scale reading
 - 26.4 Draw sketch, naming each part.
- 27. UNDERSTAND WORKING AND USE OF EARTH RESISTANCE TESTER**
- 27.1 Explain the working principle of earth tester.
 - 27.2 Draw sketch
 - 27.3 State applications

- 28. UNDERSTAND WORKING AND USE OF SINGLE PHASE INDUCTION TYPE ENERGY METER**
- 28.1 Explain the working principle
 - 28.2 Draw sketch showing assembly
 - 28.3 Enlist name of the parts
 - 28.4 Explain working of each part
 - 28.5 Explain scale reading
 - 28.6 Enlist errors and their causes.
 - 28.7 Explain calibration techniques.
- 29. UNDERSTAND WORKING AND USE OF THREE PHASE ENERGY METERS**
- 29.1 Explain construction and working
 - 29.2 Enlist parts for such errors
 - 29.3 Explain calibration techniques
- 30. UNDERSTAND THE VARIOUS SOURCES OF ERROR IN METERS AND THEIR REMEDIES**
- 30.1 Explain reason and sources of errors in voltmeter and am- meter
 - 30.2 Enlist remedial measures.
 - 30.3 Explain calibration method with standard instrument
- 31. UNDERSTAND PRINCIPLE, TYPES AND USES OF DIGITAL METERS**
- 31.1 Explain working principle (Block diagram)
 - 31.2 Explain types in lab use (Voltmeter, Ammeter, Ohmmeter, AVO meter, watt meter (single phase & three phase), Energy meter (single phase & three phase) and frequency meter)
 - 31.3 Enlist possible causes of errors.
- 32. UNDERSTAND WORKING PRINCIPLE AND TYPES OF FREQUENCY METER**
- 32.1 Explain principle of resonance type meter.
 - 32.2 Explain principle of reed type meter.
 - 32.3 Explain principle of weston type.
 - 32.4 Explain principle of digital type (Block diagram only)
- 33. UNDERSTAND PRINCIPLE OF RESISTANCE MEASURING BRIDGES AND THEIR APPLICATION**
- 33.1 Explain working principle of wheat stone bridge.
 - 33.2 Calculate unknown resistance using wheat stone bridge.
 - 33.3 Explain its construction and use
 - 33.4 Explain working principle of Kelvin's double bridge.
 - 33.5 Explain construction and use.
 - 33.6 Calculate resistance value using Kelvin's Bridge.
- 34. UNDERSTAND MURRAY LOOP TEST AND ITS APPLICATION**
- 34.1 Explain working principle
 - 34.2 Explain its use for under ground cables.
 - 34.3 Calculate fault distance using loop test.
- 35. UNDERSTAND BLAVIOR AND EARTH OVER LAP TEST**
- 35.1 Explain working principle of each

- 35.2 Explain applications.
- 36. UNDERSTAND WORKING PRINCIPLE OF INSTRUMENT TRANSFORMERS**
- 36.1 Explain working principle of P.T with vector diagram
- 36.2 Explain application of P.T's.
- 36.3 Explain construction and working principle of C.T with vector diagram
- 36.4 Explain application of C.T's.
- 36.5 Explain angle of phase difference, standard ratio, ratings and permissible errors.
- 36.6 Enlist possible errors and their remedies.
- 36.7 Explain personal and instrument safety
- 37. UNDERSTAND EFFECTS ON INSTRUMENT TRANSFORMERS**
- 37.1 Explain effect of burden
- 37.2 Calculate burden on C.T. and P.T.
- 37.3 Explain effect of frequency and variable current on C.T. and P.T.
- 37.4 Draw circuit diagrams of a loaded C.T. and P.T.
- 38. UNDERSTAND POWER FACTOR METERS**
- 38.1 State types with respect of supply (Single and three phase)
- 38.2 State types with respect to construction (Dynamometer,, moving iron).
- 38.3 Explain working principle of each type.
- 38.4 Draw circuit diagram.
- 39. UNDERSTAND TYPES OF TEMPERATURE MEASURING DEVICES**
- 39.1 Explain working of resistance type device
- 39.2 Explain working of thermocouple
- 39.3 Explain radiation type pyrometer
- 39.4 Explain principle of each
- 39.5 Explain the application of each.
- 40. KNOW ASSEMBLY AND WORKING OF LUX METER**
- 40.1 State the types and working principle.
- 40.2 Enlist applications.
- 41. KNOW THE WORKING PRINCIPLE OF FET AND TRANSISTOR VOLTMETER**
- 41.1 State the working principle of F.E.T type voltmeter and its use.
- 41.2 State the working principle of transistor type voltmeter (Block diagram only)
- 42. UNDERSTAND WORKING PRINCIPLE OF OSCILLOSCOPE**
- 42.1 Explain working of Oscilloscope tube
- 42.2 Enlist parts of Oscilloscope
- 42.3 Explain applications for finding wave shape and frequency.
- 43. UNDERSTAND WORKING PRINCIPLE CONSTRUCTION AND APPLICATION OF SYNCHRONOSCOPE**
- 43.1 State types of synchrono scope
- 43.2 State working principle of each
- 43.3 Explain application of each type.

- 44. KNOW WORKING PRINCIPLE OF SPEED/R.P.M MEASURING INSTRUMENTS**
- 44.1 State working principle of speed counter (Mechanical)
 - 44.2 State working principle of dynamometer type speedometer
 - 44.3 State working principle of electronic counter.
 - 44.4 State method of use of each
- 45. UNDERSTAND MAXIMUM DEMAND INDICATOR AND IT USE**
- 45.1 Explain construction and principle of working.
 - 45.2 Draw connection diagram.
 - 45.3 Explain the methods of taking and interpreting its readings.
- 46. KNOW WORKING OF SIGNAL GENERATOR**
- 46.1 State construction and use.
 - 46.2 State types (AF & RF)
- 47. UNDERSTAND USE OF SIGNAL GENERATOR FOR MEASURING C. & L.**
- 47.1 Explain use of signal generator for inductance 'L' measurement
 - 47.2 Explain use of signal generator for capacitance measurement

ET-223 ELECTRICAL INSTRUMENTS & MEASUREMENTS

LIST OF PRACTICALS

Note: The students should show concern for personal and equipment safety while working in Lab. Also show safe handling of instruments.

1. a. Demonstration of Absolute & Secondary instruments.
b. Study of constructional features of tangent galvanometer and its use for finding current.
2. Demonstration of various effects used as forces in instrument (magnetic heating, electrostatic etc.)
3. Comparative study of indicating, integrating & recording instruments.
4. Study of methods of Damping forces (Air friction, fluid friction, eddy current) in instruments.
5. a. Making sketches of different types of pointers fitted on shafts with weight.
b. Study of hair spring their mounting on shaft tension/position adjustment.
6. Dismantling and assembling of moving iron attraction type instrument and making sketch.
7. Dismantling and assembling of permanent magnet instrument and making sketch.
8. Dismantling and assembling of moving iron repulsion type instrument and making sketch.
10. a. Study of Thermocouple, their variety and shapes used in measuring instruments.
b. Study of thermistor used for control of current.
11. Demonstration of various pyrometers and their use in measuring instruments.
12. Study of dynamometer parts and making their sketch.
13. Demonstration of shaded pole type instruments and sketch the parts and assembly.
14. a) Study of shunts and making a shunt for extending range of D.C. Am meter.
b) Study and make multiplier for extending the range of a galvanometer.
15. a) Study the parts of induction type wattmeter with their sketches.
b) Using an induction type wattmeter for measuring power of a lamp.
16. a) Study of ohm-meter, its scale and practice of using it.
17. a) Study of Avometer (analog type), its scale reading practice and use as Voltmeter and Ammeter.
b) Practice the use of A.V.O meter analog & digital for low and high resistance measurements.
18. Study of meager and practice of its use for continuity, short circuit and insulation testing.
19. Using an earth resistance tester for finding earth resistance.
20. Study of single phase energy meter and its connections, meter reading.
21. Study of three phase energy meter and its connections, meter reading.
22. Study the types of frequency meter & to use it on lines.
23. Using wheat stone bridge for resistance measurement.
24. Study of C.T. & P.T. their use with instruments & relays (A power station may also be visited).
25. Study of P.F. meter and finding power factor of all kind of loads (Resistive, Inductive Capacitive, and Mixed).
26. Connecting power factor meter for measuring P.F.of an un balanced load 3-phase.
27. Study and use of LUX METER.
28. Study of Flux meter and measuring field strength.
29. Practice the use of C.R.O for displaying & measuring of Electrical quantities.
30. Study of synchronoscope and practice of using for operation of alternators in parallel.
31. Study of M.D.I meter and its use on line.
32. Measurement of capacitance & inductance.

Note: * Industrial visits for this course are recommended.

** Students must prepare theory and practical note books and get it checked weekly by the concerned teacher. They should produce these to external examiner for sessional work/marking check up at the time of final exam.

RECOMMENDED BOOKS

1. Testing Instruments by Audel's.
2. Electrical Instruments & Measurement by E.W. Golding.
3. Electronic Measuring Instruments by G.D. Link.
4. Elect. Technology by B.L. Theraja.
5. Industrial Electrical Measurement & Instruments by Kenelm Edgeumbe.
6. Fundamentals of Electrical Measurements by C.T. Baldwin.
7. A Text Book of Electrical Engineering by S.L. Uppal.
8. Electronics for Today & Tomorrow. by Tom Duncan.
9. Electrical and Electronics Instruments and Measurements by Syed Muhammad Azeem Urdu Bazar Lahore.
10. An introduction to Electrical Instrumentation by B.A. GREGORY

Total Contact Hours:

Theory:	64	T	P	C	
Practical:	96		2	3	3

AIM Electrical Energy is used in Industry for various job and operations including Illumination, Electroplating, Heating and Ventilation and Locomotives etc. This course will give an understanding of the principles and practices related to efficient and safe industrial use of electrical energy in some of the selected fields.

COURSE CONTENTS

- | | | |
|----------|--|----------------|
| 1 | ILLUMINATION. | 18 Hrs. |
| | 1.1 Modern theory of light and radiation from hot body. | |
| | 1.2 Terms; black-body: like hot body, solid angle, | |
| | 1.3 Law's of illumination: inverse square law, Lambert's cosine law. | |
| | 1.4 Depreciation factor, utilization factor, waste light factor. | |
| | 1.5 Lighting scheme and its design. | |
| | 1.6 Lamps, shades and reflectors. | |
| | 1.7 Flood lighting and its purpose and arrangements. | |
| | 1.8 Sources of light (Natural and artificial). | |
| | 1.9 Incandescent lamps, gas filled, clear and frosted glass lamps. | |
| | 1.10 Discharge lamps, sodium vapour, high pressure mercury vapour. | |
| | 1.11 Fluorescent lamps, stroboscopic effect. | |
| 2 | ELECTRO PLATING. | 10 Hrs. |
| | 2.1 Fundamental principles of chemistry and metallurgy relating to electroplating. | |
| | 2.2 Introduction to electro plating. | |
| | 2.3 Properties of metals, acids, alkalies and neutralization. | |
| | 2.4 Faraday's law of Electrolysis. | |
| | 2.5 Electrolytic cell, Electrodes, electrolytes and polarization. | |
| | 2.6 Acid used in electroplating H ₂ SO ₄ , HNO ₃ , HCL, aqua-regia (Nitro-Hydrochloric acid). | |
| | 2.7 Salts used in electroplating. | |
| | 2.8 Alkalies used in electroplating. | |
| | 2.9 Electroplating plants, electroplating tank, Electrical supply system. | |
| | 2.10 Rheostatic current control in electroplating. | |
| | 2.11 Electroplating process. | |
| | 2.12 Cleaning of objects mechanically and chemically. | |
| | 2.13 Copper and silver plating. | |
| | 2.14 Current densities for various thicknesses and materials of jobs. | |
| | 2.15 Planning of electroplating shop. | |
| 3 | REFRIGERATION. | 10 Hrs. |
| | 3.1 Introduction to refrigeration and air conditioning. | |
| | 3.2 Types of refrigeration and refrigerants. | |
| | 3.3 Refrigeration process / cycle. | |
| | 3.4 Refrigeration components (Evaporator, compressor, condenser etc.) | |
| | 3.5 Electrical accessories and circuits of a refrigerator. | |

- 3.6 Introduction to air conditioning.
 - 3.7 Types of domestic air conditioners and their capacities: window, split.
 - 3.8 Electrical accessories and circuit for air conditioner.
 - 3.9 Introduction to commercial air-conditioning (chiller plants and central air-conditioning system)
- 4 ELECTRIC TRACTION. 18 Hrs.**
- 4.1 Introduction to Electric Traction, its advantages and disadvantages.
 - 4.2 Systems of electric traction
 - 4.3 Electrification systems of Electric Traction.
 - 4.4 Motors used for electric traction.
 - 4.5 D.C. series motors, its characteristics.
 - 4.6 Single phase A.C. motors
 - 4.7 3-phase induction motors.
 - 4.8 Starting and speed control of traction motor, series parallel control.
 - 4.9 Drum type controllers.
 - 4.10 Field weakening and tapped field control.
 - 4.11 Electric braking, plugging rheostatic, regenerative.
 - 4.12 Trolley bus control equipment, master controllers.
 - 4.13 Overhead feeding and distributing equipment, trolley wires, trolley wheels, frogs, pantograph.
 - 4.14 Current collectors – trolley collector, BOW collector, pantograph collector.
 - 4.15 Introduction to booster, negative booster.
- 5 ELECTRIC HEATING. 8 Hrs.**
- 5.1 Introduction to Electric Heating, advantages and its application.
 - 5.2 Types of electric heating, power frequency heating, high frequency heating.
 - 5.3 Resistance heating and its types, Resistance furnaces.
 - 5.4 Arc heating and its types, Arc furnaces.
 - 5.5 Induction heating and its types, induction furnaces.
 - 5.6 Die electric heating.
 - 5.7 Infra-red heating.
 - 5.8 Eddy current heating.
 - 5.9 Review of electric welding, spot welding.

ET 233(Rev.) UTILIZATION OF ELECTRICAL ENERGY**INSTRUCTIONAL OBJECTIVES****TIME SCHEDULE**

S.NO.	MAJOR TOPICS	NO. OF PERIODS	NO. OF QUESTIONS
1.	Illumination	18	3
2.	Electroplating	10	1
3.	Refrigeration	10	1
4.	Electric traction	18	2
5.	Electric Heating	8	1
Total:		64	8

1. APPLIES CONCEPTS OF ILLUMINATION TO SIMPLE LIGHTING DESIGNS

- 1.1 Explain modern theory of light.
- 1.2 Define term, hot body, solid angle.
- 1.3 Define luminous flux, luminous intensity.
- 1.3 Define MSCP, MHSCP, lumen hour and candela
- 1.4 State law's of illumination, inverse square law, Lambert's cosine law.
- 1.5 Explain, Depreciation factor, utilization factor, height factor.
- 1.6 Identify qualities of good lighting scheme.
- 1.7 Design a given lighting scheme.
- 1.8 Give types of lamps & shades.
- 1.9 Explain polar curves for different type of reflectors.
- 1.10 Explain flood lighting.
- 1.11 Explain purposes of flood lighting.
- 1.12 Sketch diagram of lamps, incandescent, sodium vapour and mercury vapour, fluorescent lamp.
- 1.13 Describe working of lamps, incandescent, sodium vapour, mercury vapour & fluorescent
- 1.14 State stroboscopic effect.

2. UNDERSTAND ELECTROPLATING PROCESS AND PLANTS

- 2.1 State fundamental principles of chemistry and metallurgy relating to electroplating.
- 2.2 List properties of metals, acids, alkalies used in electroplating.
- 2.3 State Faraday's law of Electrolysis
- 2.4 Define neutralization
- 2.5 List types of electrolytes, electrodes.
- 2.6 Describe chemical equations used in electroplating process.
- 2.7 Define standard solution.
- 2.8 Enumerate acids used in electroplating, H₂SO₄, HNO₃, HCl
- 2.9 Enlist salts used in electroplating.
- 2.10 Name alkalies, caustic potash, caustic soda, mixed alkalies, alkali cyanide.
- 2.11 Sketch parts of electroplating plant.
- 2.12 State rheostatic current control in electroplating.
- 2.13 Explain electroplating process.
- 2.14 Give process of cleaning objects, mechanically, chemically.
- 2.15 Describe copper & silver plating.
- 2.16 Give solution addition agents.
- 2.17 Give current densities for various thicknesses and materials of jobs.
- 2.18 Plan electroplating shop.

3. UNDERSTAND COMPONENTS AND WORKING OF SIMPLE REFRIGERATION AND AIRCONDITIONING SYSTEMS

- 3.1 Define terms used in refrigeration and airconditioning systems.

- 3.2 Describe mechanical cycle of refrigeration.
- 3.3 Name different refrigerants and its applications.
- 3.4 Enlist electrical accessories used in refrigeration system.
- 3.5 Draw electrical circuit diagram of a refrigerator.
- 3.6 Explain different components of a domestic refrigerator.
- 3.7 Explain types of air-conditioners.
- 3.8 Draw electrical circuit diagram of an air-conditioner.

4. UNDERSTAND ELECTRIC TRACTION SYSTEMS AND THEIR CONTROL

- 4.1 Define electric traction.
- 4.2 List merits & demerits of electric traction.
- 4.3 Explain systems of electric traction.
- 4.4 Describe electrification systems of electric traction.
- 4.5 Name motors used for electric traction.
- 4.6 Enlist the characteristics of D.C. series motor due to which it is preferred for traction purposes.
- 4.7 Describe starting and speed control of traction motors (series, parallel control).
- 4.8 Describe bridge transition method of speed control.
- 4.9 Explain drum type controller.
- 4.10 Explain method of speed control by tapped field (field weakening).
- 4.11 Enlist A.C. motors used in traction.
- 4.12 Define methods of braking: plugging rheostatic, regenerative braking.
- 4.13 Describe trolley bus control equipment, master controller.
- 4.14 Explain over-head feeding and distributing equipment (trolley wire, trolley wheel, frogs, pantograph collector, Bow collector).
- 4.15 Define booster (negative booster)

5. UNDERSTAND ELECTRIC HEATING FURNACES

- 5.1 Describe Electric Heating.
- 5.2 List merits and demerits of Electric Heating.
- 5.3 Describe electric furnace (Resistance wire heating).
- 5.4 Define infrared (radiation) heater.
- 5.5 Describe induction furnace.
- 5.6 Describe high frequency eddy current heating and electrostatic heating.
- 5.7 Explain working of an arc furnace.
- 5.8 Describe spot welding.

LIST OF PRACTICALS

1. Verification of inverse square law.
2. Verification of Lambert's cosine law.
3. Study of various reflectors.
4. Design lighting scheme for a hall.
5. Sketch the various parts of incandescent and gas filled lamps.
6. Visit and preparing a report of electroplating plant.
7. Design a flood lighting scheme for a cricket ground.
8. Study of various materials used in electroplating and preparation of job for electroplating.
9. Study of equipment used in electroplating shop planning of electroplating shop, according to sequence of process.
10. Electroplating of a prepared job.
11. Study of an air conditioner, its components and drawing electric circuit.
12. Study of refrigerator and tracing its electric circuit.
13. Visit to an electric traction workshop, study of electric traction engine & diesel electric engine.
14. Visit to an ice factory.
15. Designing and making a 1000 W electric heating element.
16. Study of an electric resistance heating furnace.
17. Study of an electric arc furnace.
18. Study of spot welding unit.
19. Visit to hospital physiotherapy ward and operation theater.
20. Visit to a cycle factory (electroplating plant).
21. Visit to a central air-conditioning plant.
22. Visit to a stadium (flood light).
23. Visit to a cold storage.

** Students must prepare theory and practical note books and got it checked weekly by the concerned teacher. They should produce these to the external examiner for sessional work/marking check up at the time of final exam.

RECOMMENDED BOOKS

1. Utilization of electrical energy by Engr. Badshah Munir.
2. Electrical Power by Soni Gupta.
3. A Course in Electrical Engineering by Soni Gupta.
4. Illumination Engineering, by Boast.
5. Refrigeration & Air Conditioning Principles.
6. Generation, Transmission and Utilization of Electrical Power by A.T. Star.
7. Electrical Power by S.L. Uppal.

ET-242 INSTALLATION PLANNING AND ESTIMATING

Total contact hours:

				T	P	C
Theory:	32					
Practical	96	1	3	2		

AIM The course provides necessary insight and skill in the designing and planning an electrical installation keeping in view the necessary rules and regulations. It also gives practice for preparing estimates of the installation project following standard practice.

COURSE CONTENTS

- 1. INSTALLATION:** 8 Hrs.
 - 1.1 Earthing system and testing of installation.
 - 1.2 Service lines, methods of installations of service lines for single storey, multi storey buildings.
 - 1.3 Sub stations, types of substations according to service, indoor, outdoor, their advantages and disadvantages.
 - 1.4 Equipment used in substation, their classifications and ratings.
 - 1.5 Signal communication circuits, system used in industrial and commercial buildings, fire alarm, sprinkler, smoke alarm, burglar alarm, intercom, float switches and their applications.

- 2. PLANNING.** 12 Hrs.
 - 2.1 Planning and design of electrical installation, steps of planning, estimating residential building, determining number of light point and number of out lets.
 - 2.2 Determining number of circuits for residential installation, factors for selecting conductor size, main and sub main cables.
 - 2.3 Earthing system for industrial installation.
 - 2.4 Review of rules and regulation pertaining to earthing.

- 3. ESTIMATING.** 12 Hrs.
 - 3.1 Importance of estimating, tools, stationery, forms used for estimating.
 - 3.2 Cost estimate: labor cost, material cost, transport cost, factors affecting cost.
 - 3.3 Tables used in planning and estimating.
 - 3.4 Estimation of quantity of material required for industrial-residential wiring.
 - 3.5 Steps and factors to be considered in preparation of cost estimate.

ET-242 INSTALLATION, PLANNING AND ESTIMATING

TIME SCHEDULE

S.No.	Major Topics	No. of Periods	No. of Questions in Q.Paper
1.	Installations. Earthing, service lines, sub-stations installations.	8	1
2.	Planning. No. of light and power points in buildings. Wiring drawings and planning.	12	2
3.	Estimating. Material estimation. Cost estimation. Labour cost estimation.	12	2
	Total:	32	5

INSTRUCTIONAL OBJECTIVES

1. UNDERSTAND THE ELECTRICAL INSTALLATIONS.

- 1.1 Name types wiring systems.
- 1.2 Describe types of earthing systems.
- 1.3 List methods of testing electrical installations.
- 1.4 List types of service lines in single storey/multi storey buildings.
- 1.5 Enlist types of substations, (indoor, out door service).
- 1.6 Give merits and demerits of substations, (indoor, out door).
- 1.7 List the equipment used in substations
- 1.8 Classify the equipment used in substations.
- 1.9 List the ratings of equipment used in substations.
- 1.10 Draw circuit diagram for signal communication system in commercial and industrial buildings, used for fire alarm, sprinkler.
- 1.11 Describe the working of fire alarm, burglar alarm circuits by drawing circuit diagrams.
- 1.12 Explain inter-com system, with and without secrecy.
- 1.13 Explain float switches and give its applications.

2. UNDERSTAND THE PLAN OF ELECTRICAL INSTALLATIONS.

- 2.1 Explain planning & Design of electrical installations.
- 2.2 List the steps necessary for planning residential building.
- 2.3 Determine number of light points and out-lets required for a given residential building.
- 2.4 Determine number of circuits required for a given residential building, with respect to main circuit and sub main circuit.
- 2.5 Select size of cables and circuit breakers for given circuits.
- 2.6 State rules and regulation relating to earthing.
- 2.7 Explain earthing for industrial installations.
- 2.8 For given industrial load, plan an electrical installation showing cable sizes, ratings of CB, earthing system.

3. PREPARE ESTIMATES OF ELECTRICAL INSTALLATIONS.

- 3.1 Explain importance of estimating.

- 3.2 List tools required for estimating.
- 3.3 Depict stationary forms required for estimating.
- 3.4 List factors affecting cost. (material cost, labour cost, transport cost).
- 3.5 Explain importance of tables,useful for planning and estimating.
- 3.6 Estimate quantity of material required for a given residential plan for batten wiring.
- 3.7 Estimate quantity of material required for a given residential plan for concealed wiring.
- 3.8 Give steps necessary for preparing a cost estimate.
- 3.9 Prepare a cost estimate for a given residential electrical installation according to the given rate list.
- 3.10 Use standard format for preparing/presenting report of the estimates of the given installation.

ET-242 INSTALLATION, ESTIMATING AND PLANNING

LIST OF PRACTICALS

1. Drawing of a building plan for 3-bed room house.
2. Drawing of a plan of 4 bed room house.
3. Drawing of service connection diagram.
4. Drawing of alarm system.
5. Drawing of line diagrams of various types of substations, using standard symbols (two sessions).
6. Planning of electrical installation 3 bed room house for batten wiring (use plan drawn for sr. No.1 above.)
7. Planning of electrical installation for concealed conduit wiring (use plan of Sr.No.2 above.
8. Planning of Multiple earthing system for an industrial installation.
9. Load survey for one workshop in institute.
10. Work shop drawing (as surveyed at Sr.No.9 above) showing the details of electrical installations.
11. Project for planning of service and distribution of multi-storey building.
12. Planning of equipment arrangement of a panel board for the multi-storey building at Sr.No.12.
13. Drawing of connection for a panel board for each floor of building at Sr.No.12.
14. Preparation of estimation list for equipment & materials, for building as at Sr.No.12.
15. Estimation of material and quantity of material required for residential building.(planned at Sr.No.1 & 7 above) for light, and power circuits.
16. Prepare take-off sheet for the installation at Sr.No.12; pricing; time scheduling (the project from Sr.No.12 to 16 may be prepared as per commercial standards).
17. Preparation of cost estimate for concealed wiring for a given plan at Sr. 2 & 8 above)
18. Visit to see use of cathodic protection station & its earthing system (gas pumping station) at any one local station (sui gas plant).
19. Study of cathodic protection system (Bridge, port, pipeline cathodic protection).

** Students must prepare theory and practical note books and got it checked weekly by the concerned teacher. They should produce these to external examiner for sessional work/marking check up at the time of final exam.

REFERENCE BOOKS.

1. Electrical Estimating by Ashlay.
2. Electrical Installation, Planning and Estimating by Gupta.
3. Wiring Manual by Pakistan Cables Ltd.
4. Cables and Tables by Pakistan Cables Ltd.
5. Interior Electrical Wiring & Estimating (Residential) by Uhl-Dunlah.
6. Interior Electric Wiring & Estimating (Industrial) by Graham.

ET-251 APPLICATION OF COMPUTER IN ELECTRICAL TECHNOLOGY

Total Contact Hours	T	P	C	
Practical 96		0	3	1

AIM The course aims at providing practice in the development and use of simple computer programmes in high level languages such as C++. It provides an opportunity for the use of dedicated software packages for solving electrical networks.

LIST OF PRACTICALS

- 1 To use C++ as a tool for problem solving in Electrical Technology such as: -
 - 1.1 Application for the addition, subtraction, multiplication, division, and calculation of powers, roots and exponentials etc.
 - 1.2 Application for trigonometric and inverse trigonometric functions.
 - 1.3 Calculation of impedances in polar form.
 - 1.4 Calculation of impedances in rectangular form.
 - 1.5 Combination of impedances in series involving conversion from polar to rectangular and vice versa.
 - 1.6 Repeated use of rectangular to polar conversion as a part of subroutine of a file.
 - 1.7 Solution of R.L.C. series and parallel circuits.
 - 1.8 Calculation of A.C. powers, active and reactive components.
 - 1.9 Calculation for improvement of power factor.
- 2 Use of following computer software for developing/analyzing electrical networks:-
 - 2.1 ORCAD
 - 2.2 MULTISIM
 - 2.3 PSPICE
- 3 Introduction to machine language.
- 4 Introduction to PLC (Hardware and software).

TEXT/REFERENCE BOOKS

1. Introductory Circuit Analysis by Boylestad. (10th Edition)
2. C++ How to Program by Deitel and Deitel
3. Manuals for
 - 1.1 ORCAD
 - 3.2 MULTISIM
 - 1.3 PSPICE
4. Introduction to PLC Controllers by Nebojsa Matic

ET 263(Rev.) BASIC ELECTRONICS

Total Contact Hours:					
Theory:	64	2	3	3	
Practical:	96				

AIMS This course is designed to enable the students to understand the basic principles of semiconductor electronics devices. It also provides basic insight in the working and applications of power electronic devices in control circuits.

The course also includes simple problem solving.

- | | | |
|----------|---|---------------|
| 1 | ELECTRON EMISSION AND BASIC SEMI CONDUCTOR THEORY. | 4 Hrs. |
| | 1.1 Electron emission and fundamentals of solid state electronics. <ul style="list-style-type: none"> 1.1.1 Introduction to electronics. 1.1.2 Introduction to various types of electron emission and their characteristics. 1.1.3 History of electron tubes their construction and uses. 1.1.4 Semiconductors, intrinsic, extrinsic, doping. 1.1.5 P type and N type materials, carriers. | |
| 2 | SEMICONDUCTOR DIODES. | 8 Hrs. |
| | 2.1 PN Junction Diode. <ul style="list-style-type: none"> 2.1.1 Diode construction, operation and applications. 2.1.2 Half-wave & full wave rectifiers. | |
| | 2.2 D.C Power supply. <ul style="list-style-type: none"> 2.2.1 Ripple factor and filtering. 2.2.2 Circuit and block diagram of full-wave bridge rectifier with filter. 2.2.3 Circuit and block diagram of centre tapped transformer rectifier circuit. 2.2.4 Diode as a switch. | |

- 3 SPECIAL DIODES. 8 Hrs.**
- 3.1 Zener Diode.
- 3.1.1 Construction, operation and rating of zener diode.
- 3.1.2 Zener diode as a voltage regulators, series & shunt.
- 3.2 Photodiode and photo conductive cells.
- 3.2.1 Construction and working of photodiode
- 3.2.2 Photodiode as light sensor.
- 3.2.3 Use of photo conductive cell.
- 3.3 Varactor diodes
- 4 BIPOLAR JUNCTION TRANSISTOR(BJT) & FIELD EFFECT TRANSISTOR (FET) 12 Hrs.**
- 4.1 BJT Construction And Operation.
- 4.1.1 BJT, construction and types.
- 4.1.2 BJT, operation and characteristics transistor biasing.
- 4.1.3 BJT Biasing
- 4.2 BJT Application
- 4.2.1 BJT as amplifier.
- a) Types of BJT amplifier and their Characteristics (CB, CE, CC).
- b) CE as current and voltage amplifier.
- c) Applications of BJT amplifiers.
- 4.2.2 BJT as a switch
- a) Characteristics of a BJT switch.
- b) Use of BJT as switch.
- 5 SPECIAL TRANSISTORS. 8 Hrs.**
- 5.1 Field Effect Transistor (FET)
- 5.1.1 FET transistor types (JFET, MOSFET).
- 5.1.2 Application of various types of FETs,
- 5.1.3 FET amplifiers.
- 5.1.4 Characteristics of FET amplifier (Common source, common drain, common gate amplifiers).
- 5.1.5 FET as a voltage amplifier.
- 5.2 MOSFET & CMOS.
- 5.2.1 MOSFET as a switch and its characteristics.
- 5.2.2 CMOS as switch.
- 6 SILICON CONTROLLED RECTIFIERS. 6 Hrs.**
- 6.1 Silicon Controlled Rectifiers.
- 6.1.1 Silicon controlled Rectifier (SCR)
- a. SCR, construction, operation and triggering pulses.
- b. SCR application, power control of AC and DC.
- c. Phase control of SCR's.

- 7 THYRISTORS. 10 Hrs.**
- 7.1 Other Thyristors.
 - 7.1.1 Construction and operation of TRIAC & DIAC.
 - 7.1.2 DIAC/TRIAC power control circuits.
 - 7.1.3 UJT, operation, working and applications.
 - 7.1.4 Photo transistor, operation, rating and application.
 - 7.1.5 Light activated SCR (LASCR), rating and application.
 - 7.1.6 Opto-coupler, ratings & application.
- 8 INTEGRATED CIRCUITS. 8 Hrs.**
- 8.1 Integrated Circuits (IC's) and Op-amps.
 - 8.1.1 Types of IC's
 - 8.1.2 Monolithic IC's, fabrication of components
 - 8.1.3 Types of integration.
 - 8.1.4 Operational amplifiers (op-amps), characteristics and applications.
 - 8.1.5 Basic op-amp circuits.

TIME SCHEDULE

S.No.	Major Topics	No. of Periods	No. of Questions
1.	Electron Emission	4	½
2.	Semiconductor diodes and power supply	8	1
3.	Special diodes	8	1
4.	Bi-polar Junction Transistor (BJT)	12	1
5.	Field Effect Transistor (FET)/Mosfet	8	1
6.	SCR/Thyristors	6	1
7.	i. Diac & Triac	4	½
	ii. Special solid state devices	6	½
8.	Integrated circuits & op-amps.	8	½
Total:		64	7

INSTRUCTIONAL OBJECTIVES.

1 UNDERSTAND TYPES OF ELECTRON EMISSIONS AND BASIC SEMI-CONDUCTOR THEORY

- 1.1 Explain types of electron emission
- 1.2 Explain the terms-semi-conductor, intrinsic and extrinsic
- 1.3 Explain P and N type doping
- 1.4 State majority and minority charge carriers in P & N type semi-conductors
- 1.5 Name types of electron tubes and their uses.

2 UNDERSTAND THE CONSTRUCTION AND APPLICATIONS OF PN DIODES AS RECTIFIER

- 2.1 Explain formation of PN-junction.
- 2.2 Define potential barrier of PN junction.
- 2.3 Compare forward bias and reverse bias.
- 2.4 Discuss static volt ampere characteristics of diode (forward and reverse bias).
- 2.5 State applications of diode.
- 2.6 Draw and discuss half wave rectification circuit (with wave forms).
- 2.7 Draw and discuss full wave rectification circuit (with waveforms) by using:
 - a. Centre tapped transformer.
 - b. Bridge rectifier.
- 2.8 Explain the need of filters in DC power supply
- 2.9 Draw circuit diagram of filtering network (T & Pi).
- 2.10 Define term ripple factor.
- 2.11 Describe use of diode as a switch.

3 UNDERSTAND WORKING AND USES OF ZENER AND PHOTO DIODES

- 3.1 Explain the working and construction of zener diode
- 3.2 Explain the behaviour of Zener diode in Breakdown region
- 3.3 give ratings of zener diode.
- 3.4 Explain the Zener diode in power supplies and voltage regulation circuits.
- 3.5 Describe construction & working of photodiode.
- 3.6 Draw photodiode control circuit.

4 UNDERSTANDING CONSTRUCTION, WORKING AND USES OF BIPOLAR JUNCTION TRANSISTOR

- 4.1 Explain construction of transistors.
- 4.2 Constructional details of PNP and NPN transistor.
- 4.3 Draw PNP and NPN transistor circuits with proper biasing.
- 4.4 Describe principle of working of transistor as amplifier.
- 4.5 Describe current gain, voltage gain & power gain of a CE amplifier.
- 4.6 List uses of transistors.
 - a. As a switch.
 - b. As voltage & current amplifier.

5 UNDERSTAND THE WORKING AND USES OF FIELD EFFECT TRANSISTORS

- 5.1 Explain the construction & working of JFET.
- 5.2 List types of FET and their uses.
- 5.3 Describe use of JFET as an amplifier.
- 5.4 Draw characteristics curves of JFET.
- 5.5 Explain construction of MOSFET
- 5.6 State types of MOSFET(depletion mode and enhancement mode)
- 5.7 Draw symbols of IGFET and MOSFETS
- 5.8 State special handling procedures of MOSFETS

6 UNDERSTAND THE TYPES, WORKING AND USES OF THYRISTORS SPECIALLY SILICON CONTROLLED RECTIFIER, DIAC, TRIAC

- 6.1 Define a thyristor.
- 6.2 Explain construction and working operation of SCR's.
- 6.3 Draw equivalent model of SCR by two transistors analogy.
- 6.4 Draw characteristics waveforms of SCR's.
- 6.5 Explain phase control of SCR.
- 6.6 Explain use of SCR's as AC & DC Power control circuits with the help of circuit diagrams.
- 6.7 Explain the operation of Diac.
- 6.8 Draw characteristics & waveforms of Diac.
- 6.9 Explain the construction and working of TRIAC
- 6.10 Enlist applications of Diac & Triac.

7 UNDERSTAND WORKING AND USES OF SPECIAL SOLID STATE DEVICES SUCH AS UNI-JUNCTION TRANSISTOR (UJT), PHOTO TRANSISTOR, LIGHT ACTIVATED SILICON CONTROLLED RECTIFIER (LASCR), OPTO COUPLER

- 7.1 Explain the construction and working of UJT
- 7.2 Define Intrinsic stand off Ratio of UJT
- 7.3 State the equation for Peak Firing Voltage
- 7.4 Draw characteristic curve of UJT
- 7.5 Enlist common applications of UJT
- 7.6 Explain Saw-tooth oscillator using UJT , with the help of circuit diagram
- 7.7 Explain the working of photo transistor
- 7.8 State common uses of photo transistor with circuits
- 7.9 Explain the working of LASCR with the help of circuit

- 7.10 Explain the working of opto-coupler
- 7.11 State the need of opto-coupling in electronic circuits

8 UNDERSTAND BASIC WORKING AND APPLICATIONS OF IC'S AND OP-AMPS

- 8.1 Explain the term IC.
- 8.2 Define SSI, MSI, LSI, VLSI
- 8.3 Sketch a monolithic IC cross section.
- 8.4 Explain the term op-amp.
- 8.5 State the main characteristics of op-amp
- 8.6 Draw a symbol of op-amp and label it
- 8.7 Explain the working of a common op-amp with the help of block diagram (IC 741)

LIST OF PRACTICALS

1. To study vacuum tubes.
2. To construct a half wave rectifier circuit and to check its output on oscilloscope.
3. To construct a full wave rectifier circuit and measure the input & outputs wave forms.
4. Demonstrate the effects of filter capacitance on DC output voltage and ripple.
5. Measure and plot the forward and reverse characteristics of a typical Zener-diode using an Electronic VOM.
6. Measure and plot the line voltage regulation properties of a typical shunt-type Zener diode voltage regulator.
7. Assemble an alarm circuit using a photo conductive cell (Project).
8. Assemble a Regulated Power Supply Circuit (Project)
9. Identify base - emitter and collector terminals and connections of NPN and PNP transistors.
10. Demonstrate and measure the effects on base current of forward and Reverse bias in the emitter - base circuit.
11. Demonstrate and measure the effects on collector current of forward and reverse bias in the emitter - base circuit and change in collector voltage.
12. Assemble a simple transistor radio circuit (Project)
13. Determine the type of transistor, NPN or PNP, using an ohmmeter to measure the forward and reverse resistance of the emitter - base Junction.
14. Assemble a Bird Bell (Project)
15. Assemble water level alarm using transistors (Project)
16. Demonstrate and measure the effect of drain voltage on drain current with Zero gate bias, and determine the value of drain source (Pinch - off) voltage required to produce constant drain current.
17. Measure the DC operating voltages of a typical JFET voltage amplifier.
19. Demonstrate the operation and determine the voltage gain of a typical JFET voltage amplifier.
19. Demonstrate and measure the Zero bias characteristics of a metal oxide semiconductor field effect transistor.
20. Demonstrate and measure the depletion mode characteristics of a metal oxide semiconductor field effect transistor.
21. Measure the DC operating voltage of a MOSFET voltage amplifier.
22. Measure the DC operating voltages of a Dual gate MOSFET RF amplifier.
23. Test a silicon controlled rectifier (SCR) using an Ohmmeter.
24. Demonstrate the effect of Negative gate current in an SCR.
25. Verify that an SCR operates as a semiconductor switch by using it to control DC voltage applied to a load.
26. Familiarize with the operations of a half wave variable resistor phase - control circuit of SCR.
27. Demonstrate bidirectional conduction of a gated TRIAC and DIAC.
28. Demonstrate the four triggering modes of a TRIAC.
29. Assemble a switching circuit using TRIAC-DIAC (Project)
30. Measure the interbase resistance and determine the emitter base PN Junction diode characteristics of a uni-junction transistor.
31. Measure the peak emitter firing voltage of a uni-junction transistor.
32. Study various IC's and their pin configuration and packages.
33. Connect op-amps in functional circuits and observe their working and outputs.

* Students should prepare the projects mentioned above and retain them for final evaluation.

** Students should also prepare practical note books and get it checked weekly by the concerned teacher. They should also produce it to external examiner for sessional work/marking check up at the time of final exam.

Note: The Projects shown are only a reference to their level of complexity. The teachers may select other projects involving solid state devices and/or IC's.

BOOKS:

1. Basic Electronics by B.Grob.
2. Electronic Devices & Circuits by Bogart.
3. Experiments in Electronic Devices by Berlin (2nd Edition).
4. Electronics for Today & Tomorrow by Tom Duncan.
5. Fundamentals of Pulse & Digital Circuit by Tocci.
6. Electronics (Vol.1) by Manzar Saeed.

ET-271 WORKSHOP PRACTICE-II (Basic Machine Shop)

Total contact hours		T	P	C
Practical 96	0	3	1	

AIM The course aims at providing necessary skill in the use of tools/machines for basic machine shop operations. Also, this will provide an opportunity for the familiarization with the basic production processes in the factory.

COURSE CONTENTS

- 1. SHOP ORIENTATION.**
 - 1.1 Shop policies - rules and regulation.
 - 1.2 Workshop safety practices.

- 2. INTRODUCTION TO MACHINES AND TOOLS.**
 - 2.1 Grinder.
 - 2.2 Lathe and allied equipments.
 - 2.3 Micrometer, outside and inside calipers.
 - 2.4 Knurling tools.
 - 2.5 Thread gauge.

ET-271 WORKSHOP PRACTICE-II (Basic Machine Shop)

INSTRUCTIONAL OBJECTIVES

- 1. KNOW THE ESSENTIAL PARTS AND FUNCTIONS OF GRINDERS AND LATHE.**
- 2. UNDERSTAND THE OPERATIONS OF LATHE AND GRINDERS.**
 - 1.1. Identify parts of lathe and grinder.
 - 1.2. State the functions of lathe.
 - 1.3. Know different types of threads and their measuring tools.
 - 1.4. Practice turning by observing proper procedure (Simple turning, taper turning, Knurling).
 - 1.5. Measure thread with thread gauge.
 - 1.6. Observe safety precautions in machine shop.
 - 1.7. Appreciate quality of workmanship in the job.
 - 1.7. Realise the use of connect type of tool and operation for a given job.

ET-271 WORKSHOP PRACTICE-II (Basic Machine Shop)

LIST OF PRACTICALS

96 Hrs.

- 1-2. Practice for centering the job by surface gauge method.
3. Tool bit grinding.
- 4-5. Simple turning and facing practice.
6. Practice of counter-sinking.
7. Practice drilling on lathe.
8. Practice of step turning.
9. Knurling practice.
- 10-11. Practice of taper turning by compound rest method.
- 12-13. Practice of taper turning by offset method.
- 14-15. Metric thread cutting practice.
- 16-17. Practice of V-threads in inch system.
- 18-19. Drilling practice.
20. Drill grinding practice on tool grinder.

اسلامیات / مطالعہ پاکستان	
کتاب کی	GENRE
نئی پانسی	کتاب کی
101	کتاب کی
1	فصلیہ (ماہی سوئیر) حصہ اول اسلامیات حصہ دوم مطالعہ پاکستان سوز ماسٹہ قرآن مجید
2	سورۃ الفاتحہ۔ ایتہ الفری۔ سورۃ البقرۃ کی سخی آیات از امر الرسول سے تا آخر کور سورۃ تعلق مع قرآن تشریح
3	ہن منتخب احادیث سے ترجمہ و تشریح
4	بنی اسلام علی خمس شہادت لالہ الاموالموا قلم ائصلو نہ وابتا انزکوة و حج لبیت و صوم رمضان الذین انصبحتہ لمنشاء مومن للمومن علی المؤمن سنت خصاں بعد ما دما مرض و تشہدہ لزامات و وجیہہ لنا دعا
5	لیسیم علیہ نالقبہ و لیستہ انا عظمس و فصیحطہ ناغاب او شہدہ لا تخن من خنک لا یفخس الحننہ قاطع ان اللہ حرم علیکم عقوق امہات و رضاعتہ اعمال لیسر اولاتعسر اولاتنفرا دلق طعم الابان من مرضس باللہ وبالاسلام دیت بمعجمد نبیا لخصس الذکر لالہ الالہ حقوق و قرآنس
6	حصن تعلیم بطور فرس۔ والدین اور کولہ کے حقوق و فرائض۔ ہمدیہ کے حقوق اسلام کی انتہائی اقدار عبود اشتغال۔ غم دور گذر۔ ایفائے عہد۔ ہنوت۔ ایثار و قربانی

DAE

سال سوئم
حصہ اول اسلامیات

تدریس مقاصد

قرآن حکیم

عمومی مقصد: منتخب سورتوں اور آیات کی روشنی میں اسلام کے بنیادی مقاصد اور عبادت جان سکے
خصوصی مقاصد: طالب علم اس قتل ہو جائے گا کہ
سورۃ الفاتحہ: آیت الکرسی۔ سورۃ بقرۃ کی آخری آیات از امن الرسول سے اور سورۃ اخلاق کا ترجمہ و تشریح کر سکے
طالب علم درج ذیل کا مفہوم بیان کر سکے

☆ رب العالمین صرف اللہ تعالیٰ ہے

☆ اللہ رحم کرنے والا ہے

☆ قیامت کے دن پادشاہی اللہ کی ہوگی

☆ عبادت اور استعانت کا حقدار صرف اللہ ہے

☆ طالب علم درج ذیل کا مفہوم بیان کر سکے

☆ اللہ پاک ہر عیب سے پاک ہے

☆ اللہ کے اسمائے حسنہ حق اور قیوم ہیں

☆ تعلیم انبیاء پر ایمان لانا ضروری ہے

☆ رسولؐ ملا کہ کتب سلویہ پر ایمان لانا فرض ہے

☆ اطاعت حقیقی صرف اللہ کے لیے ہے

☆ اسلامی احکامات پر عمل کرنا انسانی بسلا میں ہے

☆ کفر کو اللہ کی مدد کے بغیر شکست نہیں دی جاسکتی

☆ اللہ ایک ہے

☆ اللہ کسی کا محتاج نہیں نہ اس کا کوئی شریک ہے

☆ منتخب احادیث

عمومی مقصد: احادیث کی روشنی میں اسلامی تعلیمات پر عمل پیرا ہو سکے

☆ خصوصی مقصد:

☆ احادیث کا ترجمہ بیان کر سکے

DAE

Technology

۶۱	اعلیٰ کی تشریح کر سکے
۶۲	معاشرتی اور انفرادی زندگی میں احکام سے رہنمائی حاصل کر سکے
	حقوق و فرائض
	عمومی مقصد: اسلامی معاشرے کا ایک اچھا فرد بن سکے
	خصوصی مقاصد:
۶۳	والدین کے حقوق و فرائض بیان کر سکے
۶۴	بسیوں کے حقوق بیان کر سکے
۶۵	اسلام میں حقوق و فرائض کی صورت میں اپنے اندر خدمت خلق کا جذبہ پیدا کر سکے
	اسلامی اقدار
	عمومی مقصد: طالب علم بن سکے گا کہ تعلیم کا مقصد حسن اخلاق سے متصف ہو رہا ہے
	خصوصی مقاصد
۶۶	اخلاق کے معنی و مفہوم کو بیان کر سکے
۶۷	اسلام میں حسن اخلاق کی اہمیت بیان کر سکے
۶۸	قرآن و سنت کی روشنی میں صبر و استقلال کی اہمیت بیان کر سکے
۶۹	اسلام میں عفو و درگزر کی اہمیت بیان کر سکے
۷۰	ایمانی عہد کی اہمیت بیان کر سکے
۷۱	اموت کے معنی و مفہوم کو بیان کر سکے
۷۲	اموت اسلامی کی اہمیت بیان کر سکے
۷۳	اسلام کی اعلیٰ قدر کو اپنی کر مثالی معاشرہ پیدا کر سکے

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1 0 1
کل وقت: 20 گھنٹے

GEN III

نصاب (سل سوئم)
مظاہرہ پاکستان
حصہ دوئم

موضوعات

- ☆ قیام پاکستان
- ☆ پونڈری کمیشن
- ☆ ریڈ کلف ایوارڈ
- ☆ تقسیم بنگلہ و گلگت
- ☆ تقسیم پنجاب
- ☆ مسئلہ مہاجرین
- ☆ ریاست کالہاٹی
- ☆ ریاست جموں و کشمیر
- ☆ سری پلٹی کا تنازعہ
- ☆ قرار دلو مقاصد
- ☆ علماء کے بائیس نکات
- ☆ 1956-1962 اور 1973 کے دستاویز کی اسلامی دفعات
- ☆ پاکستان کا محل وقوع اور اس کی جغرافیائی اہمیت
- ☆ قدرتی وسائل (تیل-گیس-کونکرہ)

DAE Technology

مطالعہ پاکستان (حصہ دوم)
قیام پاکستان

تدریس مقاصد

عمومی مقاصد: قیام پاکستان کے بعد درپیش مسائل سے آگاہی حاصل کرنے اور بیان کرے
خصوصی مقصد:

- ☆ باؤنڈری کمیشن تشکیل اور اس کے فرائض بیان کر سکے
- ☆ ریڈ کلف اور اس کے ایوارڈ کے بارے میں بیان کر سکے
- ☆ بنگلہ اور گلگت 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
- ☆ سرحدی پانی کے تنازعہ کو بیان کر سکے
- ☆ قرارداد مقاصد کی تفصیلات بیان کر سکے
- ☆ 22 علماء کے متفقہ اسلامی نکات بیان کر 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
- ☆ پاکستان میں قدرتی وسائل (تیل-گیس-کولہ) کے بارے میں بیان کر سکے

(غیر مسلم طلباء کے لئے)

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کل وقت: 20

Gen III

- ☆ نصاب اخلاقیات
- ☆ سال سوئم
- ☆ موضوعات
- ☆ احساس ذمہ داری
- ☆ مثبت ذہن
- ☆ عدل و انصاف
- ☆ قومی خدمت کا جذبہ
- ☆ ذکر و نظر کی پاکیزگی
- ☆ احترام آدمیت
- ☆ شائستگی
- ☆ غصہ و درگزر
- ☆ بردباری
- ☆ خود انحصاری
- ☆ اثر و نفوذ
- ☆ جامعیت
- ☆ اپنی ذات کی معرفت (بذریعہ ہم عمر طلباء۔ اساتذہ۔ اہم شخصیات لوہارہ)

DAE Technology

(غیر مسلم طلباء کے لئے)

نصاب اخلاقیات

سل سوئم

تدریس مقاصد

- عمومی مقصد: ملکی ترقی کے لیے اعلیٰ اوصاف کے ساتھ بہتر طور پر ملک و ملت کی خدمت کر سکے
- خصوصی مقاصد: طالب علم اس قابل ہو گا 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 و انصاف 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

Mgm-321 BUSINESS COMMUNICATION

T P C
1 0 1

Total contact hours
Theory 32 Hrs.

Prerequisites: The students shall already be familiar with the language concerned.

AIMS The course has been designed to enable the students for:

1. Development of communication skills.
2. Understanding basic principles of good and effective business letter writing in commercial and industrial fields.
3. Develop knowledge and skill to write technical report with confidence and accuracy.

COURSE CONTENTS

- | | |
|---|----------------|
| 1. COMMUNICATION PROCESS. | 6 Hours |
| 1.1 Purposes of communication | |
| 1.2 Communication process | |
| 1.3 Distortions in communication | |
| 1.4 Consolidation of communique | |
| 1.5 Communication flow | |
| 1.6 Communication for self development | |
|
 | |
| 2. ORAL COMMUNICATION SKILLS. | 6 Hours |
| 2.1 Significance of speaking. | |
| 2.2 Verbal and non-verbal messages. | |
| 2.3 Strategic steps of speaking. | |
| 2.4 Characteristics of effective oral messages. | |
| 2.5 Communication Trafficking. | |
| 2.6 Oral presentation. | |
|
 | |
| 3. QUESTIONING SKILLS. | 3 Hours |
| 3.1 Nature of question. | |
| 3.2 Types of questions. | |
| 3.3 Characteristics of a good question. | |
| 3.4 Questioning strategy | |
|
 | |
| 4. LISTENING SKILLS. | 5 Hours |
| 4.1 Principles of active listening. | |
| 4.2 Skills of active listening. | |
| 4.3 Barriers to listening. | |
| 4.4 Reasons of poor listening. | |
| 4.5 Giving Feedback. | |
|
 | |
| 5. INTERVIEWING SKILLS. | 3 Hours |
| 5.1 Significance of interviews. | |
| 5.2 Characteristics of interviews. | |
| 5.3 Activities in an interviewing situation | |
| 5.4 Types of interviews. | |
| 5.5 Interviewing strategy. | |

6.	REPORT WRITING.	3 Hours
6.1	Goals of report writing	
6.2	Report format.	
6.3	Types of reports.	
6.4	Report writing strategy.	
7.	READING COMPREHENSION.	2 Hours
7.1	Reading problems.	
7.2	Four Reading skills.	
8.	GROUP COMMUNICATION.	4 Hours
8.1	Purposes of conducting meetings.	
8.2	Planning a meeting.	
8.3	Types of meetings.	
8.4	Selection of a group for meeting.	
8.5	Group leadership skills.	
8.6	Running a successful meeting.	
8.7	Active participation techniques.	

RECOMMENDED BOOKS

1. Sh. Ata-ur-Rehman Effective Business Communication & Report Writing.
2. Ulman J.N. Could JR. Technical Reporting.

Mgm-321 BUSINESS COMMUNICATION.

INSTRUCTIONAL OBJECTIVES

1. **UNDERSTAND THE COMMUNICATION PROCESS.**
 - 1.1 Explain basic terminology of business communication
 - 1.2 State the benefits of two way communication.
 - 1.3 Describe a model of communication process.
 - 1.4 Explain the major communication methods used in organization.
 - 1.5 Identify the barriers to communication and methods of overcoming these barriers.
 - 1.6 Identify misconceptions about communication.

2. **UNDERSTAND THE PROCESS OF ORAL.**
 - 2.1 Identify speaking situations with other peoples.
 - 2.2 Identify the strategy steps of speaking.
 - 2.3 Identify the characteristics of effective speaking.
 - 2.4 State the principles of one-way communication.
 - 2.5 State the principles of two-way communication.
 - 2.6 Identify the elements of oral presentation skills.
 - 2.7 Determine the impact of non-verbal communication on oral communication.
 - 2.8 Letters writing skill.

3. **DETERMINE THE USES OF QUESTIONING SKILLS TO GATHER AND CLARIFY INFORMATION IN THE ORAL COMMUNICATION PROCESS.**
 - 3.1 Identify different types of questions.
 - 3.2 Determine the purpose of each type of question and its application.
 - 3.3 Identify the hazards to be avoided when asking questions.
 - 3.4 Demonstrate questioning skills.

4. **DEMONSTRATE THE USE OF ACTIVE LISTENING SKILL IN THE ORAL COMMUNICATION PROCESS.**
 - 4.1 State the principles of active listening.
 - 4.2 Identify skills of active listening.
 - 4.3 Identify barriers to active listening.
 - 4.4 State the benefits of active listening.
 - 4.5 Demonstrate listening skills.
 - 4.6 Explain the importance of giving and receiving feed back.

5. **Determine the appropriate interview type for the specific work-related situation and conduct a work-related interview.**
 - 5.1 State the significance of interviews.
 - 5.2 State the characteristics of interviews.
 - 5.3 Explain the activities in an interviewing situation.
 - 5.4 Describe the types of interviews.
 - 5.5 Explain the interviewing strategy.
 - 5.6 Prepare instrument for a structured interview.

6. PREPARE A REPORT OUT-LINE, BASED ON SUBJECT MATTER AND AUDIENCE.

- 6.1 Identify the different types of reports.
- 6.2 Determine when to use an informal or formal report presentation.
- 6.3 Identify the stages of planning a report.
- 6.4 Identify the parts of a report and choose the parts appropriate for each type of report.
- 6.5 Draft a report outline.

7. DEMONSTRATE READING COMPREHENSION.

- 7.1 Identify major reading problems.
- 7.2 Identify basic reading skills.
- 7.3 State methods of previewing written material.
- 7.4 Identify methods of concentration when reading.
- 7.5 Demonstrate reading comprehension.

8. UNDERSTAND THE PRINCIPLES OF GROUP COMMUNICATIONS.

- 8.1 State the purpose and characteristics of major types of meeting.
- 8.2 Explain responsibilities of a meeting/committee.
- 8.3 Identify problems likely to be faced at meeting and means to overcome these problems.
- 8.4 Distinguish between content and process at meetings.
- 8.5 Explain the key characteristics of a good group facilitator.
- 8.6 Writing skill of minutes of meeting.

Mgm-311 INDUSTRIAL MANAGEMENT AND HUMAN RELATIONS.

Total Contact Hours

Theory	32	T	P	C
Practical	0	1	0	1

AIMS Due to study of this subject, the students will be able to develop the management skill and understanding the basic principles of management and human relation and develop psychological approach to solve the labour problems.

COURSE CONTENTS

- 1. INDUSTRIAL PSYCHOLOGY. 2 Hours**
 - 1.1 History and definition.
 - 1.2 Nature and scope.
- 2. LEADERSHIP 1 Hour**
 - 2.1 Definition and types.
 - 2.3 Qualities of a good leader.
- 3. MOTIVATION 2 Hours**
 - 3.1 Definition.
 - 3.2 Types (Financial and non financial motives).
 - 3.3 Conflict of motives.
- 4. MORALE 1 Hour**
 - 4.1 Importance.
 - 4.2 Development.
 - 4.3 Measurement.
- 5. HUMAN ENGINEERING. 1 Hour**
 - 5.1 Importance of human factor in industry.
 - 5.2 Man-machine system.
 - 5.3 Strategy for making allocation decisions.
- 6. INDUSTRIAL FATIGUE AND BOREDOM. 2 Hours**
 - 6.1 Definition and distinction.
 - 6.2 Psychological causes.
 - 6.3 Objective causes.
 - 6.4 Prevention
- 7. INDUSTRIAL ACCIDENTS 2 Hours**
 - 7.1 Psychological causes.
 - 7.2 Objective causes.
 - 7.3 Prevention
- 8. INDUSTRIAL PREJUDICE 2 Hours**
 - 8.1 Causes

8.2	Remedies	
9.	PUBLIC RELATIONS.	2 Hours
9.1	Importance	
9.2	Functions	
10.	GUIDANCE AND COUNSELLING	2 Hours
10.1	Importance	
10.2	Choice of job.	
10.3	During service.	
11.	JOB EVALUATION	2 Hours
11.1	Importance	
11.2	Methods	
11.3	Job satisfaction	
11.4	Work simplification.	
12.	INDUSTRIAL MANAGEMENT	2 Hours
12.1	Introduction	
12.2	Functions of management.	
12.3	Subdivisions of management	
12.4	Objectives of industrial management.	
13.	PERSONNEL SELECTION.	2 Hours
13.1	Recruitment of employees.	
13.2	Training.	
13.3	Effects of training on production and product cost.	
14.	WORKING CONDITIONS.	2 Hours
14.1	Importance and consideration.	
14.2	Effects on efficiency and per unit cost.	
15.	TIME AND MOTION STUDY.	3 Hours
15.1	Concept and importance.	
15.2	Sequence of motion study.	
15.3	Principles of motion study.	
15.4	Steps to time study.	
15.5	Determination of operations time.	
16.	QUALITY CONTROL.	2 Hours
16.1	Concept and advantages	
16.2	Methods.	
17.	ROLE OF FOREMAN IN MANAGEMENT.	2 Hours
17.1	Foreman's abilities.	
17.2	Duties and functions.	

BOOKS RECOMMENDED:

1. C.S. Meyers, Industrial Psychology, Oxford University Press, London.
2. Smith Wakley, Psychology of Industrial Behaviors, Mc-Graw Hill, New York.
3. Ghulam Hussain, Nizamat-e-Sanaat Aur Insani Rawabat, Ilmi Kitab Khana, Urdu Bazar, Lahore.
4. Andrew R. Megill, The Process of Management William M New Man.
5. Richard N Omen, Management of Industrial Enterprises.

Mgm-311 INDUSTRIAL MANAGEMENT AND HUMAN RELATIONS.

INSTRUCTIONAL OBJECTIVES

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

- 1. KNOW INDUSTRIAL PSYCHOLOGY.**
 - 1.1 Describe brief history if industrial psychology.
 - 1.2 Describe in detail definition of industrial psychology.
 - 1.3 State nature and scope of industrial psychology.
 - 1.4 Elaborate the management skills.

- 2. KNOW LEADERSHIP.**
 - 2.1 Define leadership.
 - 2.2 Describe types of leadership.
 - 2.3 State qualities of a good leader.

- 3. UNDERSTAND MOTIVATION.**
 - 3.1 Define motivation.
 - 3.2 Describe financial and non financial motives.
 - 3.3 Explain conflict of motives.

- 4. KNOW MORALE.**
 - 4.1 State importance of morale.
 - 4.2 Describe development of morale.
 - 4.3 State the method of measurement of morale.

- 5. UNDERSTAND HUMAN ENGINEERING.**
 - 5.1 Explain importance of human engineering in the industry.
 - 5.2 Explain man-machine system.
 - 5.3 Explain strategy for making allocation decisions.

- 6. UNDERSTAND INDUSTRIAL FATIGUE AND BOREDOM.**
 - 6.1 Define fatigue and boredom.
 - 6.2 Describe psychological causes of fatigue and boredom.
 - 6.3 Describe objective causes of fatigue and boredom.
 - 6.4 Explain measures to prevent fatigue and boredom.

- 7. UNDERSTAND INDUSTRIAL ACCIDENTS.**
 - 7.1 Explain psychological causes of industrial accidents.
 - 7.2 Explain objective causes of industrial accidents.
 - 7.3 Explain measures to prevent industrial accidents.

- 8. UNDERSTAND INDUSTRIAL PREJUDICE.**
 - 8.1 Define prejudice
 - 8.2 Explain causes of industrial prejudice.
 - 8.3 Explain remedies of industrial prejudice.

- 9. UNDERSTAND THE SIGNIFICANCE OF PUBLIC RELATIONS.**
 - 9.1 Explain importance of public relations.
 - 9.2 Explain functions of public relations.

- 10. UNDERSTAND THE NEED FOR GUIDANCE AND COUNSELLING.**
 - 10.1 State importance of guidance and counselling.
 - 10.2 Explain the role of guidance and counselling in choosing the job.
 - 10.3 Describe help of guidance and counselling during service.

- 11. UNDERSTAND JOB EVALUATION.**
 - 11.1 Explain importance of job evaluation.
 - 11.2 Explain methods of job evaluation.
 - 11.3 Explain job satisfaction.
 - 11.4 Explain work simplification.

- 12. UNDERSTAND INDUSTRIAL MANAGEMENT.**
 - 12.1 Define management.
 - 12.2 State functions of management.
 - 12.3 Enlist subdivision of management.
 - 12.4 Explain objectives of industrial management.

- 13. UNDERSTAND TRAINING AND ITS EFFECTS.**
 - 13.1 Describe the recruitment procedure of employees in an industrial concern.
 - 13.2 Explain training.
 - 13.3 Identify the kinds of training.
 - 13.4 Explain the effects of training on production and product cost.

- 14. UNDERSTAND THE EFFECT OF WORKING CONDITION ON EFFICIENCY.**
 - 15.1 Explain importance of working condition.
 - 15.2 Describe air-conditioning, ventilation, lighting and noise.
 - 15.3 State the effects of good working conditions on efficiency and per unit cost.

- 15. UNDERSTAND TIME AND MOTION STUDY.**
 - 15.1 Explain the concept.
 - 15.2 Describe the importance of work study.
 - 15.3 Explain the sequence of motion study.
 - 15.4 State the principles of motion study.
 - 15.5 Describe the steps for carrying out time study.
 - 15.6 Explain the method of determination of operations time.

- 16. UNDERSTAND THE METHODS OF QUALITY CONTROL.**
 - 16.1 Define quality control
 - 16.2 State the advantages of quality control.
 - 16.2 Explain methods of quality control.

- 17. UNDERSTAND THE ROLE OF FOREMAN IN AN INDUSTRIAL UNDERTAKING.**
 - 17.1 Explain ability of the foreman.

- 17.2 Enlist duties of foreman.
- 17.3 Describe functions of foreman as middle management.

Total Contact Hours

Theory	128	T	P	C	
Practical	192		4	6	6

AIM At the end of this course the student will be able to have an insight into the construction, working principles and behaviour of machines under different operating conditions and an awareness of their losses and efficiency. The knowledge gained will form basis for carrying out repair and maintenance of these machines, an area covered in the programme concurrently.

COURSE CONTENTS

- | | | |
|-----------|---|----------------|
| 1 | SINGLE PHASE TRANSFORMER | 36 Hrs. |
| 1.1 | Definition, principle, basic parts. | |
| 1.2 | EMF equation, transformation ratio. | |
| 1.3 | Classification of transformer - core, mode of operation, use and cooling. | |
| 1.4 | Transformer operation (ideal) - On No load, on load, with resistive load, phasor diagram, with inductive, phasor diagram, with Capacitive load, phasor diagram. | |
| 1.5 | Transformer operation (Practical) - parameters, primary resistance, secondary resistance, primary leakage reactance, secondary leakage reactance, secondary, equivalent resistance, equivalent reactance referred to secondary, referred to primary, Exciting conductance and susceptance, equivalent circuit diagrams referred to primary & secondary, operation of practical transformer on load of different power factor, phasor diagram, approximate and exact voltage drop in transformer, regulation, percent resistance, reactance and impedance. | |
| 1.6 | Transformer losses & efficiency - Iron and copper losses. Ordinary and all day efficiencies, maximum efficiency, cooling of transformers. | |
| 1.7 | Transformer tests and specifications - Insulation test, Ratio test, Polarity test, Open circuit test. Short circuit test, Back to back test. | |
| 1.8 | Parallel operation of 1 phase transformer | |
| 1.9 | Special transformers, construction, principle and use - Instrument transformer, Auto transformer, Constant current transformer, Rotating core transformer. | |
| 2. | 3 -PHASE TRANSFORMER. | 15 Hrs. |
| 2.1 | Construction and working of 3 phase transformer. | |
| 2.2 | Connection groups of 3 phase transformer, name-plate rating. | |
| 2.3 | Connection of single phase transformers for 3 phase & 2 phase transformation -Star-Star, Star-Delta, Delta-Star, Delta-Delta, open Delta, Scott, Transformation of 3 phase to 6 phase & vice versa. | |
| 2.4 | Calculation of 3-phase transformer. | |
| 3 | A.C MOTORS INTRODUCTION | |
| 3.1. | General. | 1 Hr. |
| 3.2 | Preference of A.C motors over DC motors. | |
| 3.3 | Classifications. | |
| 4. | THREE PHASE INDUCTION MOTORS. | 24 Hrs. |
| 4.1 | Production of rotating magnetic field by 3 phase & 2 phase EMFs. | |

- 4.2 Construction of squirrel cage & wound rotor induction motor.
- 4.3 Principle of rotation of S.C. rotor, synchronous speed, rotor speed, slip, frequency of rotor induced current.
- 4.4 Motor parameters (stator resistance, reactance, rotor resistance, rotor reactance in starting & running condition. Condition for maximum starting & running torque.
- 4.5 Power stages in induction motor, Resistance measurement, No load & blocked rotor tests to determine losses, efficiency & parameters of motor.
Equivalent circuit.
- 4.6 Starting of 3 ph induction motor.
- 4.7 Speed control of induction motor.
- 5. SINGLE PHASE MOTOR. 10 Hrs.**
- 5.1 Classification.
- 5.2 Split phase motor.
- 5.3 Shaded pole motor.
- 5.4 Repulsion motor.
- 5.5 Series motor.
- 6. EXTERNAL ROTOR MOTOR. 1 Hr.**
- 6.1 Servo Motor: Construction, Working and Applications. 1 Hr.
- 7. SYNCHRONOUS GENERATOR. 32 Hrs.**
- 7.1. Construction - Stator, Rotor, Armature winding (single layer, two layer, chain), Hydrogen cooling for large machines
- 7.2 Principle. EMF equation.
- 7.3. Performance of Synchronous Generator on Load.
- 7.4 Voltage variation on load
- 7.5 Armature Reaction
- 7.6 Synchronous impedance
- 7.7. Phasor Diagram of Loaded Synchronous Generator on different power factors.
- 7.8. Regulation & its Determination by Synchronous Impedance Method.
- 7.9 O.C. and S.C. tests
- 7.10 Calculation of voltage regulation
- 7.11 Synchronization of Generator by different methods (lamp bright, lamp dark, synchroscope).
- 7.12 Load sharing.
- 7.13 Brushless A.C. Generator: Construction, Working & Uses.
- 8 SYNCHRONOUS MOTOR. 10 Hrs.**
- 8.1. Principle, construction, operation & uses of 3 phase synchronous motor
- 8.2. Principle, construction operation, characteristics & uses of unexcited single phase synchronous motor.

INSTRUCTIONAL OBJECTIVES

TIME SCHEDULE

S.No.	Major Topics	No. of Periods	No. of Questions in Q. Paper
1.	Transformer single phase	36	
	a. Construction, no load, off load regulation, open circuit & short circuit		2
	b. Efficiency, parallel operation, auto transformer etc.		1
2.	Three phase transformer	15	2
3.	A.C. motors single phase	12	1
4.	A.C. motors three phase	25	1
5.	Synchronous generator	32	
	a. Types of rotors, winding, EMF of generator		1
	b. Generator on load and voltage regulation		2
	c. Synchronizing etc. etc.		1
6.	Synchronous motors	8	1
	Total:	128	12

1. UNDERSTAND CONSTRUCTION & PRINCIPLE OF TRANSFORMER.

- 1.1. Define transformer as step up and step down.
- 1.2. Describe parts of transformer.
- 1.3. Explain principle of transformer.
- 1.4.
 - a) Describe classification of transformer.
 - b) Differentiate core type & shell type transformer.
- 1.5. Derive EMF equation of transformer.
- 1.6. Solve problems related to above.

2. UNDERSTAND OPERATION OF TRANSFORMER ON NO LOAD AND LOAD.

- 2.1 Differentiate between ideal & practical transformer.
- 2.2 Draw the phasor diagram of transformer on no load and load
- 2.3 Explain components of no load primary current.

- 2.4 Calculate energy component & magnetizing component of no load current.
 - 2.5 Explain the transient changes in current when load is connected.
 - 2.6 Distinguish between primary leakage flux, & secondary leakage flux.
 - 2.7 State methods of reducing leakage flux.
 - 2.8 State the relation of current & transformation ratio rating it to KVA.
- 3. UNDERSTAND EQUIVALENT CIRCUIT OF TRANSFORMER.**
- 3.1 Identify the primary resistance, secondary resistance, primary reactance, secondary reactance and magnetizing - branch components
 - 3.2 Convert the parameters of primary side onto secondary and vice versa, calculating equivalent values
 - 3.3 Draw the equivalent circuit of transformer.
 - 3.4 Draw the phasor diagram of transformer loaded with resistive, inductive, capacitive load with parameters referred to (a) both sides (b) primary (c) secondary.
 - 3.5 Solve problems on equivalent circuit of transformers under different loading conditions.
- 4. CALCULATE REGULATION OF TRANSFORMER.**
- 4.1 Define regulation.
 - 4.2 State factors on which regulation depend.
 - 4.3 Explain the voltage drop in transformer.
 - 4.4 Derive expression for approximate voltage drop & exact voltage drop.
 - 4.5 Define % Resistance, % Reactance & % Impedance.
 - 4.6 State formula for % impedance.
 - 4.6 Calculate regulation for various loading conditions.
- 5. CALCULATE EFFICIENCY OF TRANSFORMER.**
- 5.1 List the losses in transformer.
 - 5.2 Identify the parts in which these losses occur and the causes for the losses to occur.
 - 5.3 Define efficiency.
 - 5.4 Differentiate between commercial efficiency & all day efficiency.
 - 5.5 Calculate all day efficiency.
 - 5.6 Solve numericals on Losses & Efficiency
 - 5.7 Derive conditions for maximum efficiency and hence calculate maximum efficiency.
- 6. UNDERSTAND TESTS OF TRANSFORMER.**
- 6.1 List transformer tests.
 - 6.2 Describe various tests.
 - 6.3 Interpret the results of tests as parameters of equivalent circuit and components of losses.
 - 6.4 Solve numerical problems, related to open circuit test & short circuit test.
- 7. OPERATE TRANSFORMER IN PARALLEL.**
- 7.1 State the need of parallel operation.
 - 7.2 Describe the conditions for parallel operation and how these are fulfilled.
 - 7.3 Explain parallel operation under various conditions
 - 7.4 Solve problems on parallel operation of transformers, related to load-sharing.
- 8. UNDERSTAND CONSTRUCTION AND WORKING OF SPECIAL PURPOSE TRANSFORMER.**
- 8.1 Describe construction & working of special purpose transformers (such as auto-transformer,

- instrument transformers, constant current transformers, rotating core transformers).
- 8.2 State the uses of special purpose transformer.

9. UNDERSTAND CONSTRUCTION & WORKING OF 3 PHASE TRANSFORMER.

- 9.1 State advantages & disadvantages of 3 phase transformer over 1 phase transformer and 3-phase transformer over a bank of three phase transformers.
- 9.2 Describe the construction of 3 phase transformer (insulation, winding arrangement, core, cooling, terminals).

10. UNDERSTAND THE CONNECTION GROUPS OF 3 PHASE TRANSFORMER.

- 10.1 Enlist connection groups of 3 phase transformer.
- 10.2 Explain the voltage relationships & phasor diagrams of different groups along with their application
- 10.3 Explain the vector groups: Dd0, Yy0, Dd6, Dy11.

11. A) UNDERSTAND TRANSFORMATION FROM 1 PHASE TO 2 PHASE & 3 PHASE & VICE VERSA USING SINGLE PHASE TRANSFORMERS.

B) UNDERSTAND TRANSFORMATION OF 3 PHASE TO SIX PHASE.

- 11.1 Explain with phasor diagram transformation of 1 phase to 3 phase & 2 phase by using 3/2 single phase transformer (Star-star, Delta-Delta, Star-Delta, Delta-Star, open delta, scott.)
- 11.2 Compare different connection as mentioned above
- 11.3 Draw diagram of different methods for obtaining 6 phase from 3- phase (Double star, double delta, diametrical)
- 11.4 Explain the 6 phase to 3 phase transformation.

12. UNDERSTAND THE COOLING METHODS OF TRANSFORMER.

- 12.1 State necessity of cooling of transformer
- 12.2 List cooling methods.
- 12.3 Explain methods of cooling
- 12.4 State the location & of function of (a) Breather (b) explosion vent (c) conservator (d) oil level indicator.
- 12.5 Explain the construction and operation of Buchholz's Relay.

A.C. MOTORS.

1. COMPREHEND CONSTRUCTION AND WORKING OF A.C. SYNCHRONOUS MOTORS.

- 1.1 List parts of synchronous motor.
- 1.2 Explain principle of production of rotating magnetic field
- 1.3 Explain principle of working of synchronous motor
- 1.4 Explain the performance of synchronous motor on load with phasor diagram
- 1.5 Explain the effect of varying excitation on the AC line current (magnitude and phase) in synchronous Motors.
- 1.6 Explain the significance and use of V-curves of synchronous motor
- 1.7 Solve simple problems related to induced e.w.f., line current and PF.
- 1.8 Explain the phenomenon of hunting
- 1.9 State how hunting is prevented
- 1.10 State starting methods of Synchronous motor
- 1.11 State the field of application of synchronous motor

1.12 Describe the construction & principle of unexcited synchronous motor

2. COMPREHEND THE CONSTRUCTION AND WORKING OF 3 PHASE INDUCTION MOTORS.

- 2.1 State the function of different parts of 3 phase induction motor
- 2.2 State the principle of working of 3-phase induction motor
- 2.3 Derive the equation relating torque, power and slip, and for the pull out torque
- 2.4 Solve problem on the performance of induction motor relating torque, slip and power.
- 2.5 Explain the relationship between slip and torque using slip-torque curve.
- 2.6 Explain losses in an induction motor
- 2.7 Calculate efficiency of induction motor for given slip and torque/power conditions.
- 2.8 Explain blocked rotor and no-load tests.
- 2.9 Derive parameters of equivalent circuit from tests.
- 2.10 Explain general principles of 3 phase stator winding
- 2.11 Define terms related to winding
- 2.12 Classify the windings as short and full-pitched, single and double-layer, progressive and retrogressive
- 2.13 Draw winding diagrams of typical slot pole combinations
- 2.14 State the methods of starting of induction motor
- 2.15 Sketch the circuit diagram of induction motor & explain its working with D.O.L. starter, Y-delta starter, Auto transformer starter
- 2.16 Describe speed control methods

3. COMPREHEND WORKING OF 1 PHASE INDUCTION MOTOR.

- 3.1 State the types of 1 phase Induction motor
- 3.2 Explain principle of working of split phase, capacitor & shaded pole motor
- 3.3 State speed control methods of 1 phase induction motor

4. COMPREHEND WORKING OF COMMUTATOR MOTOR.

- 4.1 State different type of AC commutator motors
- 4.2 Explain the principle of repulsion motor, a.c. series motor, universal motor and schrage motor
- 4.3 Describe speed control methods of commutator motor
- 4.4 State the methods of speed & phase control of schrage motor

5. UNDERSTAND BRAKING OF AC MOTORS.

- 5.1 Define braking
- 5.2 Describe methods of braking of induction motor
- 5.3 Explain the principle of braking as applied to induction motor

SYNCHRONOUS GENERATOR

1. UNDERSTAND THE CONSTRUCTION & CLASSIFICATION OF SYNCHRONOUS GENERATOR.

- 1.1 Describe the construction of alternator
- 1.2 Classify alternators based on speed and poles (salient, smooth cylindrical).
- 1.3 Compare rotating field type with rotating armature type
- 1.4 List the parts with materials used
- 1.5 State the function of each part
- 1.6 Describe salient pole construction

- 1.7 List types armature winding used in synchronous generator
 - 1.8 Define terms related to armature winding: pitch and pitch factors, distribution factor, single and double layer, overhang etc.
 - 1.9 Compare different armature windings
 - 1.10 Draw the winding diagrams
- 2. UNDERSTAND THE PRINCIPLE OF SYNCHRONOUS GENERATOR**
- 2.1 Explain the principle of alternator
 - 2.2 Derive the emf equation of synchronous generator
 - 2.3 State advantages of rotating field construction
 - 2.4 State need of exciter
 - 2.5 List various types of exciters (main, pilot & static)
 - 2.6 Explain the static excitation in synchronous generator (brush less excitation)
 - 2.7 Solve problems on equation (emf of alternator)
 - 2.8 Describe measures of wave-form improvement
- 3. COMPREHEND THE PERFORMANCE, TESTING OF ALTERNATORS (SYNCHRONOUS GENERATOR).**
- 3.1 State reasons for voltage variation on load
 - 3.2 State importance of voltage regulation
 - 3.3 Define regulation of synchronous generator
 - 3.4 Define synchronous impedance
 - 3.5 State the effect of synchronous impedance on terminal voltage
 - 3.6 Draw the phasor diagram for loads at different power factors
 - 3.7 Describe O.C & S.C test on alternator
 - 3.8 Calculate regulation of 1-phase and 3-phase alternator by synchronous impedance method
 - 3.9 State the importance & drawbacks of synchronous impedance method
 - 3.10 Explain phasing of 3-ph alternator in star, delta
 - 3.11 Describe hunting
 - 3.12 Calculate regulation for different load power-factors, using synch. impedance.
- 4. COMPREHEND THE PROCEDURE FOR VOLTAGE CONTROL & SYNCHRONIZATION.**
- 4.1 State the necessity of parallel operation
 - 4.2 State conditions for synchronism
 - 4.3 Explain the synchronization procedure for 3-ph and 1-ph alternators using bright lamp method, dark lamp method, synchronoscope
 - 4.4 Explain method for adjusting the loads shared by two alternators or one alternator with infinite bus bar
 - 4.5 Explain the voltage control of alternators using carbon pile regulator
 - 4.6 Calculate the load sharing by two alternators in parallel.

LIST OF PRACTICALS**TRANSFORMERS**

- 1 Study various transformers.
- 2 Determination of transformation ratio.
- 3 Determination of polarity of 1 phase transformer.
- 4 Transformer winding Project I.
- 5 Transformer winding Project I (Contd).
- 6 Open circuit test.
- 7 Short circuit test.
- 8 Determination of regulation of 1 phase transformer.
- 9 Determination of efficiency by direct loading.
- 10 Determination of efficiency by back to back test.
- 11 Parallel operation 1 phase transformer.
- 12 Study and connection of auto transformer.
- 13 Verification of current & voltage ratio of an auto transformer.
- 14 Study of 3 phase transformer & its connection.
- 15 Transformer winding project I (Contd).
- 16 Connecting 3 single phase transformer in Star-Star, & Star-Delta.
- 17 Connecting 3 single phase transformer in Delta-Delta & Delta-Star.
- 18 Connecting two 1 phase transformers in open delta & in scott.
- 19 Transformer project I (Contd).
- 20 Transformer project I (Contd).
- 21 Parallel operation, 3 phase transformers.
- 22 Connect 3-phase transformers as per given vector groups (Yy0, Dd0, Dy11, Dd6)

A.C MOTORS.

- 1 Verification of rotating magnetic field.
- 2 Study 3 phase motors.
- 3 Measuring starting & running currents of induction motor.
- 4 Study slip torque curves.
- 5 Determination of slip of stroboscope.
- 6 Connecting 3 phase motor with (a) D.O.L. (b) Auto Transformer, starters.
- 7 Connecting 3 phase motor with (a) Star-Delta starter & (b) 3 position push button starter.
- 8 Determination of efficiency of 3 phase motor.
- 9 Speed control by primary voltage control method & rotor resistance control method.
- 10 Cascade control of motor.
- 11 Starting of wound rotor motor.
- 12 Study of connection of split phase motor.
- 13 Study & connection of shaded pole motor.
- 14 Project II induction motor winding session I.
- 15 Study of repulsion motor.
- 16 Work on project II. Session II
- 17 Work on project II. Session III
- 18 Work on project II. Session IV

- 19 Work on project II. Session V
- 20 Work on project II. Session VI
- 21 Work on project II. Session VII
- 22 Work on project II. Session VIII

SYNCHRONOUS GENERATORS

- 1 Study of alternator & its operation.
- 2 Study effect of speed on frequency.
- 3 Practice alternator winding.
- 4 Practice alternator winding.
- 5 Open circuit test.
- 6 Short circuit test.
- 7 Determination of voltage regulation (synchronous impedance method).
- 8 Parallel operation of alternators by dark lamp method.
- 9 Parallel operation of alternators by bright lamp method.
- 10 Study sharing of WATTS and VARS load of two parallel-operating alternators.
- 11 Study power angle with change of load.

SYNCHRONOUS MOTORS

- 1 Study of operation as Synchronous motor.
- 2 Starting of synchronous motor using various methods.
- 3 Study effect of excitation on armature current & power factor.
- 4 Study of Torque angle with change of load.

CONVERTERS AND RECTIFIERS

- 1 Study & operate motor generator set.
- 2 Study & operate motor converter set.
- 3 Study of brushless converter.
- 4 Study of brushless A.C generator.
- 5 Study of servomotor.

Note: Students must prepare theory and practical note books and got these checked weekly by the concerned teacher. They should produce it to external examiner for sessional work/marking check up at the time of final exam.

RECOMMENDED BOOKS:

1. B.L Theraja. Electrical Technology
2. Philips Kemp. Alternating Current Electrical Engineering
3. Elementary Electrical by Chapman
4. Drinkall Hadik Grant. Alternator Current Motors
5. Kates-Stafford. Electrical Generator
6. Coral H-Dunlop. Transformers

ET-322 POWER PLANTS AND ENERGY CONSERVATION

Total Contact Hours:

Theory (only):	64	T	P	C
		2	0	2

AIMS Power Generator is essential area of electrical technology. Familiarization of the types, construction, working and operation of different types of power plants is aimed at. The student should be able to see the power station as a unit, with need and working of each component integrated into the unit.

An area of growing concern covered is the energy conservation, as also an introduction to the economic aspects of electricity supply as an Industry, showing concern for investments and returns.

- 1. SOURCES OF POWER.** 6 Hrs.
 - 1.1 Introduction to different sources of power.
 - 1.2 Salient features of systems of power sources.
 - 1.3 Comparison of different sources, Thermal, Hydel, Nuclear Solar, Tidal, Wind Magneto Dynamic and Geothermal.

- 2. THERMAL POWER STATION.** 14 Hrs.
 - 2.1 Introduction to thermal power station.
 - 2.2 Selection of fuels and site.
 - 2.3 Type of thermal power stations and their working.
 - 2.4 Parts of thermal power station and their working.
 - 2.5 Boilers and their types, under tube, fire tube etc.
 - 2.6 Steam turbines and their types, Impulse and Reaction.
 - 2.7 Construction and working principle of steam turbine.
 - 2.8 Selection and capacity of steam turbine.
 - 2.9 Construction of turbo generators.
 - 2.10 Function and application of condenser in a steam turbine power station.
 - 2.11 Water circulation system in a thermal power station.
 - 2.12 Introduction to diesel engine power station.
 - 2.13 Working of a diesel surface, two stroke, four stroke and their comparison.
 - 2.14 Cooling system of diesel engine.
 - 2.15 Site and schematic of diesel power station.

- 3. NUCLEAR POWER STATIONS.** 8 Hrs.
 - 3.1 Introduction to Nuclear power station.
 - 3.2 Main parts of nuclear power station.
 - 3.3 Principle of nuclear energy, atomic structure, atomic, number (For materials mostly used for nuclear energy).
 - 3.4 Kinetic energy and isotopes, fuel (Nuclear).
 - 3.5 Fission and fusion.
 - 3.6 Heavy water and its importance.
 - 3.7 Nuclear reactor, its types.
 - 3.8 Line diagram of a nuclear reactor.
 - 3.9 Nuclear power stations in Pakistan.

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|-----------|---|----------------|
| 4. | HYDEL POWER STATION. | 12 Hrs. |
| | 4.1 Introduction to Hydel Power station. | |
| | 4.2 Classification of Hydel Power Station. | |
| | 4.3 Merits & demerits of Hydel Power Station. | |
| | 4.4 Selection of site for Hydel Power Station. | |
| | 4.5 General arrangement and operation of Hydel Power Station. | |
| | 4.6 Types of Hydel turbines and their characteristic. | |
| | 4.7 Governing of Turbines. | |
| | 4.8 Comparison between turbines. | |
| | 4.9 Hydro electric generation in Pakistan. | |
| 5. | GAS TURBINE POWER STATION. | 8 Hrs. |
| | 5.1 Introduction to Gas Power station. | |
| | 5.2 construction & working of simple gas turbine. | |
| | 5.3 Layout of a gas turbine station. | |
| | 5.4 Gas power station in Pakistan. | |
| | 5.5 Introduction to combined cycle Power station. | |
| | 5.6 Combined cycle power stations in Pakistan. | |
| 6. | TARIFFS AND ECONOMICS. | 8 Hrs. |
| | 6.1 Introduction to economics consideration(cost of generation). | |
| | 6.2 Factors influencing cost of generation, load factor, demand factor, diversity factor. | |
| | 6.3 Different load curves. | |
| | 6.4 Depreciation of plant cost and method of charging. | |
| | 6.5 Types of Tariffs. | |
| | 6.6 Calculations on tariffs (simple problems). | |
| | 6.7 Fundamentals of load management. | |
| 7. | CONSERVATION OF ENERGY. | 8 Hrs. |
| | 7.1 Introduction & necessity of energy conservation. | |
| | 7.2 Source of energy loss. | |
| | 7.3 Effect of factors on energy loss. | |
| | 7.4 Methods to limit losses effect of over-sized drives on losses. | |
| | 7.5 Methods to improve power factor in the context of energy conservation. | |
| | 7.6 Economical limits of PF improvement | |

TEXT AND REFERENCE BOOKS

1. Diesel Electric Power Plants by Kates.
2. Electrical Power by S.L Opal.
3. Elements of Power Station Design M.V. Deshpande
4. Heat Engines by K.P. Roy.
5. Applied Thermodynamics by R.S. Khurmi.
6. Diesel Locomotive-Mechanical-Electrical Fundamentals By Drancy.
7. Nuclear Power Plants by Dr. S.M. Bhutta
8. Power Plant Technology by El-Wakil (relevant sections only)
9. Electric Power System by B.M. Weedy (Chap-I,II only)
10. Literature from ENERCON (GOP)

ET-322: POWER AND ENERGY CONSERVATION

INSTRUCTIONAL OBJECTIVES

TIME SCHEDULE

S.No.	Major Topics	No. of Periods	No. of Questions in Q. Paper
1.	Source of power	6	½
2.	Thermal power stations	14	1 ½
3.	Nuclear power stations	8	½
4.	Hydel power stations	12	1
5.	Gas turbine power stations	8	1
6.	Tariffs and economics	8	½
7.	Conservation	8	1
	Total:	64	6

1. KNOW DIFFERENT SOURCES OF ELECTRICAL POWER.

- 1.1 Name different sources of power, (thermal, hydel, nuclear, solar, tidal, magneto hydro dynamic, wind)
- 1.2 State sources of power as Renewable and Exhaustible
- 1.3 State merits and demerits of each source (installation & working w.r.t. economics)
- 1.4 State characteristics of each category of sources: Power sensitivity, environmental effects, life an life-cycle, cost, technology.
- 1.5 State the power generation as an energy conversion process, starting from the available source.

2. UNDERSTAND THE TYPES AND WORKING COMPONENTS THERMAL POWER STATION.

- 2.1 List types of fuel used in thermal power house (Coal, Oil, Gas).
- 2.2 State requirements of site selection (cost of land, availability of abundant water, transport, load control location, climate, pollution) indicating relative weightages.
- 2.3 Enlist the types of thermal power station.
- 2.4 Explain working of a power plant showing parts/components on a block-diagram integrating into a unit (station)
- 2.5 Explain the parts of the thermal power plant.
- 2.6 State types of boilers water tube, fire tube.
- 2.7 Describe steam turbine (Reaction, impulse).
- 2.8 Explain construction and working of a steam turbine.
- 2.9 Explain types of steam turbines.
- 2.10 Describe method of determining the capacity of a steam turbine.
- 2.11 Describe construction of a turbo generator.
- 2.12 Explain function and application of condenser in steam turbine.
- 2.13 Draw layout of water circulation system in steam power station
- 2.14 Describe diesel engine power station.

- 2.15 Compare two stroke and four stroke diesel engine.
 - 2.16 Explain a diesel power station with the help of block- diagram.
 - 2.17 Show schematic diagram of diesel power station.
 - 2.18 State requirements of a site selection for diesel power plant (location, climatic condition, water cost of utilities, pollution etc. consideration), comparing relative weightage
 - 2.19 Describe environmental effects of thermal power stations and measures to offset such hazards.
- 3. UNDERSTAND CONSTRUCTION AND WORKING OF A NUCLEAR POWER STATION.**
- 3.1 Enlist main parts of a nuclear power station.
 - 3.2 Write working principle of nuclear energy in context with atomic structure, atomic number, mass number for materials used for nuclear energy.
 - 3.3 Define kinetic energy, isotope, nuclear fuel.
 - 3.4 Describe fusion and fission
 - 3.5 State importance of heavy water (D₂O).
 - 3.6 Enlist the fissionable and fertile fuels
 - 3.7 List types of nuclear reactors.
 - 3.8 Describe the construction and working of a thermal Reactor
 - 3.9 Explain the working of a Nuclear Station with the help of a line diagram of a nuclear power plant.
 - 3.10 Describe salient features of nuclear power station working in Pakistan
- 4. UNDERSTAND THE TYPES, WORKING AND COMPONENTS OF HYDEL POWER STATION.**
- 4.1 Enlist types of hydro electric power station (head of water, demand of load & quantity of water)
 - 4.2 Enlist merits and demerits of hydel power station.
 - 4.3 Describe Hydel Power Stations.
 - 4.4 Explain requirements of site selection for installation of hydel power plant.
 - 4.5 Explain general arrangements and operation of hydel power station.
 - 4.6 Describe types of hydel turbines and their characteristics.
 - 4.7 Compare different hydel turbines.
 - 4.8 State function of turbine components.
 - 4.9 Name hydro-electric power plants working in Pakistan alongwith their capacities.
- 5. UNDERSTAND THE WORKING AND USES OF GAS TURBINE.**
- 5.1 Enlist advantages and disadvantages of Gas turbine stations
 - 5.2 Describe gas turbine (construction and working).
 - 5.3 Sketch block diagram of a gas turbine power station.
 - 5.4 List gas turbine power station working in Pakistan.
 - 5.5 Describe combined cycle power station.
 - 5.6 Explain combined cycle power station working in Pakistan.
 - 5.7 Describe environmental effects of gas turbine stations and measures to improve the situation.
- 6. UNDERSTAND TARIFF AND ECONOMICS.**
- 6.1 Explain effects of cost generation (Tariff, economics).
 - 6.2 Draw load curves.
 - 6.3 Define load factor, demand factor, diversity factor, power plant factor.
 - 6.4 Define type of tariff, flat rate, two part tariff, block rate tariff, maximum demand tariff, power factor tariff.
 - 6.5 Calculate simple problem relating to tariffs and cost of generation
 - 6.6 Describe measures to reduce cost of electricity

6.7 Define the terms: supply-side load Management and Load-side Load Management

7. UNDERSTAND METHODS OF ENERGY CONSERVATION.

- 7.1 Identify sources of energy losses, light, heat energy loss, electric energy loss, fuel losses.
- 7.2 Explain methods to limit losses in energy (improvement of efficiency of working units, avoid over-sized drives).
- 7.3 State effects of low power factor on energy losses.
- 7.4 Explain methods of P.F. improvement for the purpose of energy conservation (Phase advancer, capacitor, synchronous condenser).
- 7.5 Calculate the economic limit of PF improvement for given costs/tariff

Total Contact Hours:

Theory:	128	T	P	C
Practical:	96	4	3	5

AIMS The course aims to provide understanding of the systems, constants, effects and mechanical consideration of both overhead and underground transmission and distribution lines, effects of low power factor on system performance are also included.

The 2nd half of the course is designed to provide understanding of system protection techniques, switch gear involved and protective relaying schemes. It is also aimed to provide sufficient knowledge of various solid state (Static) relays being used and the schemes of protection of generators, transformers, feeders and transmission lines.

1. TRANSMISSION SYSTEMS. 16 Hrs.

- 1.1 Introduction with respect to Voltages (Low Medium and E.H.T), overhead and underground and A.C. & D.C.
- 1.2 Comparison between A.C. & D.C. supply systems.
- 1.3 Purpose of transmission.
- 1.4 Choice of frequency.
- 1.5 Choice of voltages.
- 1.6 Choice of conductors.
- 1.7 Choice of supply circuits.
- 1.8 Ring system of transmission (A.C.).
- 1.10 Economic consideration of power factor improvement.
 - 1.10.1 Causes of low p.f.
 - 1.10.2 Disadvantages of low p.f.
 - 1.10.3 Effect of power factor on industrial tariff.
 - 1.10.4 Improving methods: (Bank capacitors, Synchronous compensators, Phase advancers)
 - 1.10.5 Calculations on power factor improvement.

2. TRANSMISSION LINES. 16 Hrs.

- 2.1 Constants of transmission line for 1 phase & 3 phase (with equal spacing).
 - 2.1.1 Resistance.
 - 2.1.2 Inductance.
 - 2.1.3 Capacitance.
 - 2.1.4 Formulae & calculation (without derivations).
- 2.2 Charging current of transmission lines.
- 2.3 Voltage drop in H.V. transmission lines.
 - 2.3.1 T-Method.
 - 2.3.2 Pi(π)-Method.
 - 2.3.3 Simple calculation on voltage drop in short transmission lines with vector diagrams.
- 2.4 Effects on transmission lines.
 - 2.4.1 Feranti effect.
 - 2.4.2 Skin effect.
 - 2.4.3 Corona effect.

3.	INSULATORS.	4 Hrs.
3.1	Types.	
3.1.1	Pin type.	
3.1.2	Suspension type and String Insulator.	
3.1.3	Strain.	
3.1.4	L.T.Insulators.	
3.2	Uses.	
4.	OVERHEAD LINE CONDUCTORS.	2 Hrs.
4.1	Types.	
4.1.1	Stranded copper.	
4.1.2	Aluminum conductor steel reinforced (ACAR).	
4.2	Selection of line conductors.	
5.	POLES & TOWERS FOR TRANSMISSION LINES.	2 Hrs.
5.1	Types.	
5.2	Supports.	
5.3	Vibrators.	
5.3	Dampers and Spacers.	
6.	SAG.	7 Hrs.
6.1	Sag in transmission Lines with equal and unequal heights.	
6.2	Minimum ground clearance standards.	
6.3	Calculation on sag.	
6.4	Effect of wind & ice on transmission lines.	
6.4.1	Problems solving.	
7.	UNDER GROUND POWER CABLES.	4 Hrs.
7.1	Types (HVXLPE cables, HV oil filled cable etc).	
7.2	Constructions.	
7.3	Effect, characteristics & uses.	
7.4	Stress on insulation & capacitance.	
7.5	Laying of under-ground cables.	
8.	CONCEPT OF A.C. DISTRIBUTED LOADS WITH THE HELP OF VECTOR DIAGRAMS AND AC DISTRIBUTION CALCULATIONS.	6 Hrs.
8.1	Calculations about AC Distributors	
8.1.1	Voltage drop.	
8.1.2	Voltage regulation.	
8.1.3	Power loss.	
8.1.4	Vector Diagrams	
9.	BALANCERS & BOOSTERS (A.C & D.C).	2 Hrs.
9.1	Balancers-Definition.	
9.1.1	Types of Boosters.	
9.1.2	Types of Balancers.	

9.1.3 Uses of each.

- 10. SUB-STATION.** 5 Hrs.
- 10.1 Classification.
 - 10.2 Relative merits of Indoor & outdoor.
 - 10.3 Equipment.
 - 10.4 Bus Bar arrangements.
 - 10.5 Grounding of star Neutral point.
 - 10.5.1 Necessity of grounding.
 - 10.5.2 Solid grounding.
 - 10.5.3 Resistance grounding.
 - 10.5.4 Reactance grounding.
 - 10.5.5 Different sub-station schemes.
 - 10.6 Importance & advantages of Interconnected power stations.
 - 10.7 National Grid system of Pakistan.
 - 10.8 Necessity of Load management (Load Despatch Centre, KESC/WAPDA).
- 11. REPRESENTATION OF POWER SYSTEM BY.** 5 Hrs.
- 11.1 One (single) line diagram,
 - 11.2 Impedance diagram.
 - 11.3 Reactance diagram.
 - 11.3.1 Per unit & percentage quantities.
- 12. FAULTS IN POWER SYSTEM.** 5 Hrs.
- 12.1 Types of faults in power system.
 - 12.2 Selection of Base KVA.
 - 12.3 Calculation of percentage reactance at base KVA.
 - 12.5 Symmetrical fault.
 - 12.6 Problems on short circuit capacity.
- 13. REACTORS.** 4 Hrs.
- 13.1 Necessity of reactors.
 - 13.2 Construction of reactors.
 - 13.3 Advantages of reactors.
 - 13.4 Disadvantages of reactors.
 - 13.5 Types of reactors.
 - 13.5.1 Unshielded.
 - 13.5.2 Magnetically shielded.
 - 13.6 Methods of Locating Reactors.
 - 13.6.1 Generator reactors.
 - 13.6.2 Feeder reactors
 - 13.6.3 Bus bar reactors.
 - Ring system.
 - Tie bar system.
- 14. CIRCUIT BREAKERS.** 16 Hrs.
- 14.1 Necessity.
 - 14.2 Theory of A.C Interruption

- 14.2.1 Phenomena of arc & its effects.
- 14.2.2 Magnitude of arc
- 14.2.3 Maintenance of arc (Arc quenching) in:
 - a. Oil circuit breakers.
 - b. Air circuit breakers.
 - c. Gas circuit breakers.
 - d. Vacuum circuit breakers.
- 14.3 Oil circuit breaker.
 - 14.3.1 Working and construction.
 - 14.3.2 Advantages and disadvantages.
 - 14.3.3 Types
 - a) Bulk oil.
 - Single break.
 - Double Break.
 - b) Low oil C.B.
 - c) Self generated pressure type.
 - d) Externally generated pressure type.
- 14.4 Air Circuit Breakers.
 - 14.4.1 Working & Construction
 - 14.4.2 Advantages & Disadvantages.
 - 14.4.3 Types of Air Blast breakers.
 - a. Cross Blast.
 - b. Axial Blast.
 - c. Radial Blast.
 - 14.4.4 Ratings.
 - a. Breaking capacity.
 - b. Making capacity.
 - c. Short circuit line current ratings.
 - d. Rated voltages.
 - e. Normal current ratings.
 - f. Operating duty.
- 14.5 Gas Circuit Breakers.
 - 14.5.1 Working & Construction of SF₆ Circuit Breakers.
 - 14.5.2 Advantages.
 - 14.5.3 Physical & chemical properties.
 - 14.5.4 Dielectric properties of SF₆ Gas.
- 14.6 Vacuum Circuit Breakers.
 - 14.6.1 Working & construction.
 - 14.6.2 Advantages.
- 14.7 Gas Insulated Substations.

15. ISOLATORS.

2 Hrs.

- 15.1 Working principle.
- 15.2 Uses.
- 15.3 Types of Isolation.

PROTECTIVE DEVICES.

- 16. FUSES. 4 Hrs.**
- 16.1 Definitions- Fuses, carrying current, fusing current, prospective current & cut off current, total operating time, breaking capacity.
 - 16.1.1 Fuses Materials.
 - 16.1.2 Factors effecting fusing currents.
 - 16.1.3 Fusing factors.
 - 16.1.4 Arcing & pre-arcing (Melting) time.
 - 16.2 Selection of fuses.
 - 16.3 Advantages & disadvantages.
 - 16.4 Types of fuses.
 - 16.5 Application.
- 17. PROTECTIVE RELAYING. 12 Hrs.**
- 17.1 Necessity of relaying.
 - 17.2 Requirements of relaying.
 - 17.2.1 Speed.
 - 17.2.2 Selectivity.
 - 17.2.3 Sensitivity.
 - 17.2.4 Reliability.
 - 17.2.5 Simplicity.
 - 17.2.6 Economy.
 - 17.3 Primary & back-up protections.
 - 17.4 Classification of relays w.r.t
 - 17.4.1 Construction & Principle.
 - 17.4.2 Application (Uses).
 - 17.4.3 Time of operation.
 - 17.5 Construction & Principle of operation.
 - 17.5.1 Buchholz's relay.
 - 17.5.2 Induction over current relay (Non directional).
 - 17.5.3 Induction reverse-power relay.
 - 17.5.4 Induction directional over current relay.
 - 17.5.5 Distance relay.
 - 17.5.6 Impedance relay.
 - 17.5.7 Beam relay.
 - 17.5.8 Frequency relay.
 - 17.5.9 Static relays (Electronic relays).
 - 17.5.10 Amplitude-comparator relays.
 - 17.5.11 Phase comparator relay.
 - 17.5.12 Static over current relay.
 - 17.5.13 Static distance relay.
 - 17.5.14 Differential protection.
 - a. Current Balance.
 - b. Voltage Balance.
- 18. BUS-BAR PROTECTION. 4 Hrs.**
- 18.1 Bus bar protection.
 - 18.2 Frame leakage protection.
 - 18.3 Circulating current protection.

19.	FEEDER & TRANSMISSION LINE PROTECTION.	4 Hrs.
	19.1 Time Graded Protection.	
	19.2 Differential protection.	
	19.3 Ring mains protection.	
20.	ALTERNATOR PROTECTION.	3 Hrs.
	20.1 Alternator faults.	
	20.2 Protection against stator faults (Merz-price).	
	20.3 Balanced Earth fault protection.	
	20.4 Stator In-turn protection.	
	20.5 Un-Balanced loads.	
21.	TRANSFORMER PROTECTION.	3 Hrs.
	21.1 Transformers faults.	
	21.2 Merz-price system of protection for:	
	21.2.1 Delta-Star.	
	21.2.2 Delta-Delta.	
	21.2.3 Star-Delta.	
	21.2.4 Star-Star.	
	21.3 Over current & Unrestricted earth fault protection.	
22.	LIGHTNING ARRESTERS.	2 Hrs.
	22.1 Phenomenon (Mechanism) of lightning.	
	22.2 Effects of lightning on Electrical power system.	
	22.3 Lightning strokes.	
	22.3.1 Direct stroke.	
	22.3.2 Indirect strokes.	
	22.4 Protection of H.T Lines & building with ground wire.	
	22.5 Types of arrestor.	
	22.5.1 Expulsion.	
	22.5.2 Valve type.	
	22.5.3 Horn gap (Rod gap) type.	

** Students must prepare theory and practical note books and get it checked weekly by the concerned teacher. They should produce these to external examiner for sessional work/marking check up at the time of final examination.

PRACTICAL EXERCISE**UNIT-1 TRANSMISSION & DISTRIBUTION.**Lab Assignment (Lab Report-1).

The student will visit all the workshop, administrative buildings, classes, hostel and colony etc to find out the connected load of whole Institute/College. He should be supposed to find out the demand in KW, Load of individual Technology unit, with following load factors.

- Light Load-60%
- Motor Load-50%
- Welding shop load 40%

With the application of diversity factor of 0.8, he will find out the KVA Capacity required for a poly-technic along the residential accommodations, street lights & hostels.

On the main switch gear side he will divide the system into 3-Sub-mains and find out the feeder size with pole design, conductor size conductor spacing & insulator etc., service lines for each Technology. Service lines may be connected through underground cables. Capacities of Main switches, fuses & circuit breakers used may also be ascertained.

This report must be submitted in the 18 week of the session

Lab Report-2

1. Design of pole with minimum sag of 11 KV lines as per WAPDA/KESC specifications in streets, on road crossings, road sides & high ways.
2. Study of various poles & towers used in distribution & transmission lines and their designs.
3. Study of various types of insulators used in distribution & transmission systems and their designs.
4. Prepare a lay-out & scheme for a small grid station of a tehsil HQ/city on the drawing sheet.

Visit and Prepare Report for Report-3

- Large grid station for general study .
- Power House.
- Enlist the equipment with KV rating & power cables used in above installations.
- Draw the drawings of: Insulators & Poles used in above installation Industrial power plant (Diesel set), Industrial scheme of distribution of a factory with at least the load of 200 KVA capacity on drawing sheets. Enlist all Electrical equipment installed there.
- Also note the power factor improving methods used by the industries visited.

UNIT-2 SWITCH GEAR & PROTECTION.**1 Study of different types of relays such as:-**

- 1.1 Attracted Armature type relay.

- 1.2 Buchholz's relay.
- 1.3 Plunger type relay.
- 1.4 Induction over current relay.
- 1.5 Induction reverse power relay.
- 1.6 Induction relay.
- 1.7 Impedance relay.
- 1.8 Reactance relay.
- 1.9 Beam relay.
- 1.10 Frequency relay.
- 1.11 Static relays.
- 1.12 Amplitude-comparator relay.
- 1.13 Phase comparator relay.
- 1.14 Over voltage, Under voltage relay.
- 1.15 Static over-current relay.
- 1.16 Static distance relay.
- 1.17 Differential protection relay.
- 1.18 Current Balance.
- 1.19 Voltage Balance.
- 1.20 Photoelectric relay.
- 1.21 Thermal relay.

Note: The study should include physical design, electrical/mechanical systems, operation, maintenance procedures, and special the techniques of setting various relays on the front panels.

- 2. Study various protective schemes employing protective relays.**
- 3. Perform calibration of electro-mechanical and static relays using calibrating equipment.**
- 4. Study the:-** Protection schemes used for Bus bar & its Protection, Alternators protection, Transformer protection, Feeder protection, Protecting relaying in a power house/grid station.
- 5. Study the Mechanical Designs, Operation and maintenance procedures for various types of circuit breakers, isolators, lightning arrestors.**

Note: All the reports, journals/assignments must be periodically checked by the teacher and presented for assessment to the examiner during final practical test.

Books:

1. Transmission & Distribution by Turan Gonen.
2. Transmission & Distribution by Ghulam Mohiud-Din.
3. Electrical Power System by C.L. Bhadwa.
4. A Course in Electrical Power by Soni Gupta.
5. Electrical Power by SL Uppal.
6. Construction Practice of Substations in India by R. Sabal.

INSTRUCTIONAL OBJECTIVES

TIME SCHEDULE

S.No.	Major Topics	No. of Periods	No. of Questions in Q. Paper
1.	Transmission		
	a. System choice & power factor	16	1½
	b. Transmission lines & conductor	16	1½
	c. Insulators & towers etc.	6	½
	d. Sag and under ground cables etc.	9	1
2.	Distributors	13	1½
3.	a. Power System	10	
	b. Reactor etc.	4	½
	c. Circuit Breakers Oil, Air, Vacuum, and gas type C.B. etc.	16	1½
	d. Isolator	2	1
4.	Protective devices	16	1½
5.	Protective systems	14	1
6.	Lightning arrester	6	½
	Total:	128	12

UNIT- 1

1. UNDERSTAND DIFFERENT ELEMENTS AND TYPES OF TRANSMISSION SYSTEMS.

- 1.1 Explain how transmission systems are classified with respect to different factors.
- 1.2 Explain the need of transmission and distribution lines.
- 1.3 Explain both supply systems (A.C. and D.C.)
- 1.4 Compare supply systems with their relative advantages and disadvantages.
- 1.5 Compare over head and underground transmission systems with respect to cost ease of maintenance and installation etc.
- 1.6 Explain effects of following on transmission line performance:
 - a) Supply frequency.

- b) Supply voltages
 - c) No of conductors.
 - d) Power factor.
- 1.7 Explain the effects of low power factor in industry and on performance of transmission lines.
 - 1.8 Choose correct method of improving of P.F.
 - 1.9 Solve problems on power factor improvement.
- 2. UNDERSTAND THE CONSTANTS AND EFFECTS OF TRANSMISSION LINES.**
- 2.1 State & Explain constants of transmission lines.
 - 2.2 Perform calculations on the constants of transmission lines.
 - 2.3 Explain effect of charging current on transmission lines.
 - 2.4 Explain the voltage drop in High Voltage transmission lines.
 - 2.5 Solve problems on voltage drop in short transmission lines.
 - 2.6 Define effects on transmission lines.
 - (a) Ferranti effect.
 - (b) Skin effect.
 - (c) Corona effect.
 - 2.7 Explain Kelvin's Economy Law of feeders.
- 3. UNDERSTAND THE TYPES AND USES OF INSULATORS USED IN TRANSMISSION & DISTRIBUTION LINES.**
- 3.1 Explain various insulators used in overhead high voltage transmission lines.
 - 3.2 State uses of each type.
 - 3.3 Explain various insulators used in medium and low voltage transmission/distribution line.
 - 3.4 Select proper insulators for given systems.
- 4. UNDERSTAND OVER-HEAD LINE CONDUCTORS.**
- 4.1 Name the conductors used in over-head lines.
 - 4.2 Compare various transmission line conductors.
 - 4.3 Select the most useful conductor for given situation.
 - 4.4 State the merits and demerits of different conductor materials.
- 5. UNDERSTAND THE CONSTRUCTION AND USES OF DIFFERENT POLES & TOWERS (LINE SUPPORTS).**
- 5.1 State the requirements of line supports.
 - 5.2 State the advantages & disadvantages of different line supports.
 - 5.3 Enlist the formula for the spacing of conductors.
 - 5.4 Explain the necessity of vibrators and dampers.

UNIT- 2

- 6. UNDERSTAND THE IMPORTANCE AND NEED OF SAG IN LINES.**
- 6.1 Define sag.
 - 6.2 State the factors effecting the sag.
 - 6.3 Write the minimum ground clearance at different locations.
 - 6.4 Write the formula of sag at same level.
 - (a) Under still air conditions.
 - (b) Under wind storm.

- (c) Under ice condition (snow fall).
 - 6.5 Enlist the demerits of loose sag.
 - 6.6 Solve the simple problems of sag.
- 7. UNDERSTAND THE NEED, TYPES, AND CHARACTERISTICS OF UNDERGROUND CABLES USED IN L.T/H.T CIRCUIT.**
- 7.1 Define cable.
 - 7.2 Compare over head lines with under ground cables.
 - 7.3 Explain necessity of underground cables.
 - 7.4 Enlist types of cables for LT/HT/E.H.T/H type/SL.type/HSL type/Gas filled.
 - 7.5 State the construction of different cables.
 - 7.6 Explain the characteristics and uses of each type.
 - 7.7 State the classification of cables according to.
 - (a) No. of conductors.
 - (b) Voltage.
 - (c) Insulation.
 - 7.8 Explain the stress produced due to tangential forces due to dielectric stress.
 - 7.9 Explain the causes of formation of voids in cables.
 - 7.10 Explain the methods of laying the under ground cables.
 - 7.11 Explain jointing methods for underground cables.
- 8. CONCEPT OF AC DISTRIBUTOR LOADS WITH THE HELP OF VECTOR DIAGRAMS AND ITS CALCULATIONS.**
- 8.1 Draw the Vector Diagrams of AC distributor loads.
 - 8.2 Calculations on Voltage drop in AC distributors.
 - 8.3 Define, Calculate the Voltage Regulation for AC Distributors.
 - 8.4 Solve the Numerical examples of a power loss in AC Distributors.
- 9. UNDERSTAND THE NEED AND WORKING OF BALANCER AND BOOSTERS.**
- 9.1 Define the Balancer.
 - 9.2 Define the booster.
 - 9.3 Explain the uses of Balancer.
 - 9.4 Explain the uses of Boosters.
 - 9.5 Solve simple problems of D.C balancer.
 - 9.6 Discuss the working of Boosting transformer.
- 10. UNDERSTAND THE TYPES, COMPONENTS AND SYSTEMS OF SUB-STATIONS.**
- 10.1 Explain the types of substations,
 - (a) Step up substation,
 - (b) Primary Grid substation,
 - (c) Secondary substation,
 - (d) Distributor substations.
 - 10.2 Explain the merits of indoor and out door substations.
 - 10.3 Enlist the equipment installed at a substation.
 - 10.4 Explain the necessity of various Bus Bar arrangements.
 - (a) Single Bus Bar.
 - (b) Double Bus Bar.
 - (c) Sectionizing Bus Bar.

- (d) Bus Bar coupler.
- 10.5 Describe the necessity of single C.B, one & half C.B. and double C.B-scheme.
- 10.6 Explain the necessity of neutral Point grounding.
- 10.7 Select the suitable grounding method for given system:
 - (a) Solid Grounding.
 - (b) Resistance Grounding.
 - (c) Reactance Grounding.
- 10.8 Explain advantages of neutral grounding.
- 10.9 Explain the advantages of interconnected power stations.
- 10.10 Draw the line diagram of Pakistan National Grid System of 500 KV, 220 KV, 132 KV.

UNIT-3

SWITCH GEAR:

11. UNDERSTAND SHORT CIRCUIT FAULT CONSIDERATIONS IN THE POWER SYSTEMS.

- 11.1 Draw the single line diagram of power system.
- 11.2 Write the formula of percentage reactance and percentage reactance at base KVA.
- 11.3 Solve the short circuit KVA at symmetrical fault (Simple Problems).
- 11.4 Solve the short circuit capacity of a Alternator in a system (Simple Problems).

12. UNDERSTAND THE NEEDS, TYPES AND LOCATIONS OF REACTORS.

- 12.1 Explain the necessity of reactors.
- 12.2 Explain the type of reactors from constructional point of view.
- 12.3 Propose the location of reactors in a system (Feeder, Bus Bar, Generator).
- 12.4 Point out the advantages & disadvantages of reactors.
- 12.5 Draw a diagram showing the reactor in a ring system, Tie-Bar system.

13. UNDERSTAND THE TYPES, CONSTRUCTION AND WORKING OF CIRCUIT BREAKERS.

- 13.1 Explain the theory of A.C Arc Interruption.
- 13.2 State the arc phenomena.
- 13.3 Enlist type of circuit breakers.
- 13.4 Explain working and construction of oil circuit breaker.
- 13.5 Discuss advantages and disadvantages of O.C.B.
- 13.6 Enlist the types of O.C.B, also discuss the comparison between each case.
- 13.7 Explain working and construction of air circuit breaker.
- 13.8 Discuss advantages and disadvantages of A.C.B.
- 13.9 Explain the types of A.C.B.
- 13.10 State rating of A.C.B.
- 13.11 Discuss the factors effecting on rating of A.C.B.
- 13.12 Explain working and construction of gas circuit breaker (SF₆).
- 13.13 Enlist advantages of G.C.B.
- 13.14 Discuss chemical, physical and dielectric properties of SF₆ gas.
- 13.15 Explain working and construction of vacuum circuit breaker.
- 13.16 Explain advantages of V.C.B.

14. UNDERSTAND WORKING AND USES OF ISOLATORS.

- 14.1 Explain working principle and need of Isolator.
- 14.2 State uses of Isolators.
- 14.3 Enlist types of Isolators.

UNIT-3.

PROTECTIVE DEVICES:

15. APPLY CONCEPTS FOR SELECTION OF PROPER FUSES FOR GIVEN LOADS.

- 15.1 Define the terms, fuse carrying, current fusing current protective current, cut-off current, total operating time, breaking capacity, fuse materials.
- 15.2 State fuse materials, with their characteristics.
- 15.3 Explain fuse factors and other factors effecting fusing current.
- 15.4 Explain arcing & pre-arcing (Melting) time.
- 15.5 Compare advantages and disadvantages of each type.
- 15.6 Enlist types of fuses.
- 15.7 Select fuses for given conditions.

16. APPLY CONCEPTS OF PROTECTIVE RELAYS FOR SELECTION AND SETTING.

- 16.1 Explain the necessity of protective relaying.
- 16.2 Define the requirements of relaying such as
 - a) Speed,
 - b) Selectivity,
 - c) Sensitivity,
 - d) Reliability,
 - e) Simplicity,
 - f) Economy.
- 16.3 Explain primary and backup protections.
- 16.4 Enlist classifications of relays w.r.t,
 - a) Construction and Principle.
 - b) Applications (uses)
 - c) Time of operation.
- 16.5 Describe construction and working of following relays.
 - a) Buchholz's.
 - b) Induction over current.
 - c) Induction reverse-power.
 - d) Induction directional over current.
 - e) Distance
 - f) Impedance
 - g) Beam
 - h) Frequency
 - i) Static (Electronic)
 - j) Amplitude Comparator.
 - k) Phase comparator relay.
 - l) Static over current.
 - m) Static distance.
 - n) Differential protection with current and voltage balance.

- 16.6 Draw protective schemes using relays.
 - 16.7 Explain the calibration procedure for relays.
 - 16.8 Explain the relay setting procedure for each type of relay
- 17. UNDERSTAND BUS BAR PROTECTION.**
- 17.1 Define and explain bus bar protection.
 - 17.2 Describe frame leakage protection.
 - 17.3 Explain circulating current protection.
 - 17.4 Perform relay settings
- 18. UNDERSTAND FEEDER AND TRANSMISSION PROTECTION.**
- 18.1 Define time grade protection.
 - 18.2 Explain differential protection.
 - 18.3 Draw and discuss feeder protection.
 - 18.4 Perform relay settings
- 19. UNDERSTAND ALTERNATOR PROTECTION.**
- 19.1 Explain alternator faults.
 - 19.2 Explain Merz-price systems of protection.
 - 19.3 Discuss balanced earth fault protection.
 - 19.4 Explain stator inter turn protection scheme.
 - 19.5 Describe protection for unbalanced loads.
 - 19.6 Perform relay settings
- 20. UNDERSTAND TRANSFORMER PROTECTION.**
- 20.1 Enlist transformer faults.
 - 20.2 Describe and draw merz-price system of transformer protection for Star-Delta, Star-Star, Delta-Star and Delta-Delta
 - 20.3 Explain over current and unrestricted earth faults protection schemes.
 - 20.4 Perform relay settings
- 21. UNDERSTAND LIGHTNING AND LIGHTNING ARRESTOR.**
- 21.1 Explain phenomena of Lightening.
 - 21.2 Define effect of lightening on electrical power system.
 - 21.3 Discuss about direct and indirect lightening strokes.
 - 21.4 Describe protection of HT lines and buildings with the help of ground wires.
 - 21.5 Enlist and explain following types of lightening arrestor.
 - a) Expulsion type,
 - b) Valve Type.
 - c) Horn (rod) gap type

ET 343(Rev.) TELECOMMUNICATION

Total Contact Hours

Theory	64		T	P	C
Practical	96	2	3	3	

AIM Based on sound principles of electrical and electronics engineering, this area has become the back bone of present day economy. Knowledge of state of the art equipment and practices such as digital communication have been included in this course.

COURSE CONTENTS

- 1 INTRODUCTION TO TRANSMISION MEDIA** 6 Hrs.
 - 1.1 Cable
 - 1.2 Optical fibre
 - 1.3 Air (Wireless communication)

- 2 TELEPHONY** 28 Hrs.
 - 2.1 Electro-Mechanical telephone.
 - 2.2 Components of telephone (transmitter, receiver, telephone bell, indicators, telephone relay, dial, induction coil)
 - 2.3 Block diagram of an electro-mechanical telephone.
 - 2.4 Side tone and anti-side tone circuits.
 - 2.5 Telephone exchanges (manual and automatic)
 - 2.6 Automatic telephone exchanges (Block diagram of E.M.D. (Edible Motor Drehauler and Digital)
 - 2.7 Electro-Mechanical telephone switching.
 - 2.8 Telephone trunking system.
 - 2.9 Routing signalling system.
 - 2.10 Block diagram of a Digital telephone.
 - 2.11 Pulse code modulation, frequency modulation, amplitude modulation.
 - 2.12 Principles of digital switching.
 - 2.13 Time division multiplexing (TDM) & Frequency division multiplexing (FDM).
 - 2.14 Store programme control (SPC) Exchange.
 - 2.15 Large scale electronic switching.
 - 2.16 P.C.M. based PABX (Block Diagram).
 - 2.17 N.W.D. system.
 - 2.18 I.S.D. system.
 - 2.19 Gate way exchange

- 3 OPTICAL FIBRE.** 12 Hrs.
 - 3.1 Components of optical fibers.
 - 3.2 Fibre-optics transmission system
 - 3.3 Use of optical fibers in telecommunication system
 - 3.4 Merits and Demerits.

- 4 MICROWAVE AND SATELLITE COMMUNICATION.** 18 Hrs.
 - 4.1 Microwave, frequency ranges in terms of bands
 - 4.2 Generation of microwave by Klystrons, Magnetrans and Travelling wave tubes (TWTs)

- 4.3 Microwave transmission lines
- 4.4 Inter linkage of telephonic exchanges through microwave
- 4.5 Block diagram of satellite communication
- 4.6 Function of earth satellite station
- 4.7 Function of geo-stationary satellite
- 4.8 inter linkage of telephonic exchange through satellite
- 4.9 Merit and demerit of satellite communication.

INSTRUCTIONAL OBJECTIVES

TIME SCHEDULE

S.No.	Major Topics	No. of Periods	No. of Questions in Question Paper
1.	Transmission Media	6	½
2.	Telephony		
	a. Electro-mechanical telephone and components	10	1
	b. Electro-mechanical switching		
	c. Digital switching	20	1½
	d. Digital telephone exchanges		
3.	Optical fibre		
	a. Components of optical fibre	10	1
	b. Transmission system		
4.	Microwave & Satellite Communication		
	a. Generation of microwave	8	1
	b. Microwave transmission		
	c. Interfacing microwave station with telephone exchange		
	d. Essentials of satellite communication	10	1
	e. Working telecommunication system through satellite		
	Total:	64	6

1 UNDERSTAND FUNDAMENTALS OF TRANSMISSION MEDIA.

- 1.1 Define Transmission Medium.
- 1.2 Name different types of transmission media.
- 1.3 Explain types of cables used as transmission medium.

2 UNDERSTAND THE TYPES, WORKING AND APPLICATIONS OF TELEPHONY.

- 2.1 Describe automatic telephone system
- 2.2 Explain the block circuit diagram of an electro-mechanical telephone
- 2.3 Describe the schematic diagram of side tone and anti side tone circuits
- 2.4 List the parts of an electro mechanical telephone set

- 2.5 Explain functioning of dialing, signalling, receiving and transmitting mechanisms
- 2.6 Describe manual exchange
- 2.7 Explain automatic exchange (EMD and digital)
- 2.8 Describe step by step impulsing switching
- 2.9 Explain working of electro-mechanical selectors (two-motion, uniselectors)
- 2.10 Describe trunking and routing signalling system
- 2.11 Explain demerits of manual exchange
- 2.12 Explain block diagram of a digital telephone
- 2.13 Describe waveform of pulse modulation
- 2.14 Explain waveform of frequency and amplitude modulation
- 2.15 Describe the principle of digital switching
- 2.16 Explain time division multiplexing
- 2.17 Describe the basic principle of SPC exchange
- 2.18 Describe block diagram of digital symmetrical matrix (DSD)
- 2.19 Explain programme control system/S.P.C. processor
- 2.20 Explain block diagram of PCM based PABX
- 2.21 Describe N.W.D. system
- 2.22 Explain I.S.D. system
- 2.23 Describe gate way exchange
- 3 OPTICAL FIBRE: UNDERSTAND THE FIBRE OPTICAL COMMUNICATION SYSTEM.**
- 3.1 Explain the transmitter and receiver
- 3.2 Describe the construction of fibre cable
- 3.3 Explain sources and detectors
- 3.4 Describe the fibre-optics transmission system
- 3.5 Explain the uses of optical fibers in telecommunication system
- 3.6 Enlist the merits and demerits of optical fibre communication
- 4 UNDERSTAND FUNDAMENTALS OF MICROWAVE AND SATELLITE COMMUNICATION SYSTEM.**
- 4.1 State microwave communication
- 4.2 Describe microwave frequency and microwave channel
- 4.3 Tabulate microwave frequency ranges in terms of bands
- 4.4 Explain generation of microwave by;
 - 4.4.1 Klystrons
 - 4.4.2 Magnetrons
 - 4.4.3 Travelling wave tubes (TWTS)
- 4.5 Describe microwave transmission line
- 4.6 Explain interfacing microwave station with telephone exchange
- 4.7 Describe block diagram of satellite communication system
- 4.8 Explain block diagram of earth satellite station
- 4.9 Describe the working communication of geo-stationery satellite
- 4.10 Explain telephone link via satellite

LIST OF PRACTICALS

- 1 Study the electro-mechanical telephone set and draw its block diagram
- 2 Study side-tone and anti-side tone circuits
- 3 Observe electro-mechanical telephone exchange switching system
- 4 Draw line diagram of 12 lines intercom set
- 5 Draw block diagram of digital telephone set**
- 6 Study generation of double side band AM with carrier present or suppressed**
- 7 Demodulation of double side band modulation with carrier
- 8 Observe frequency modulated carrier and measurement of frequency component when carrier is modulated by sinusoid**
- 9 Observe demodulation by an FM detection circuit**
- 10 Study of aerials**
- 11 Study of demodulation of binary coding of dc input levels for 3, 4 and 8 bit words in PCM
- 12 Investigate effects of sampling and TDM on analog wave form
- 13 Measurement of analyzing signal-to-noise in TDM
- 14 Demonstrate channel switching
- 15 Study power & current of LED
- 16 Determine fibre-photodiode coupling efficiency**
- 17 Determine Fibre-Fibre coupling efficiency
- 18 Study analog transmission by fibre optics
- 19 Study digital transmission by fibre optics
- 20 Draw block diagram of PCM based PABX
- 21 Visit microwave station
- 22 Study satellite receiving stations
- 23 Study a satellite receiving system
- 24 Study of microwave signal generators
- 25 Study of microwave wave guides
- 26 Install a home satellite dish system
- 27 Visit to a digital telephone exchange

RECOMMENDED BOOKS.

- 1 Telephony & Telegraphy by E.H. Jolley
- 2 Electronic Communication System by Gearge Kanady
- 3 Electronic Communication Techniques by Young
- 4 Electronics for Today & Tomorrow by Tom Duncan
- 5 Electronic Communication by Robert L. Shrader
- 6 Review of Digital Communication by J. Dos
- 7 Communication Engineering Journal by TecQuipment Ltd., Nottingham, England

ET-353 REPAIR AND MAINTENANCE OF ELECTRICAL EQUIPMENT

Total Contact Hours		T	P	C
Theory	32	1	6	3
Practical	192			

- AIMS**
1. Understand different faults in Electrical Equipment, Machines and Appliances.
 2. Undertake repair work on various electrical appliances and equipment safely.
 3. Schedule routine and preventive maintenance for a given installation.

COURSE CONTENTS

1	FUNDAMENTALS OF ELECTRICAL MAINTENANCE.	3 Hrs.
1.1	Scheduled maintenance	
1.2	Minor repairs	
1.3	Major repairs, overhauls	
1.4	Tools and Equipment used for repair work.	
1.5	Safety rules to be observed during repair work	
2	COMMON FAULTS OF STARTERS AND SPEED CONTROLLERS.	3 Hrs.
2.1	Direct on line magnetic starter	
2.2	Star Delta Starter (Manual and Automatic)	
2.3	3 point D.C. motor starter	
2.4	4 point D.C. motor starter	
2.5	Speed controllers for D.C. motors.	
2.6	Testing	
3	FAULTS THEIR CAUSES AND REMEDIES OF A.C. 3 PHASE MOTORS.	4 Hrs.
3.1	Squirrel Cage Induction motor	
3.2	Wound Rotor Induction motor	
3.3	Synchronous motor	
3.4	Testing	
4	FAULTS THEIR CAUSES AND REMEDIES OF SINGLE PHASE A.C. MOTORS.	3 Hrs.
4.1	Split phase motors (capacitor start and capacitor run motors)	
4.2	Universal motors	
4.3	Synchronous motors.	
4.4	Testing	
5	DIRECT CURRENT MOTORS; THEIR FAULTS, CAUSES AND REMEDIES.	4 Hrs.
5.1	D.C. series motor	
5.2	D.C. shunt motor	
5.3	D.C. compound motor.	
5.4	Testing	
6	DIRECT CURRENT GENERATORS THEIR FAULTS, CAUSES AND REMEDIES.	3 Hrs.
6.1	D.C. series generator	
6.2	D.C. shunt generator	

6.3	D.C. compound generator.	
6.4	Testing	
7	FAULTS, THEIR CAUSES AND REMEDIES OF ALTERNATORS.	2 Hrs.
7.1	3 phase salient pole type	
7.2	3 phase non salient pole type (Smooth Cylindrical type)	
8	FAULTS THEIR CAUSES AND REMEDIES OF TRANSFORMERS.	3 Hrs.
8.1	3 phase power transformer oil cooled	
8.2	Air cooled transformers, 1-phase and 3-phase	
8.3	Auto transformer	
9	FAULT THEIR CAUSES AND REMEDIES OF HOUSE HOLD APPLIANCES.	5 Hrs.
9.1	Automatic Electric Iron	
9.2	Toaster	
9.3	Refrigerator	
9.4	Air conditioner	
9.5	Washing Machine	
9.6	Cooking oven	
9.7	Safety	
10	BATTERIES, THEIR FAULTS, CAUSES AND THEIR REMEDIES.	2 Hrs.
10.1	Lead Acid Battery	
10.2	Alkaline Battery	
10.3	Safety which using acids	

** Students must prepare theory and practical note books and get then checked weekly by the concerned teacher. They should produce these to external exam for sessional work/marking check up at the time of final exam.

ET-353 REPAIR AND MAINTENANCE OF ELECTRIC EQUIPMENT

INSTRUCTIONAL OBJECTIVES

TIME SCHEDULE

S.NO.	TOPICS	NO. OF PERIODS	NO. OF QUESTIONS	
1.	Fundamentals of Electrical Maintenance	3	½	
2.	Faults causes and their remedies			
	a. Motor starter and speed controllers	3	½	
	b. A.C. Motors	(B-1) Three Phase	4	½
		(B-2) Single Phase	3	½
		c. D.C. Motors	4	½
	d. D.C. Generator	3	½	
	e. Alternator	2	½	
	f. Transformer	3	½	
	g. House Hold Appliance	5	½	
	h. Lead Acid Battery	2	½	
	Total:	32	5	

1 UNDERSTAND THE NEED AND TYPES OF MAINTENANCE OF ELECTRICAL EQUIPMENT.

- 1.1 Compare routing maintenance and general overhaul
- 1.2 Explain maintenance schedule
- 1.3 Differentiate between minor and major repair
- 1.4 Enlist the tools and instruments necessary for an electrical maintenance shop
- 1.5 Sketch the single line diagram of maintenance shop
- 1.6 Demonstrate use of testing tools and testing equipment

2 APPLY THE KNOWLEDGE ABOUT THE FAULTS, CAUSES AND REMEDIES OF MOTOR STARTERS AND CONTROLLERS.

- 2.1 Identify the parts of a Direct on line magnetic starter, star delta starter
- 2.2 Describe the parts of 3 point and 4 point D.C. starters and D.C. motor controllers
- 2.3 Explain the faults, their causes and remedies starters and controllers.
- 2.4 Perform maintenance on starters and controllers

3 UNDERSTAND FAULTS, CAUSES AND REMEDIES OF A.C. 3 PHASE MOTORS.

- 3.1 Enlist the faults their causes and remedies of squirrel cage 3 phase A.C. motor and wound rotor motor.

- 3.2 Identify the faults, their causes and remedies of 3 phase synchronous motor.
 - 3.3 Explain common tests to locate faults in A.C. motors stators.
 - 3.4 State the mechanical faults in A.C. motors.
 - 3.5 Perform maintenance work on AC 3-phase motors
- 4 APPLY THE KNOWLEDGE OF THE FAULTS, CAUSES AND REMEDIES OF A.C. SINGLE PHASE MOTORS.**
- 4.1 Explain the faults, causes and remedies of single phase capacitor start motors.
 - 4.2 Explain the faults, causes and remedies of single phase capacitor run motors.
 - 4.3 Explain the faults, causes and remedies of universal motors.
 - 4.4 Prepare the list of faults, causes and remedies of single phase synchronous motors.
 - 4.5 Perform maintenance work on AC single phase motors.
- 5 UNDERSTAND THE FAULTS, CAUSES AND THEIR REMEDIES OF D.C. MOTORS.**
- 5.1 Explain the various tests to be carried out for locating the faults in armature.
 - 5.2 Enlist the faults, causes and remedies of series, shunt and compound motors.
 - 5.3 Perform maintenance on DC Motors
- 6 UNDERSTAND THE FAULTS AND REMEDIES OF D.C. GENERATORS.**
- 6.1 Describe the causes of failure of the building up process in D.C. Generator.
 - 6.2 Explain the methods for control of armature reaction in D.C. machines.
 - 6.3 Explain the fault, causes and remedies of D.C. generators.
 - 6.4 Perform maintenance work on DC generators
- 7 UNDERSTAND FAULTS, CAUSES AND REMEDIES OF ALTERNATORS.**
- 7.1 Explain the effect of speed and weakening of main magnetic field on Emf of an alternator.
 - 7.2 Prepare list of faults, causes and remedies of Brushless alternators.
 - 7.3 Enlist the common faults of salient and cylindrical rotor alternators.
 - 7.4 Perform maintenance work on alternators
- 8 UNDERSTAND THE FAULTS, CAUSES AND THEIR REMEDIES OF TRANSFORMER.**
- 8.1 Explain the methods of testing transformer oil and its reconditioning.
 - 8.2 Explain the test of presence of moisture in silica gel and its drying method.
 - 8.3 Identify the faults, causes and remedies of three phase power transformer.
 - 8.4 Enlist the faults and remedies of on load and off load tap changer.
 - 8.5 Perform maintenance work on oil and air cooled transformer
- 9 UNDERSTAND THE FAULTS AND THEIR REMEDIES OF HOUSE HOLD APPLIANCES.**
- 9.1 Explain the function of thermostat and its faults in an electric iron.
 - 9.2 Enlist the general faults and their remedies of automatic electric iron.
 - 9.3 Enlist the major faults in fans and their remedies.
 - 9.4 State the common faults with causes in Refrigerators and Air conditioners and their remedies.
 - 9.5 Explain the faults in components of a washing machines and their rectification.
 - 9.6 State the defects in electric cooking oven and their remedies.
 - 9.7 Explain the defects and their remedies in water heaters
 - 9.8 Explain the common defects and their remedies in kitchen appliances.
- 10 UNDERSTAND THE MAJOR FAULTS, CAUSES AND THEIR REMEDIES OF ACCUMULATORS.**

- 10.1 Explain the method of preparing and checking gravity of an electrolyte.
- 10.2 Describe the different methods of battery charging.
- 10.3 Explain the faults, causes and remedies of lead acid and alkaline batteries.

ET-353 REPAIR AND MAINTENANCE OF ELECTRICAL EQUIPMENT

LIST OF PRACTICALS

- 1 Draw the Layout of Repair shop and also prepare a safety chart.
- 2 Prepare the list of tools and equipment used in Electrical repair shop.
- 3 Rewind and replace a hold-on coil of D.C. Motor Starter. This should include Varnishing & baking of coil. Also Polish the contact points of the starter and perform its general maintenance. Maintenance of timers/over load relays installed in starters should also be done.
- 4 Repair & general overhauling and maintenance of
 - 4.1 Direct on the line starter
 - 4.2 Star Delta starter
 - 4.2.1 Non automatic
 - 4.2.2 Automatic
 - 4.3 Auto transformer starter
 - 4.3.1 Non Automatic
 - 4.3.2 Automatic
 - 4.4 D.C. motor starters
 - 4.4.1 3 point starter
 - 4.4.2 4 point starter
 - 4.5 Automatic D.C. motor starter
- 5 Pull out a bearing of a motor and replace it after cleaning and greasing.
 - 5.1 Replace a bush bearing.
- 6 Polarity testing of stator winding of a 3 phase motor i.e. no of poles/phase and their position.
- 7 Repair, over hauling and maintenance of
 - 7.1 Three phase squirrel cage induction motors.
 - 7.2 Three phase wound rotor induction motors.
 - 7.3 Three phase synchronous motor induction motors.
 - 7.4 Single phase capacitor start.
 - 7.5 Single phase capacitor run motor.
 - 7.6 Single phase shaded pole motor.
 - 7.7 Single phase universal motor.
 - 7.8 Single phase synchronous motor.
- 8 Pony Brake Load Test of a Repaired Motor.
 - 8.1 Dynamic Brake Test of a Repaired Motor.
- 9 Repair, overhauling and maintenance of DC motors and generators.
 - 9.1 Polarity marking of D.C. Motor/Generator.
 - 9.2 Repair and Polishing of D.C. commutator trueing of brush.
 - 9.3 General overhauling and maintenance of
 - 9.3.1 D.C. motors
 - 9.3.2 D.C. generators

- 9.4 Armature and field winding testing by Growler.
- 10 Test the sample of oil by:
 - 10.1 Oil Tester
 - 10.2 Copper Sulphate
- 11 Take out the silica gel from a oil cooled transformer and recondition it.
- 12 Recondition the oil of a transformer.
- 13 General repair and over hauling of a oil cooled transformer.
- 14 Testing & calibrating an energy meter
- 15 Repair, over hauling, maintenance and assembling of
 - 15.1 Electric Iron
 - 15.2 Pedestal Fan
 - 15.3 Ceiling Fan
 - 15.4 Kitchen Grinder
 - 15.5 Juicer
 - 15.6 Water Heater
 - 15.7 Kitchen Oven
 - 15.8 Air Conditioner
 - 15.9 Refrigerator
- 16 Preparation of Electrolyte for Battery charging.
 - 16.1 Charging a Battery with
 - 16.1.1 Constant current method
 - 16.1.2 Constant voltage method

RECOMMENDED BOOKS:

1. Repair and Maintenance of Electrical Equipment by Stafford.
2. Testing and Connecting D.C. Motors by Annet.
3. Repair of Electrical Appliances by A.I.O.U.

ET-364(Rev.) DIGITAL & INDUSTRIAL ELECTRONICS

Total contact hours:		T	P	C
Theory	96	3	3	4
Practical	96			

AIM This course is aimed to provide sufficient knowledge in digital and industrial electronics so as to make the student capable of working with control systems employing these two technologies. Students should be able to understand and assemble functional projects in digital electronics. As the application of solid state electronics in the control of electrical systems is increasing rapidly, the 2nd half of this course provides reasonable knowledge of power electronics including control of AC/DC motors, synchro-servo system etc. concepts and applications of Programmable Logic Controllers (PLC) have also been included.

PART-I

DIGITAL ELECTRONICS

- 1 **INTRODUCTION.** 3 Hrs.
 - 1.1 Comparison of digital and analogy quantities
 - 1.2 Review of Number Systems
 - 1.3 BIT, BYTE, NIBBLE and WORD
 - 1.4 Laws and Rules Boolean Algebra

- 2 **LOGIC GATES (ALL INCLUDE LOGIC, TRUTH TABLE AND TTL CIRCUITRY)** 3 Hrs.
 - 2.1 NOT (Inverter)
 - 2.2 OR
 - 2.3 AND
 - 2.4 NAND
 - 2.5 NOR
 - 2.6 XOR
 - 2.7 XNOR
 - 2.8 Application of Gates.

- 3 **ARITHMETIC LOGIC CIRCUITS(INCLUDING LOGIC AND CIRCUITY).** 3 Hrs.
 - 3.1 Half adders
 - 3.2 Full adders
 - 3.3 Half and full subtractor
 - 3.4 Comparators

- 4 **COMBINATIONAL LOGIC AND DATA PROCESSING CIRCUITS.** 3 Hrs.
 - 4.1 Decoders
 - 4.2 BCD-to-Decimal Decoders (such as 7445)
 - 4.3 Seven-Segment Decoders and Displays
 - 4.4 Encoders(IC's such as 74147)
 - 4.5 Multiplexers and logic (IC's such as 74150)
 - 4.6 De-Multiplexers (IC's such as 74154)

- 5 **LATCHES AND FLIP-FLOPS.** 4 Hrs.

	5.1	RS Latch	
	5.2	Clocked RS Flip-Flop	
	5.3	D Flip-Flop	
	5.4	JK Flip-Flop	
	5.5	T-Flip-Flop	
6		CLOCKS & TIMERS.	4 Hrs.
	6.1	TTL Clock	
	6.2	555 - astable, monostable	
	6.3	Applications	
7		SHIFT REGISTERS.	3 Hrs.
	7.1	Introduction, shift-Right and shift Left	
	7.2	Serial in-serial out	
	7.3	Serial-in parallel-out	
	7.4	Parallel-in serial-out	
8		COUNTERS.	3 Hrs.
	8.1	Introduction, types	
	8.2	Asynchronous counter	
	8.3	2-BIT, 3-BIT, Decade, Asynchronous counter	
	8.4	Synchronous Counter	
	8.5	2-BIT, 3-BIT, Decade Synchronous counters	
9		MEMORIES.	3 Hrs.
	9.1	Introduction, volatile, non-volatile,	
	9.2	ROM, Types of ROM	
	9.3	RAM, Types of RAM	
10		D/A AND A/D CONVERTERS.	4 Hrs.
	10.1	Introduction	
	10.2	D/A converter	
	10.3	A/D converter	

PART-II

INDUSTRIAL ELECTRONICS

- | | | |
|-----------|--|--------|
| 1. | POWER DIODES & THYRISTORS. | 6 Hrs. |
| | 1.1 Construction, ratings and characteristics of power diodes | |
| | 1.2 Series & parallel operation of power diodes | |
| | 1.3 Review of SCR, its characteristics | |
| | 1.4 SCR phase control | |
| | 1.5 Series & parallel operation of SCR's | |
| 2. | CONTROLLED RECTIFIERS (1-PHASE & 3-PHASE) | 8 Hrs. |
| | 2.1 Basic controlled rectifier circuits | |
| | 2.2 Forced commutated controlled rectifier circuit (1-Phase & 3-Phase) | |
| | 2.3 Naturally commutated controlled rectifier circuit (1-Phase & 3-Phase) | |
| 3. | INVERTERS. | 7 Hrs. |
| | 3.1 1-Phase full-wave inverter circuit | |
| | 3.2 3-phase full-wave bridge circuit as a line-commutated inverter | |
| | 3.3 Four quadrant control | |
| 4. | CONTROL OF DC & AC MOTORS. | 8 Hrs. |
| | 4.1 DC motor speed control system | |
| | 4.2 3-phase full-wave controlled rectifier circuit to control DC motors | |
| | 4.3 1-phase full-wave controlled rectifier circuit to control DC motor | |
| | 4.4 Introduction to speed control of induction motors | |
| | 4.5 SCR cyclo-converter. | |
| | 4.6 Open-loop & closed-loop induction motor speed control. | |
| 5. | SYNCHRO-SERVO SYSTEMS. | 8 Hrs. |
| | 5.1 Synchro-generator and synchro-motor | |
| | 5.2 Differential synchro | |
| | 5.3 AC & DC servo-mechanism | |
| | 5.4 Servo motors, characteristics & uses | |
| 6. | PROGRAMMABLE LOGIC CONTROLLER | |
| | Dedicated PLC's. | 5 Hrs. |
| | 6.1 Introduction to PLC's | |
| | 6.2 ladder logic inputs, ladder logic outputs, symbols | |
| | 6.3 Input and output modules | |
| | 6.4 Relays, Timers and counters | |
| | 6.5 Modes of operation | |
| | 6.6 Ladders and Rungs | |
| | 6.7 Multiple contacts | |
| | 6.8 Use of A/D and D/A converters | |
| | 6.9 Programming and operation of simple motor control circuits for given ladder logic. | |
| | Computer Software Control. | 5 Hrs. |

- 6.10 Ladder relay instructions
- 6.11 Ladder timer instructions
- 6.12 Ladder counter instructions

INSTRUCTIONAL OBJECTIVES

TIME SCHEDULE

S.No.	Major Topics	No. of Periods	No. of Question in Q.Paper
PART-I: DIGITAL ELECTRONICS			
1.	Logic Gates	4	½
2.	Arithmetical circuits	6	1
3.	Combinational logic	6	1
4.	Data Processing circuits	6	1
5.	Flip-Flop	6	1
6.	Clocks and Timers	4	½
7.	Sift-Registers	3	1
8.	Counters	6	1
9.	Memories	3	½
10.	D/A AND A/D converters	4	½
	Sub-Total:	48	8
PART-II: INDUSTRIAL ELECTRONICS			
1.	Power Diodes & Thyristors	6	½
2.	Phase controlled rectifiers	8	1
3.	Invertors	8	1
4.	Control of DC and AC motors	8	1
5.	Synchro-Servo System	8	1
6.	Programmable logic controllers		
	a. Fundamental	5	1
	b. Programming logic	5	1/2
	Sub-Total:	48	6
	Grand Total:	96	14

PART-I

DIGITAL ELECTRONICS.

- 1 KNOW BASIC TERMS RELATED TO DIGITAL ELECTRONICS.**
 - 1.1 State in a tabulated form the merits and demerits of analog & digital quantities
 - 1.2 Define basic terms related to digital electronics.

- 2 UNDERSTAND THE WORKING OF LOGIC GATES, USING TRUTH TABLES AND TTL CIRCUITRY.**
 - 2.1 Define the logic gates NOT, OR, AND, NAND, NOR, XOR, XNOR.
 - 2.2 Draw truth tables for the logic gates, showing symbols and equations.
 - 2.3 Explain logic gates, using TTL circuitry.

- 3 UNDERSTAND ARITHMETIC CIRCUITS FOR LOGIC CIRCUIT ELEMENTS.**
 - 3.1 Define elements of arithmetic logic circuits: half-adder, full-adder, subtractor, comparators.
 - 3.2 Explain the operation of arithmetic logic circuits (as above), using symbols, and block-diagram.
 - 3.3 Explain the inter-connection and inter-conversion of arithmetic logic circuits

- 4 UNDERSTAND THE WORKING AND USES OF COMBINATIONAL LOGIC CIRCUITS, INCLUDING DATA PROCESSING CIRCUITS.**
 - 4.1 Define the terms multiplexers, demultiplexers, decoders, encoders.
 - 4.2 Explain multiplexers, using logic circuits & block-diagrams (multiplexers using IC's such as 74150).
 - 4.3 Explain Demultiplexers using block-diagrams (using IC's such as 74154).
 - 4.4 Explain using block diagram, BCD and its conversion to Decimals, using IC's, such as 7445.
 - 4.5 Explain seven segments decoders, showing block diagrams, giving examples for letters & digits.
 - 4.6 Describe the operation of combinational logic circuits as applied to data processing circuits.
 - 4.7 Explain the working of 7-segment display circuit

- 5 UNDERSTAND FLIP-FLOPS AS ELEMENTS OF DIGITAL LOGIC CIRCUITS, USING BLOCK DIAGRAMS.**
 - 5.1 Define Latch flip-flops & triggers.
 - 5.2 State different types of flip-flops at triggers
 - 5.3 Explain various flip-flops (RS, Clocked RS, D, JK and T), using block diagrams for describing their functions.
 - 5.4 Describe the functions of Edge trigger circuits, with the help of circuit diagram.

- 6 UNDERSTAND THE WORKING OF CLOCKS & TIMERS FOR APPLICATIONS IN DIGITAL LOGIC CIRCUITS.**
 - 6.1 Define timers, clocks, enlisting their types
 - 6.2 Explain with the help of block diagram, the TTL Clock
 - 6.3 Explain 555 timer, describing its use as astable and monostable multivibrators
 - 6.4 Give examples of the use of clocks and timers for digital circuits, showing block diagrams.

- 7 EXPLAIN THE FUNCTION OF SHIFT REGISTERS, USING BLOCK DIAGRAMS.**
 - 7.1 Define shift-registers, stating its various types
 - 7.2 Describe the function of the following shift registers, using block-diagrams:-
 - 7.2.1 Serial-in, serial-out (SISO)
 - 7.2.2 Serial-in, parallel-out (SIPO)
 - 7.2.3 Parallel-in, serial-out (PISO)
 - 7.2.4 Parallel-in, parallel-out (PIPO)
 - 7.3 Explain shift-Right and Shift-Left registers

- 8 UNDERSTAND DIGITAL COUNTERS & CLOCK USING BLOCK DIAGRAMS.**
 - 8.1 Enlist various types of counters
 - 8.2 Describe various types of counters using block diagram (Asynchronous, synchronous).

- 8.3 Explain working 2-BIT, 3-BIT, Decade Asynchronous Counters.
- 8.4 Explain working of 2-BIT, 3-BIT, Decade Synchronous Counters.

9 KNOWS VARIOUS TYPES OF MEMORIES.

- 9.1 Define various types of memories: ROM, PRM, EPROM, RAM.
- 9.2 State memory of common memory devices in KB, MB.
- 9.3 Know the system of memory addressing.

10 UNDERSTAND INTERCONVERSION OF ANALOG AND DIGITAL SIGNALS, USING BLOCK DIAGRAMS.

- 10.1 State need for D/A and A/D conversion.
 - 10.2 Describe the system of D/A conversion using block diagram.
 - 10.3 Explain the system of A/D conversion, using block diagram.
 - 10.4 Give example of a simple system from analog input to analog output, using A/D & D/A converters.
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PART-II

INDUSTRIAL ELECTRONICS

11 UNDERSTAND THE WORKING OF POWER DIODES AND THYRISTORS.

- 11.1 State the ratings of power diodes and SCR.
- 11.2 Explain characteristics of power diodes
- 11.3 Explain the series & parallel operation of power diodes
- 11.4 Draw and explain characteristics of SCR.
- 11.5 Describe the phase control and resulting output of SCR.
- 11.6 Explain series & parallel operation of SCRs.

12 UNDERSTAND THE OPERATION OF PHASE CONTROLLED RECTIFIERS & CONVERTERS, WITH THE HELP OF CIRCUIT AND WAVE DIAGRAMS.

- 12.1 State various methods of phase control for SCRs.
- 12.2 Explain with the help of circuit and wave diagrams the operation of controlled rectifier.
- 12.3 Explain the natural commutation and forced commutation in 3-phase and 1-phase rectifiers.
- 12.4 Explain the operation of half and full-wave naturally commutated converters.

13 UNDERSTAND SINGLE AND THREE PHASE FULL-WAVE CONVERTER/INVERTER.

- 13.1 Draw circuit for 1-phase and 3-phase full-wave inverter circuit.
- 13.2 Explain the working of inverter circuit (1-phase & 3-phase)
- 13.3 Explain the line commutated (single and three phase) inverter with full-wave output.
- 13.4 Know the combined operation of rectifier and inverter as four quadrant control of a converter.

14 UNDERSTAND THE USE OF POWER ELECTRONICS FOR CONTROL OF A.C./D.C. MOTORS - UNDERSTAND THE USE OF DIODES & SCRs CONNECTED FOR 1-PHASE & 3-PHASE, FOR SPEED CONTROL OF D.C. MOTORS.

- 14.1 State the methods of speed control of DC motors.
- 14.2 Explain the speed control of DC motors employing 3-phase full-wave controlled rectifier circuits.
- 14.3 Describe the speed control of DC motors employing 1-phase fully controlled rectifier circuit, with the help of circuit and waveform.
- 14.4 Draw circuit for a 3-phase fully phase controlled, 4-quadrant speed control of DC motors.

17. UNDERSTAND USE OF POWER ELECTRONICS FOR CONTROL OF AC MOTORS.

- 17.1 State methods of AC Motors Control.
- 17.2 Draw circuit, and waveform for 3-phase AC variable output voltage employing semi-conductor devices.
- 17.3 Draw block diagram and waveform for cyclo-converters giving 1-phase and 3-phase variable frequency output.
- 17.4 State the use of SCR cyclo-converters for speed control of AC motors.
- 17.5 Draw and explain the open-loop speed control of electric motors.
- 17.6 Draw and explain the closed-loop speed control of motors.

18 UNDERSTAND WORKING AND USES OF SERVO AND SYNCHRO SYSTEMS.

- 18.1 Define synchro-generator, synchro motor, types of synchro-servo mechanism.
- 18.2 Draw and explain diagram showing use of synchro-generator and synchro-motor.
- 18.3 Describe the differential synchros.
- 18.4 Draw and explain block and circuit diagrams for AC and DC systems of servo mechanism.
- 18.5 Explain characteristics and industrial applications of servo-motors.

19 UNDERSTAND THE USE OF PLC'S FOR A GIVEN LADDER-LOGIC CONTROL.

- 19.1 Explain the working of PLC's
- 19.2 Explain the uses of PLC in industrial control

- 19.3 Define the terms: ladder logic, input logic output of PLC's.
- 19.4 Write the codes for the input-output devices for a given logic.
- 19.5 Know the various modes of operation for PLC's.
- 19.6 Converts the given ladder logic diagram of a control problem into its components as inputs, outputs, logic elements & numbering the logic elements.
- 19.7 Know method for sequencing multi-rung circuits into sequenced sections for additional capacity of PLC.
- 19.8 Know the use of A/D & D/A converter for use alongwith a given ladder logic diagram.
- 19.9 Know the use of timers, sequential registers and other multi-contact logic devices.

20. UNDERSTAND USE OF COMPUTER SOFTWARE FOR LADDER LOGIC CONTROL.

- 20.1 How to write a ladder instructions for a relay logic.
- 20.2 How to write a ladder instructions for a timer logic.
- 20.3 How to write a ladder instructions for a counter logic.

LIST OF PRACTICALS

- 1 Identify and verify truth tables for AND, OR, NOT Gates IC's
- 2 Identify and verify truth tables for NOR, NAND, XOR, XNOR, Gates IC's
- 3 Construct and verify truth tables for half adder, full adder, subtractor
- 4 Study multiplexing and demultiplexing circuits
- 5 Construct and verify decoder circuit using 74-series IC
- 6 Construct seven-segment decoder circuit and verify its function
- 7 Construct and verify the functions of Latch using NAND, NOR Gates.
- 8 Construct and verify the functions of Clocked RS Flip-Flop
- 9 Construct and verify the functions of D Flip-Flop
- 10 Construct and verify the functions of JK Flip-Flop
- 11 **Connect a 555 IC as**
 - 11.1 **Astable multivibrator**
 - 11.2 **Monostable multivibrator**
 - 11.3 **Bistable multivibrator**
- 12 **Connect and observe the working of shift registers (SISO, SIPO, PISO, PIPO).**
- 13 **Identify, connect and observe working of ripple and synchronous counters**
- 14 **Connect and observe working of D/A and A/D converters**
- 15 **Assemble and observe working of frequency counter**

INDUSTRIAL ELECTRONICS

- 16 Study the characteristics and series-parallel working of power diodes
- 17 Demonstrate SCR phase control
- 18 Observe the characteristics & working of forced commutated controlled-rectifier circuits
- 19 Observe the characteristics and working of naturally commutated full-wave convertors
- 20 Construct and study working of 1-phase full-wave inverter circuit
- 21 Construct and study working of 3-phase full-wave inverter
- 22 Study 3-phase full-wave control circuit for DC motors
- 23 Study working of AC to AC convertors as AC motor speed controller
- 24 Study working of SCR cyclo-converter
- 25 Study open & closed loop induction motor speed control
- 26 Study characteristics and working of synchro-generator and synchro-motors
- 27 Study characteristics & working of servo-motors.
- 28 Study of given process and development of ladder diagrams
- 29 Developing software for a given ladder diagram and inputting it
- 30 Application of PLC to practical control applications
- 31 Use of computer software for practical control applications.

TEXT/REFERENCE BOOKS

- 1 Digital Electronics by Malvino
- 2 Electronics in Industry by Chute
- 3 Digital Fundamentals by FLOYD
- 4 Power Electronics by B.W. Williams
- 5 Power Electronics & Controls, Samir Datta
- 6 Trade Literature on PLC and their Applications
- 7 Allen Bradley: Mini-Programmable Controllers Programming and Operation Manual
- 8 Programmable Logic Controllers by Mike Birmingham and Keith Brown