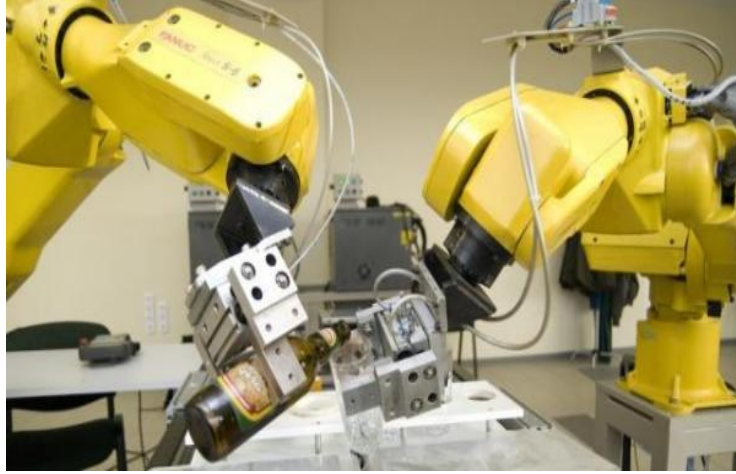# Curriculum for 3-Years'DAE in
Mechatronics Technology
CCTE (2+1) Sino-Pak Joint Education, Dual Diploma

Technical Education and Vocational Training Authority, Lahore. (TEVTA-Punjab)

Submitted By:

TEVTA-Punjab Faculty Members and Zibo Vocational College, China experts

Developed August, 2023

SCHEME OF STUDIES
Sino-Pak 3-Years' Dual Diploma CCTE (2+1) programe in MECHATRONICS Technology

CODE	TITLE	T	P	C
YEAR -I				
GEN-111	Islamiat & Pakistan Studies	1	0	1
ENG-112	English	2	0	2
GENC- 112	Chinese Language-I	2	0	2
MATH-123	Applied Mathematics-I	3	0	3
PHY-122	Applied Physics	1	3	2
CH-112	Applied Chemistry	1	3	2
MTRC-113	Basic Engineering Drawing & CAD-I	1	6	3
COMPC-112	Introduction to Computer Studies & Programming	1	3	2
MTRC-121	Introduction to Mechatronics	1	0	1
MTRC-133	Electrical Essentials	2	3	3
MTRC-143	Workshop Practice (a) Metal Work and Machining (b) Wood Working (c) Welding	1	6	3
MTRC-151	Occupational Health Safety & Environment	1	0	1
	Total	**15**	**24**	**23**

CODE	TITLE	T	P	C
YEAR -II				
GEN-201	Islamiat & Pakistan Studies	1	0	1
MATH-212	Applied Mathematics-II	2	0	2
GENC-212	Chinese Language-II	2	0	2
MGMC-212	Understanding China	2	0	2
MGM-212	Business Communication & Report Writing	1	3	2
MTRC-202	Engineering Materials	1	3	2
MTRC-212	Drives & Linkages	1	3	2
MTRC-222	Sensors & Actuators	1	3	2
MTRC-233	Motors & Generators	2	3	3
MTRC-253	Measuring Instruments	2	3	3
MTRC-263	Electronic Devices & Circuits	2	3	3
MTRC-272	Digital Logic Design	2	3	3
	Total	**15**	**24**	**23**

	YEAR- III				
CODE	TITLE	T	P	C	Taught by
GEN-301	Islamiat & Pakistan Studies	1	0	1	GCT-
MGMC-311	Intelligent production and management	1	0	1	ZBVI
MTRC-313	Digital Design and Simulation of Production Line	2	3	3	ZBVI
MTRC-321	Hydraulics& Pneumatics	1	0	1	ZBVI
MTRC-333	Programmable Logic Controllers	2	3	3	ZBVI
MTRC-343	Micro controller Application Technology	2	3	3	ZBVI
MTRC-353	Fundamentals of Industrial Robotics	2	3	3	ZBVI
MTRC-361	Overview of Artificial Intelligence	1	0	1	ZBVI
MTRC-372	Programming and practical training of CNC machine tools	1	3	2	ZBVI
MTRC-383	Mechanical and Electrical Comprehensive Training	2	3	3	ZBVI
MTRC-392	Project	0	6	2	ZBVI
	Total	**15**	**24**	**23**	

YEAR - 1

ی	پی	سی	GEN III	حصہ اول اسلامیات
1	0	1		حصہ دوم مطالعہ پاکستان

موضوعات حصہ اول اسلامیات   سال اول   کل وقت: 20 گھنٹے

کتاب و سنت

الف) قرآن مجید

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

1.1   تنالوا البر حتی تنفقوا مما تحبون

1.2   واعتصموا بحبل اللّٰہ جمیعاً ولا تفرقو

1.3   ولا یجرمنکم شنان قوم علی ان لا تعدلوا

1.4   ان اللّٰہ یامرکم ان تودوا الامانات الی اھلھا

1.5   ان اللّٰہ یامر بالعدل والاحسان

1.6   ان الصلوٰۃ تنھی عن الفحشاء والمنکر

1.7   لقد کان لکم فی رسول اللّٰہ سوۃ حسنۃ

1.8   ان اکرمکم عند اللّٰہ اتقاکم

1.9   وما اٰتاکم الرسول فخرزوو ما نھی عنھوا انتھوا

1.10 واوفو بالعھد

1.11 وماشروھن بالمعروف

1.12 یمحق اللّٰہ الربوو یربی الصدقات

1.13 واصبر علی ما اصابک

1.14 وقولوا قولا سدیدا

1.15 ان الدین عند اللّٰہ السلام

ب) سنت

1-   سنت کی اھمیت

2-   دس منتخب احادیث مع ترجمہ و تشریح

1- انما الاعمال بالنیات

2- امابعثت لاتم مکارم الاخلاق

3- لا یومن احدکم حق یحب الاخیه مایحب النفسه

4- المسلم من سلم المسلمون من سلم المسلمون من السانه ویده

5- قل امنت باللّه سلم استفم

6- خیرکم خیرکم لاله

7- سباب المسلم فسوق وقتاله کفر

8- المومن اخوالمومن

9- کل المسلم علی المسلم حرام بمعه وماله وفرقه

10- ایته المنافق ثلات اذا حدیث کذب وافا و تمن خان واذاو فداخلف

دین اسلام

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

1- توحید

2- رسالت

3- آخرت

4- ملائکہ

5- آسمانی کتب

2.2 عبادات

1- نماز 2- روزہ 3- حج 4- زکواۃ

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

حصہ اول

حصہ اسلامیات

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تدریسی مقاصد

1- قرآن مجید

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

خصوصی مقاصد : طالب علم اس قابل ہو جائے گا کہ

☆ قرآن مجید کی تعریف کر سکے گا

☆ قرآن مجید کے نزول کی صورت بیان کر سکے

☆ قرآن مجید کی مکی و مدنی سورتوں کی پہچان کر سکے

☆ منتخب آیات کا ترجمہ و تشریح کر سکے

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

☆ قرآنی آیات کا ترجمہ تشریح کر سکے

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

2- سنت

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

خصوصی مقصد :

☆ سنت کی تعریف بیان کر سکے

☆ سنت کی اہمیت و ضرورت کی وضاحت کر سکے

☆ سنت کی روشنی میں اسوہ حسنہ پر عمل کر سکے

3- منتخب احادیث نبویہ

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

خصوصی مقصد : احادیث کا ترجمہ و تشریح کر سکے

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

</div>

4- دین اسلام

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

خصوصی مقاصد

لفظ دین اسلام کے لغوی اور اصطلاحی معنی بیان کر سکے

اسلام کے بنیادی مقاصد کی اہمیت بیان کر سکے

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

عبادت کے لفظی و اصطلاحی معنی بیان کر سکے

عقیدے اور عبادت کا فرق بیان کر سکے

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

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

(غیر مسلم طلباء کے لئے)

GEN III

نصاب اخلاقیات سال اول

حصہ دوم مطالعہ پاکستان

نی	بی	سی
1	0	1

کل وقت: 20 گھنٹے

موضوعات

اخلاقیات کی تعریف اور اہمیت

اخلاقیات کا معیار (قانون، عقل، الہمی کتب)

مندرجہ ذیل اخلاق کی وضاحت

☆ دیانت داری

☆ وفاداری

☆ نظم و ضبط

☆ راست گوئی

☆ صبر و استقلال

☆ حوصلہ مندی

☆ وقت کی پابندی

☆ صفائی

☆ اعتماد

☆ باہمی احترام

☆ مصلحت

نصاب اخلاقیات (سال اول)

تدریسی مقاصد

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

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

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

حصہ دوئم   مطالعہ پاکستان   کل وقت 12 گھنٹے

موضوعات

☆ حریت فکر : مسلمان قوم میں آزادی فکر کی تاریخ ۔ مسلمانوں میں سیاسی آزادی کی اہمیت اور ضرورت ۔ ذہنی و جسمانی غلامی کے نقصانات

☆ نظریہ پاکستان

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

☆ نظریہ پاکستان کا تاریخی پہلو

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

☆ تعلیمی تحریکیں

علی گڑھ ۔ ندوت العلماء۔ دیوبند ۔ مدرسۃ الاسلام ۔ (سندھ) اسلامیہ کالج (پشاور) انجمن حمایت اسلام (لاہور)

مطالعہ پاکستان (حصہ دوئم)

تدریسی مقاصد

حریت فکر:

عمومی مقصد

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

خصوصی مقاصد

☆ حریت فکر کا معنی و مفہوم بیان کر سکے

☆ آزادی فکر کی اہمیت بیان کر سکے

☆ خصوصاً اسلام میں آزادی اظہار رائے کی اہمیت بیان کر سکے

☆ ذہنی غلامی کے قومی سطح پر نقصانات کے بیان کر سکے

☆ جسمانی غلامی قومی سطح پر نقصانات بیان کر سکے

نظریہ پاکستان

عمومی مقصد:

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

خصوصی مقاصد:

☆ نظریہ کی تعریف بیان کر سکے اور اس کی وضاحت کر سکے

☆ نظریہ پاکستان کی تعریف کر سکے اور اس کا مفہوم بیان کر سکے

☆ علامہ اقبال اور قائد اعظم کے فرمودات کی روشنی میں نظریہ پاکستان بیان کر سکے

نظریہ پاکستان کا تاریخی پہلو

عمومی مقصد

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

خصوصی مقاصد:

☆ محمد بن قاسم کے بارے میں بیان کر سکے

☆ محمد بن قاسم کے ہندوستان پر حملہ کی وجہ بیان کر سکے

☆ محمد بن قاسم کے ہندوستان پر حملہ کے اثرات بیان کر سکے

☆ بیان کر سکے کہ ہندوستان میں ہندو مسلم دو قومی نظریہ کا نکتہ آغاز کیا ہے

☆ مجدد الف ثانی کی علمی خدمات بیان کر سکے

☆ شاہ ولی اللہ کی علمی خدمات بیان کر سکے

☆ مجدد الف ثانی اور شاہ ولی اللہ نے جو تبلیغ دین اور مسلمانوں میں سیاسی شعور پیدا کیا اسے بیان کر سکے

علمی تحریکیں

عمومی مقصد

☆ برصغیر کی علمی تحریکوں سے آگاہی حاصل ہو سکے

خصوصی مقاصد :

☆ علی گڑھ - دیو بند - ندوت العلماء مدرستہ السلام - اسلامیہ کالج- انجمن حمایت اسلام نے تعلیم کے ذریعہ سیاسی شعور مسلمانوں میں پیدا کیا اسے بیان کر سکے

☆ آزادی ہند کے سلسلہ میں تحریک مجاہدین کی خدمات بیان کر سکے

Eng-112   ENGLISH

Total Contact Hours

		T	P	C
Theory	64			
Practical	0	2	0	2

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

COURSE CONTENTS

ENGLISH PAPER "A"

1.   PROSE/TEXT   16 Hours

1.1   First eight essays of Intermediate. English Book-II

2.   CLOZE TEST   4 Hours

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

ENGLISH PAPER "B"

3.   GRAMMAR   26 Hours

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

4.   COMPOSITION   8 Hours

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

5.   TRANSLATION   6 Hours

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

RECOMMENDED BOOKS

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

ENG-112   ENGLISH

INSTRUCTIONAL OBJECTIVES

PAPER-A

1.   DEMONSTRATE BETTER READING, COMPREHENSION AND   VOCABULARY
1.1   Manipulate, skimming and scanning of the text.
1.2   Identify new ideas.
1.3   Reproduce facts, characters in own words
1.4   Write summary of stories

2.   UNDERSTAND FACTS OF THE TEXT
2.1   Rewrite words to fill in the blanks recalling the text.
2.2   Use own words to fill in the blanks.

PAPER-B

3.   APPLY THE RULES OF GRAMMAR IN WRITING AND SPEAKING
3.1   Use rules of grammar to construct meaningful sentences containing a subjectand a predicate.
3.2   State classification of time, i.e. present, past and future and use verb tensecorrectly 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 PRACTICALSITUATIONS
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 inpractical 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 andsentences.

GenC-112   **Chinese Language- I**

Total contact hours

Theory	64		T	P	C
Practical	0		2	0	2

PART ONE

AIMS This course consists of 18 classes (including mid-term test and final test). After completing this part, students can master the primary Chinese language knowledge taught in the content of the course, and be able to achieve and exceed the **HSK level One**.

INSTRUCTION OBJECTIVE The course is mainly for zero-based learners. Through the study of this course, learners can lay a solid language foundation and have a preliminary understanding of Chinese language structure, including Pinyin, Chinese characters, words, grammar and other knowledge. After completing this course, learners can understand and use some basic words and sentences, and complete the most basic communication, such as greeting, asking, introducing, shopping and so on.

COURSE CONTENTS

1. Lesson 1 Hello Vs Nǐhǎo   **1 hour**
This lesson briefly introduces pinyin and spelling methods.

2. Hello!   **1 hour**
This lesson briefly introduces the sentence patterns used in greeting, such as dialogue, greeting farewell, and introducing one's own name.

3. Lesson 3 I am Britain   **2 hour**
Teach students to understand basic classroom language, learn to use "national + person" for simple communication dialogue, and introduce which country they come from.

4. Lesson 4 What's the date today   **2 hour**
This lesson introduces the expression of numbers, years, months, etc., and teaches students to ask about a date and answer it.

5. Lesson 5 This is my brother   **2 hours**
By introducing family members, students can understand the simple words when asking about family status and introduce them briefly.

6. Lesson 6 I'm nineteen years old   **2 hours**
This lesson expands quantifiers and animal names, and introduces the expression of age, so that students can ask and answer each other's age correctly.

7. Lesson 7 What time is it   **2 hours**
This lesson introduces the usage of hours, minutes and seconds, so that students can describe their lives with time points.

8. Lesson 8 What do you like to do on weekends   **2 hours**
This lesson introduces the expressions of hobbies, interests, activities and other related nouns, so as to help students communicate with each other by using simple linking sentences.

Semi-MID-TERM REVIEW   **2 hours**

Mid-term review is a summary of the knowledge learned in the past. The test paper uses the knowledge points learned in the past to design listening questions, answering questions by looking at pictures, connecting questions, filling in blanks, etc., which are illustrated with pictures and interesting, and can test students' learning effect.

9. Lesson 9 Introduce yourself   **2 hours**
Explain the related expressions related to self-introduction, and students can correctly introduce their names, families, ages, hobbies, school majors, etc.   2

10.Lesson 10 My father is in Beijing   **2 hours**
This lesson introduces the names of major cities in China, Britain and Europe, and introduces the use of "person + place" in sentences.

11.Lesson 11 I came to Beijing by plane   **2 hours**
This lesson introduces the means of transportation and how to express long sentences in combination with the time and place learned before.

12.Lesson 12 I eat at the company 2 hours   **2 hours**
This lesson introduces the polite expressions used in eating.

13.Lesson 13 The weather is fine on Monday   **2 hours**
It shows the conversations and topics that may appear when you want to date.

14.Lesson 14 How much is it altogether   **2 hours**
This lesson introduces the vocabulary and sentences commonly used in shopping, and how to use Chinese for daily shopping.

15.Lesson 15 What would you like to have   **2 hours**
This lesson introduces the classic Chinese and Thai cuisine, the terms of treating guests, and the communicative terms of how to order food in restaurants.

16.Lesson 16 The bathroom is next to the pantry   **2 hours**
This lesson introduces location and location words, and how to use location words to introduce the location of a place.

Semi- FINAL REVIEW   **2 hours**

Similar to the mid-term test questions, it is a test of important knowledge points of the course to test students' learning effect. This lesson briefly introduces pinyin and spelling methods.

PART- TWO

AIMS After completing this part, students can master the basic Chinese language knowledge taught in the content of the course, and be able to reach and exceed **HSK level TWO.**

INSTRUCTION OBJECTIVE Learners can master the language knowledge and use some basic grammar and sentence patterns in communication, learn to express personal feelings and attitudes in Chinese, and can complete communicative functions such as gratitude, apology, introduction and farewell, and begin to understand Chinese cultural knowledge and cultivate interest in learning.

COURSE CONTENTS

1. Lesson 1 I was still sleeping at 7 o'clock   **1 hour**
This lesson introduces the grammatical points of "still", so that students can correctly understand the meaning of sentences related to "still" and use this sentence pattern correctly for communication.

2. Lesson 2 It will be cloudy tomorrow   **1 hour**

By introducing the weather in several Chinese cities, explain how to use temperature to answer weather questions.

3. Lesson 3 That one is five hundred dollars cheaper than this one   1 hour
This lesson explains comparative sentences, and compares them in terms of price, height and temperature, so that students can understand comparative sentences thoroughly.

4. Lesson 4 This is a family photo   1 hour
This lesson introduces family members in detail through appearance, clothing and occupation, so that students can master more detailed description methods.

5. Lesson 5 It is forbidden to take pictures here   2 hours
This lesson leads students to understand the relevant knowledge points of expressing commands, such as forbidden and forbidden, so that students can correctly understand the meaning of words in daily life.

6. Lesson 6 I can't find something   2 hours
This lesson introduces the use of language points in "V + should + result complement", so that students can correctly use relevant sentence patterns in communication.

7. Lesson 7 I have been to Sichuan and seen pandas   2 hours
This lesson introduces Chinese culture through "V + have been to", such as the Great Wall, the Forbidden City, national treasures, etc., so that students can use this sentence pattern correctly in communication.

8. Lesson 8 I hope you can come to my wedding   2 hours
By introducing Chinese weddings, this lesson enables students to master the verbal usage of banquet invitation, holiday blessing, emotional expression and euphemistic refusal.

Semi-MID-TERM REVIEW   2 hours

This section leads students to review the knowledge points they have learned in the past and conduct mid-term tests through reading pictures, listening questions and connecting questions to test students' learning effect.

9. Lesson 9 Be ill, take more rest   2 hours
This lesson introduces the vocabulary related to illness and the doctor's medication advice, so that students can correctly describe and understand the doctor's meaning in the process of seeing a doctor.

10. Lesson 10 The station is just across the road   2 hours
This lesson introduces the way of asking places and answers by asking directions, which helps students to use relevant sentence patterns for practical communication questions and answers.

11. Lesson 11 She sings very well   2 hours
This lesson focuses on hobbies and introduces the correct use of related words in sentences.

12. Lesson 12 Did you do well in the exam   2 hours
By describing the examination process and the situation of answering questions, students can correctly understand the instructions of the examination room, the distribution of questions and the analysis of test paper problems

13. Lesson 13 Buy two and get one free   2 hours
This lesson introduces the commodity names of supermarkets, as well as common terms such as promotional activities, discounts and price reductions.

14. Lesson 14 We're a new restaurant   2 hours

This lesson helps students understand how to understand the waiter's recommendation and put forward the food requirements for ordering.

15.Lesson 15 The girl is dressed in white clothes　　　　　　　　　　　　　**2 hours**
This lesson introduces others' clothes and how to use grammar points to describe the state of something through "V + be dressed in".

16.Lesson 16 You can be discharged from hospital next week　　　　　　　**2 hours**
This lesson introduces a variety of expressions, such as hospitalization, visiting patients and discharge, so that students can understand the language of hospital scenes and strengthen their multi-scene communication ability.

Semi- FINAL REVIEW　　　　　　　　　　　　　　　**2 hours**

This section is similar to the mid-term review, which leads students to review the knowledge points they have learned in the past and conduct final tests by looking at pictures, listening questions, connecting questions, etc., to test students' learning effect.

Recommended Book

Tang Chinese Course 1 for PART TWO

Tang Chinese Course 2 for PART TWO

Math-123   APPLIED MATHEMATICS-I

	T	P	C
	3	0	3

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

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

1.   Solve problems of Algebra, Trigonometry, vectors, Mensuration, Matrices and Determinants.

2.   Develop skill, mathematical attitudes and logical perception in the use of mathematical instruments as required in the technological fields.

3.   Acquire mathematical clarity and insight in the solution of technical problems.

COURSE CONTENTS

1.   QUADRATIC EQUATIONS   6 Hours

1.1   Standard Form

1.2   Solution

1.3   Nature of roots

1.4   Sum & Product of roots

1.5   Formation

1.6   Problems

2.   BINOMIAL THEOREM   6 Hours

2.1   Factorials

2.2   Binomial Expression

2.3   Binomial Co-efficient

2.4   Statement

2.5   The General Term

2.6   The Binomial Series

2.7   Problems.

3. PARTIAL FRACTIONS   **6 Hours**

    3.1   Introduction

    3.2   Linear Distinct Factors   Case I

    3.3   Linear Repeated Factors Case II

    3.4   Quadratic Distinct Factors   Case III

    3.5   Quadratic Repeated Factors   Case IV

    3.6   Problems

4. FUNDAMENTALS OF TRIGONOMETRY   **6 Hours**

    4.1   Angles

    4.2   Quadrants

    4.3   Measurements of Angles

    4.4   Relation between Sexagesimal & circular system

    4.5   Relation between Length of a Circular Arc & the Radian Measure of its central Angle

    4.6   Problems

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

    5.1   Trigonometric functions of any angle

    5.2   Signs of trigonometric Functions

    5.3   Trigonometric Ratios of particular Angles

    5.4   Fundamental Identities

    5.5   Problems

6. GENERAL IDENTITIES   **6 Hours**

    6.1   The Fundamental Law

    6.2   Deductions

    6.3   Sum & Difference Formulae

    6.4   Double Angle Identities

    6.5   Half Angle Identities

    6.6   Conversion of sum or difference to products

    6.7   Problems

7. SOLUTION OF TRIANGLES   **6 Hours**

7.1   The law of Sines

7.2   The law of Cosines

7.3   Measurement of Heights & Distances

7.4   Problems

8.   VECTORS AND PHASORS   12 Hours

8.1   Scalars and Vectors

8.2   The unit Vectors i, j, k

8.3   Direction Cosines

8.4   Dot Product

8.5   Cross Product

8.6   Analytic Expressions for dot and cross products

8.7   Phasors

8.8   Significance of j Operator

8.9   Different Forms

8.10   Algebraic Operations

8.11   Problems

9.   COMPLEX NUMBERS   9 Hours

9.1   Introduction and Properties

9.2   Basic Operations

9.3   Conjugate

9.4   Modulus

9.5   Different Forms

9.6   Problems

10.   BOOLEAN ALGEBRA AND GATE NETWORKS   15 Hours

10.1   Concept and basic laws

10.2   Sums of product and products of sums

10.3   Binary, decimals and octals, presentation of decimal numbers in BCD

10.4   Intercoversion of numbers

10.5   OR Gates and AND Gates

10.6   Logical Expressions and their simplifications

10.7   Demorgan's Theorams

10.8   NAND Gates and NOR Gates

10.9   Problems

11.   PLANE ANALYTIC GEOMETRY AND STRAIGHT LINE   6 Hours

11.1   Coordinate system

11.2   Distance formula

11.3   Ration Formulas

11.4   Inclination and slope of line

11.5   Slope Formula

11.6   Problems

12.   EQUATIONS OF THE STRAIGHT LINE   6 Hours

12.1   Some Important Forms

12.2   General form

12.3   Angle Formula

12.4   Parallelism and Perpendicularity

12.5   Problems

13.   EQUATIONS OF THE CIRCLE   6 Hr.

13.1   Standard and Central forms of equations

13.2   General Form of Equation

13.3   Radius and Coordinates of Center

13.4   Problems

RECOMMENDED BOOKS

Applied Mathematics Math-113, by Nasir -ud-Din Mahmood, Sana-ullah Khan, Tahir Hameed, Syed Tanvir Haider, Javed Iqbal, Vol - I, National Book Foundation

Math-123   APPLIED MATHEMATICS-I

INSTRUCTIONAL OBJECTIVES

1.   USE DIFFERENT METHODS FOR THE SOLUTION OF QUADRATIC EQUATION

   1.1   Define a standard quadratic equation.

   1.2   Use methods of factorization and method of completing the square for solving the equations.

   1.3   Derive quadratic formula.

   1.4   Write expression for the discriminant.

   1.5   Explain nature of the roots of a quadratic equation.

   1.6   Calculate the sum and product of the roots.

   1.7   Form a quadratic equation from the given roots.

   1.8   Solve problems involving quadratic equations.

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

   2.1   State binomial theorem for positive integral index.

   2.2   Explain binomial coefficients:

            $(n,0), (n,1)......(n,r)....., (n,n)$

   2.3   Derive expression for the general term.

   2.4   Calculate the specified terms.

   2.5   Expand a binomial of a given index.

   2.6   Extract the specified roots.

   2.7   Compute the approximate value to a given decimal place.

   2.8   Solve problems involving binomials.

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

   3.1   Define a partial fraction, a proper and an improper

            fraction.

   3.2   Explain all the four types of partial fractions.

   3.3   Set up equivalent partial fractions for each type.

   3.4   Explain the methods for finding constants involved.

3.5   Resolve a single fraction into partial fractions.

3.6   Solve problems involving all the four types.

4.   UNDERSTAND THE SYSTEMS OF MEASUREMENT OF ANGLES.

4.1   Define angles and the related terms.

4.2   Illustrate the generation of an angle.

4.3   Explain sexagesimal and circular systems for the

measurement of angles.

4.4   Derive the relationship between radian and degree.

4.5   Convert radians to degrees and vice versa.

4.6   Derive a formula for the circular measure of a central angle.

4.7   Use this formula for solving problems.

5.   UNDERSTAND BASIC CONCEPTS AND PRINCIPLES OF TRIGONOMETRIC FUNCTIONS.

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

5.2   Derive fundamental identities.

5.3   Find trigonometric ratios of particular angles.

5.4   Draw the graph of trigonometric functions.

5.5   Solve problems involving trigonometric functions.

6.   USE TRIGONOMETRIC IDENTITIES IN SOLVING TECHNOLOGICAL PROBLEMS.

6.1   List fundamental identities.

6.2   Prove the fundamental law.

6.3   Deduce important results.

6.4   Derive sum and difference formulas.

6.5   Establish half angle, double and triple angle formulas.

6.6   Convert sum or difference into product and vice versa.

6.7   Solve problems.

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

7.1   Define angle of elevation and angle of depression.

7.2   Prove the law of sines and the law of cosines.

7.3   Explain elements of a triangle.

7.4   Solve triangles and the problems involving heights and distances.

8.   UNDERSTAND PRINCIPLES OF VECTORS AND PHASORS

8.1   Define unit vectors i, j, k.

8.2   Express a vector in the component form.

8.3   Explain magnitude, unit vector, direction cosines of a vector.

8.4   Explain dot product and cross product of two vector.

8.5   Deduce important results from dot and cross product.

8.6   Define phasor and operator j.

8.7   Explain different forms of phasors.

8.8   Perform basic Algebraic operation on phasors.

8.9   Solve problems on phasors.

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

9.1   Define a complex number and its conjugate.

9.2   State properties of complex numbers.

9.3   Give different forms of complex numbers.

9.4   Perform basic algebraic operations on complex numbers.

9.5   Solve problem involving complex numbers.

10.   SOLVE TECHNICAL PROBLEMS USING PRINCIPLES OF BOOLEAN ALGEBRA

10.1   Explain fundamental concepts of Boolean algebra

10.2   Explain binary numbers, octal numbers, decimal numbers and their interconversion.

10.3   Explain digital addition and multiplication and its applications to OR gates and AND Gates

10.4   Illustrate complimentation and inversion

10.5   Evaluate logical expression

10.6   List basic Laws of Boolean Algebra

10.7   Explain De-Morgan's theorem

10.8   Explain basic duality of Boolean algebra

10.9   Derive Boolean expression

10.10   Explain combination of GATES

10.11   Illustrate sum of products and product of sum

10.12   Derive product of sum expression

10.13   Explain NAND Gates and NOR Gates

10.14   Use the map methods for simplifying expressions

10.15   Explain sub-cubes and covering

11.   UNDERSTAND THE CONCEPT OF PLANE ANALYTIC GEOMETRY

11.1   Explain the rectangular coordinate system.

11.2   Locate points in different quadrants.

11.3   Derive distance formula.

11.4   Describe the ratio formula

11.5   Derive slope formula

11.6   Solve problems using the above formulae.

12.   USE EQUATIONS OF STRAIGHT LINE IN SOLVING PROBLEMS.

12.1   Define equation of a straight line.

12.2   Derive slope intercept and intercept forms of equations of a straight line.

12.3   Write general form of equations of a straight line.

12.4   Derive an expression for angle between two straight lines.

12.5   Derive conditions of perpendicularity and parallelism of two straight lines.

12.6   Solve problems using these equations/formulae.

13.   SOLVE TECHNOLOGICAL PROBLEMS USING EQUATIONS OF CIRCLE

13.1   Define a circle.

13.2   Describe standard, central and general forms of the

         equation of a circle.

13.3   Convert general form to the central form of equation of a circle.

13.4   Deduce formula for radius and coordinates of the center of a circle.

13.5   Derive equation of the circle passing through three points.

13.6   Solve problems involving these equations.

Phy-122 Applied Physics

Total Contact Hours

Theory	32		**T**	**P**	**C**
Practical	96		1	3	2

AIMS: The students will be able to understand the fundamental principles and concept of physics and apply this to solve technical problems pertaining to real life situations. This shall also inspire them to learn advance physics and other technical courses.

COURSE CONTENTS

1   MEASUREMENTS.   **2 Hours**

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

2.   SCALARS AND VECTORS.   **4 Hours**

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

3.   MOTION   **4 Hours**

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

4.   TORQUE, EQUILIBRIUM AND ROTATIONAL INERTIA   **2 Hours**

4.1   Torque
4.2   Center of gravity and center of mass
4.3   Equilibrium and its conditions
4.4   Torque and angular acceleration

4.5   Rotational inertia

5.   WAVE MOTION   5 Hours

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

6.   SOUND   5 Hours

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

7.   LIGHT   5 Hours

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

8.   OPTICAL FIBER   2 Hours

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

9.   LASERS   3 Hours

9.1   Corpuscular theory of light
9.2   Emission and absorption of light
9.3   Stimulated absorption and emission of light
9.4   Laser principle

9.5   Structure and working of lasers

9.6   Types of lasers with brief description.

9.7   Applications (basic concepts)

9.8   Material processing

9.9   Laser welding

9.10   Laser assisted machining

9.11   Micro machining

9.12   Drilling scribing and marking

9.13   Printing

9.14   Lasers in medicine

RECOMMENDED BOOKS

1.   Applied Physics, Phy-122 by Mr. Khalid Mehmood, Zafar Tarar, Dr. Muhammad Ajmal, Mr. Habib-ullah, Mr. Asif Ali

Phy-122   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 offorces
2.2   Describe method of resolution of a vector into components
2.3   Describe method of addition of vectors by rectangular components
2.4   Differentiate between dot product and cross product of vectors
2.5   Use the concepts in solving problems involving addition resolution and multiplication of vectors

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

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

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

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

5   USE CONCEPTS OR WAVE MOTION IN SOLVING RELEVANT PROBLEMS
5.1   Explain Hooke's Law of Elasticity
5.2   Derive formula for Motion under an elastic restoring force
5.3   Derive formulae for simple harmonic motion and simple pendulum
5.4   Explain wave form with reference to S.H.M. and circular motion
5.5   Explain Resonance

5.6   Explain Transverse vibration of a stretched 'string

5.7   Use the above concepts and formulae of S.H.M. to solve relevant problems.

6   UNDERSTAND CONCEPTS OF SOUND

6.1   Describe longitudinal wave and its propagation

6.2   Explain the concepts: Intensity, loudness, pitch and quality of sound

6.3   Explain units of Intensity of level and frequency response of ear

6.4   Explain phenomena of silence zones, beats

6.5   Explain Acoustics of buildings.

6.6   Explain Doppler Effect giving mathematical expressions.

7   USE THE CONCEPTS OF GEOMETRICAL OPTICS TO MIRRORS AND LENSES

7.1   Explain laws of reflection and refraction

7.2   Use mirror formula to solve problems

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

8   UNDERSTAND WAVE THEORY OF LIGHT

8.1   Explain wave theory of light

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

8.3   Describe uses of polarization given in the course contents.

9   UNDERSTAND THE STRUCTURE, WORKING AND USES OF OPTICAL FIBER

9.1   Explain the structure of the Optical Fiber

9.2   Explain its principle of working

9.3   Describe use of optical fiber in industry and medicine.

Phy-122   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) $y = l/x$
2. Find the volume of a given solid cylinder using Verniercalipers.
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.
II. Find the weight of a given body using principle ofmoments.
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 columnin 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 lens using converging lens.
31. Find focal length of diverging lens using concave mirror.
32. Find angular magnification of an astronomical telescope.
33. Find angular magnification of a simple microscope (Magnifying Glass)
34. Find angular magnification of a compound microscope.
35. Study working and structure of camera.

36. Study working and structure of sextant.
37. Compare the different scales of temperature and verify the conversion formula.
38. Determine the specific heat of lead shots.
39. Find the coefficient of linear expansion of a metallic rod.
40. Find the heat of fusion of ice.
41. Find the heat of vaporization.
42. Determine relative humidity using hygrometer

Ch-112   **APPLIED CHEMISTRY**

	T	P	C
	1	3	2

Total Contact Hours

Theory   **32**

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.   Become acquainted with the basic principles of chemistry as applied in the study of relevant Technology.
3.   Know the scientific methods for production, properties and use of materials of industrial & .technological significance.
4.   Gains skill for the efficient conduct of practical's in a Chemistry lab.

COURSE CONTENTS

1   INTRODUCTION AND FUNDAMENTAL CONCEPTS   2 Hrs

1.1   Orientation with reference to this technology

1.2   Terms used & units of measurements in the study of chemistry

1.3   Chemical Reactions & their types

2   ATOMIC STRUCTURE   2 Hrs

2.1   Sub-atomic particles

2.2   Architecture of atoms of elements, Atomic No. & Atomic Weight

2.3   The periodic classification of elements periodic law

2.4   General characteristics of a period and group

3   CHEMICAL BOND   2 Hrs

3.1   Nature of chemical Bond

3.2   Electrovalent bond with examples

3.3   Covalent Bond (Polar and Non-polar, sigma & Pi Bonds with examples

3.4   Co-ordinate Bond with examples

4   WATER   2 Hrs

4.1   Chemical nature and properties.

4.2   Impurities

4.3   Hardness of water (types, causes & removal)

4.4   Scales of measuring hardness (Degrees Clark

4.5   Boiler feed water, scales & treatment

4.6   Sea-water desalination, sewage treatment

5   ACIDS, BASES AND SALTS   2 Hrs

5.1   Definitions with examples

5.2   Properties, their strength, basicity & Acidity

5.3   Salts and their classification with examples

5.4   pH-value and scale

6	**OXIDATION & REDUCTION**	**2 Hrs**

6.1   The process, definition& examples

6.2   Oxidizing and reducing agents

6.3   Oxides and their classifications

7	**NUCLEAR CHEMISTRY**	**2 Hrs**

7.1   Introduction

7.2   Radioactivity (alpha, beta and gamma rays)

7.3   Half life process

7.4   Nuclear reaction & transformation of elements

8	**CEMENT**	**2 Hrs**

8.1   Introduction

8.2   Composition and manufacture

8.3   Chemistry of setting and hardening

8.4   Special purpose cements

9	**GLASS**	**2 Hrs**

9.1   Composition and raw material

9.2   Manufacture

9.3   Varieties and uses

10	**PLASTICS AND POLYMERS**	**2 Hrs**

10.1   Introduction and importance

10.2   Classification

10.3   Manufacture

10.4   Properties and uses

11	**PAINTS, VARNISHES AND DISTEMPER**	**2 Hrs**

11.1   Introduction

11.2   Constituents

11.3   Preparation and uses

12	**CORROSION**	**2 Hrs**

12.1   Introduction with causes

12.2   Types of corrosion

12.3   Rusting of iron

12.4   Protective measures against-corrosion

13	**REFRACTORY MATERIALS AND ABRASIVE**	**2 Hrs**

13.1   Introduction to Refractories

13.2   Classification of Refractories

14   ALLOYS   2 Hrs

15   FUELS AND COMBUSTION   2 Hrs

16   LUBRICANTS   1 Hr

17   POLLUTION   1 Hr

BOOKS RECOMMENDED

1.   Applied Chemistry-112, developed byMr. Muhammad Ayub, Mr. QasimShamim, Mr. YousufQamar, Shaukat Ali Awan and Muhammad Naushad

INSTRUCTIONAL OBJECTIVES

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

1.1   Define chemistry and its important terms

1.2   State the units of measurements in the study of chemistry

1.3   Write chemical formula of common compounds

1.4   Describe types of chemical reactions with examples

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

2.1   Define atom.

2.2   State the periodic law of elements.

2.3   Describe the fundamental sub atomic particles

2.4   Distinguish between atomic ho. and mass no.; isotopes and isobars

2.5   Explain the arrangements of electrons in different shells and sub energy levels

2.6   Explain the grouping and placing of ^elements' in the periodic table

3   UNDERSTAND THE NATURE OF CHEMICAL LBOUND

3.1   Define chemical bond

3.2   Describe the nature of chemical bond

3.3   Differentiate .between electrovalent an^ covalent bonding

3.4   Explain the formation of polar and non polar, sigma and pi-bond with examples

3.5   Describe the nature of coordinate bond with examples

4   UNDERSTAND THE CHEMICAL NATURE OF WATER

4.1   Describe the chemical nature of water with its formula

4.2   Describe the general impurities present in water

4.3   Explain the causes and methods to removing hardness of water

4.4   Express hardness .in different units like mg/Iiter, p.p.m, degrees Clark and degrees French

4.5   Describe the formation and nature of scales in boiler feed water

4.6   Explain the method for the treatment of scales

4.7   Explain the sewage treatment and desalination of sea water

5   UNDERSTAND THE NATURE OF ACIDS, BASES AND SALTS

5.1   Define acids, bases and salts with examples

5.2   State general properties of acids and bases

5.3   Differentiate between acidity and basicity and use the related terms

5.4   Define salts, state their classification with examples

5.5   Explain p-H value of solution and pH scale

6   UNDERSTAND THE PROCESS OF OXIDATION AND REDUCTION

6.1   Define oxidation

6.2   Explain the oxidation process with examples

6.3   Define reduction

6.4   Explain reduction process with examples

6.5   Define oxidizing and reducing-agents and give it least six examples of each

6.6   Define oxides

6.7   Classify the oxides and give example

7   UNDERSTAND THE FUNDAMENTALS OF NUCLEAR CHEMISTRY

7.1   Define nuclear chemistry and radio activity

7.2   Differentiate between alphas, Beta and Gamma particles

7.3   Explain hall-life process

7.4   Explain at least six nuclei reactionsresulting in the transformation of some elements

7.5"   State important uses of isotopes

8   UNDERSTAND THE MANUFACTURE, SETTING AND   HARDENING CEMENT

8.1   Define port land cement and give its composition

8.2   Describe the method of manufacture

8.3   Describe the chemistry of setting and hardening of cement

8.4   Distinguish between ordinary and special purpose cement

9   UNDERSTAND THE PROCESS OF MANUFACTURE OF GLASS.

9.1   Define glass

9.2   Describe its composition and raw materials

9.3   Describe the manufacture of glass

9.4   explain its varieties and uses

10   UNDERSTAND THE NATURE AND IMPORTANCE OF PLASTICS POLYMERS

10.1.   Define plastics and polymers

10.2   Explain the mechanism of polymerization

10.3   Describe the preparation and uses of some plastics/polymers

11   KNOW THE.CHEMISTRY OF PAINTS, VARNISHES AND DISTEMPERS

11.1   Define paints, varnishes and distemper

11.2   State composition of each

11.3   State methods of preparation of each and their uses

12   UNDERSTAND THE PROCESS OF CORROSION WITH ITS CAUSES AND TYPES

12.1   Define corrosion

12.2   Describe different types of corrosion

12.3   State the causes of corrosion

12.4   Explain the process of rusting of iron

J2.5   Describe methods to prevent/control corrosion

13   UNDERSTAND THE NATURE OF REFRACTORY MATERIALS AND ABRASIVE

13.1   Define refractory materials

13.2   Classify refractory materials

13.3   Describe properties and uses of refractories

13.4   Define abrasive.
13.5   Classify natural and artificial abrasives
13.6   Describe uses of abrasives

14   UNDERSTAND THE NATURE AND IMPORTANCE OF ALLOYS
14.1   Define alloy
14.2   Describe different methods for the preparation of alloys
14.3   Describe important properties of alloys
14 4   Enlist some important alloys with their composition, properties and uses

15   UNDERSTAND THE NATURE OF FUELS AND THEIR COMBUSTION
15.1   Define fuels
15.2   Classify fuels and make distinction of solid, liquid & gaseous fuels
15.3   Describe important Fuels
15.4   Explain combustion
15.5   Calculate air quantities in combustion, gases

16   UNDERSTAND THE NATURE OF LUBRICANTS.
16.1   Define a lubricant
16.2   Explain the uses of lubricants
16.3   Classify lubricants and cite examples
16.4   State important properties of oils, greases and solid lubricants
16.5   State the criteria for the selection of lubricant tor, particular purpose/job

17   UNDERSTAND THENATURE OF POLLUTION
17.1   Define Pollution (air. water, food)
17.2   Describe the causes of environmental pollution.
17.3   Enlist some common pollutants.
17.4   Explain methods to prevent pollution

CH-112   APPLIED CHEMISTRY

LIST OF PRACTICALS

1.   To introduce the common apparatus, glassware and chemical reagents used in the lab.

2.   To purify a chemical substance by crystallization.

3.   To separate a mixture of sand and salt.

4.   To find the melting point of substance.

5.   To find the pH of a solution with pH paper.

6.   To separate a mixture of inks by chromatography.

7.   To determine the co-efficient of viscosity of benzene with the help of Ostwald vasomotor.

8.   To find the surface tension of a liquid with a stalagmometer.

9.   To perform electrolysis of water to produce Hydrogen and Oxygen.

10.   To determine the chemical equivalent of copper by electrolysis of $Cu SO$.

11.   To get introduction with the scheme of analysis of salts for basic radicals.

12.   To analyse 1st group radicals (Ag^+ - Pb^{++} - Hg^+).

13.   To make practice for detection 1st group radicals.

14.   To get introduction with the scheme of II group radicals.

15.   To detect and confirm II-A radicals (hg^{++}, Pb^{++++}, Cu^+, Cd^{++}, Bi^{+++}).

16.   To detect and confirm II-B radicals Sn^{+++}, Sb^{+++}, As^{+++}).

17.   To get introduction with the scheme of III group radicals (Fe^{+++} - Al^{+++}, Cr^{+++})

18.   To detect and confirm Fe^{+++}, Al^{+++} and Cr^{+++}.

19.   To get introduction with he scheme of IV group radicals.

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

21.   To detect and conform Co^{++} and Ni^{++} radicals of IV group.

22.   To get introduction with the Acid Radical Scheme.

23.   To detect dilute acid group.

24.   To detect and confirm CO''_3 and HCO'_3 radicals.

25.   To get introduction with the methods/apparatus of conducting volumetric estimations.

26.   To prepare standard solution of a substance.

27.   To find the strength of a given alkali solution.

28.   To estimate HCO'_3 contents in water.

29.   To find out the %age composition of a mixture solution of KNO_3 and KOH volumetrically.

30. To find the amount of chloride ions in water volumetrically.

MTRC-113 Basic Engineering Drawing and CAD-1

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

Pre-requisites: None

AIMS: At the end of this course the students will be able to understand the *Fundamentals of Engineering Drawing* with specific reference to Mechanical/Mechatronics Technology. The students shall become familiar with the use of conventional drawing equipment as well as the modern techniques (i.e., AutoCAD)to develop & understand technical drawings that impart the competency to draw simple geometrical figuresand two/three-dimensional drawing of objects, efficiently and more precisely.

Part-A: **Manual Drawing**   **50 %**

1. **Application Of Technical Drawing**   **4 Hours**
   - 1.1   Importance of Technical Drawing
   - 1.2   Type of Drawing
   - 1.3   Application of Technical drawing
   - 1.4   Bill of material
   - 1.5   Bill of Quantity
   - 1.6   Process flow drawings
   - 1.7   General Assembly drawing
   - 1.8   Symbol of devices and components

2. **Drafting Equipment, Types of Lines And Lettering**   **3 Hours**
   - 2.1.   List of drawing equipment
   - 2.2.   Basic lines
   - 2.3.   Types of line
   - 2.4.   Use of pencil for different lines
   - 2.5.   Application of lines
   - 2.6.   Lettering
   - 2.7.   Guidelines

3. **Basic Dimensioning**   **2 Hours**
   - 3.1.   Dimensioning
   - 3.2.   Elements of dimensioning
   - 3.3.   System of measurements

3.4. Tolerance

3.5. Note & specification.

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

    4.1. Introduction to geometry, plane, and solid type

    4.2. Different conventional shapes, surfaces, and objects

    4.3. Introduction to sketching techniques.

    4.4. Introduction to the curve

    4.5. Cone and conic section

    4.6. Spiral and Involutes

    4.7. Cycloid, Epicycloids, Hypocycloid

5. **Introduction To Multi-View Drawings**   **4 Hours**

    5.1. Introduction to the plane and its types

    5.2. Dihedral and Trihedral angles

    5.3. Projection of point, lines, plane, and solids

    5.4. Definition and concept of multi-view drawings

    5.5. Perceptual views of plan of projections

    5.6. Orthographic projections

    5.7. 1st angle and 3rd angle projection

    5.8. Isometric sketching

    5.9. Principal views and its arrangements

    5.10. multi-view drawings and missing line

Part B: **AutoCAD**   **50%**

1. **Installation and Introduction of AutoCAD Mechanical (Latest Version)**   **4 Hours**

    1.1 Installation and activation of Auto CAD

    1.2 User Interface

    1.3 Understand Template

    1.4 Understand Layers and Object

    1.5 Understand Mechanical Structure

2. **Drawing aids and coordinate system**   **3 Hours**

    2.1 Object snap and ortho

    2.2 Dynamic input setting

    2.3 Units and user Coordinate system

    2.4 Methods of drawing lines

    2.5 Introduction, Creation and working in layers.

3. **Dimensions, Symbols and Drawing Layout**   **3 Hour**

    3.1 Understand create Dimension.

    3.2 Understand create Symbols and annotations.

    3.3 Understand creation of Layout

    3.4 Understand creation of Drawing Frame

    3.5 Understand creation of Contents and Template

4. **Sketching of different objects in 2D**   **3 Hour**

4.1   Creating 2D sketch.

4.2   Modify 2D Sketch.

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

5.1   Conversion of 2D into 3D

5.2   Extrude command.

5.3   Revolve command.

5.4   Sweep command.

5.5   Loft command.

5.6   Conversion of 3D into 2D

INSTRUCTIONAL OBJECTIVES

1.   Application of Technical Drawing

1.1 Importance of Technical Drawing

   1.1.1   Explain the significance of technical drawing in various industries.

   1.1.2   Describe how accurate technical drawings contribute to efficient communication and problem-solving.

1.2 Types of Drawing

   1.2.1   Differentiate between different types of technical drawings, such as orthographic, isometric, and perspective drawings.

   1.2.2   Explain the purpose and appropriate use of each type of drawing.

1.3 Application of Technical Drawing

   1.3.1   Recognize real-world applications of technical drawing in fields like engineering, architecture, manufacturing, and more.

   1.3.2   Explain how technical drawings are used to communicate design intent and specifications.

1.4 Bill of Material

   1.4.1   Define what a Bill of Material (BOM) is and its role in design and production processes.

   1.4.2   Interpret a BOM and understand how it lists components, materials, and quantities.

   1.4.3   Create a basic BOM for a simple assembly.

1.5   Bill of Quantity

   1.5.1   Define a Bill of Quantity (BOQ) and its purpose in project management and procurement.

   1.5.2   Differentiate between BOM and BOQ.

   1.5.3   Develop a simple BOQ for a construction or engineering project.

1.6 Process Flow Drawings

   1.6.1   Explain the concept of process flow drawings and their significance in illustrating workflow and sequences.

   1.6.2   Create a basic process flow diagram to represent a simple process.

1.7 General Assembly Drawing

   1.7.1   Define a General Assembly Drawing (GAD) and its role in showcasing the relationship between various components in an assembly.

   1.7.1   Interpret a GAD and identify individual components within an assembly.

        1.7.2   Develop a simple GAD for a basic mechanical assembly.

1.8 Symbols of Devices and Components

        1.8.1   Recognize and explain common symbols used to represent devices and components in technical drawings.

        1.8.2   Interpret technical drawings with various symbols and annotations.

        1.8.3   Create a reference sheet that lists and explains commonly used symbols in technical drawings.

2. **Drafting Equipment, Types of Lines, and Lettering (3 Hours)**
   2.1 List of Drawing Equipment

a) Identify and list essential drafting equipment used in technical drawing.
b) Explain the purpose of each drafting tool and its contribution to creating accurate drawings.

2.2 Basic Lines

a) Define the concept of basic lines in technical drawings.
b) Differentiate between various types of basic lines, such as straight, curved, and freehand lines.
c) Demonstrate the ability to draw neat and precise basic lines.

2.3 Types of Line

a) Classify different types of lines used in technical drawings, including object lines, hidden lines, centerlines, and more.
b) Explain the significance of each type of line in conveying information about an object's features.

2.4 Use of Pencil for Different Lines

a) Understand how to control pencil pressure to achieve various line weights.
b) Apply appropriate pencil techniques to create consistent and accurate lines, such as light lines, dark lines, and hatching.

2.5 Application of Lines

a) Apply the knowledge of different types of lines to create accurate technical drawings.
b) Use appropriate line types to represent different features of objects, such as visible, hidden, and dimension lines.
   2.6 Lettering

a) Define the concept of lettering in technical drawings and its role in conveying information.
b) Demonstrate the ability to create consistent and legible lettering using appropriate techniques.

2.7 Guidelines

a) Explain the purpose of guidelines in technical drawing.
b) Create and use guidelines effectively to maintain proper alignment, spacing, and proportions in drawings.

Module 3: Basic Dimensioning (2 Hours)

3.1 Dimensioning

a) Define dimensioning and its importance in technical drawings.
b) Differentiate between linear, angular, and radial dimensions.
c) Explain the purpose of dimension lines, extension lines, and arrowheads in dimensioning.

3.2 Elements of Dimensioning

a) Identify and describe the elements of dimensioning, including dimension lines, extension lines, arrowheads, and leaders.
b) Apply proper placement and alignment of dimensions on technical drawings.

3.3 System of Measurements

a) Understand different systems of measurement, such as the metric and imperial systems.
b) Convert measurements between different units within a system.
   3.4 Tolerance

a) Define tolerance and its significance in engineering design.
b) Explain the concepts of upper and lower limits, and nominal dimensions.
c) Interpret tolerance notations on technical drawings.
   3.5 Note & Specification

a) Understand the use of notes and specifications in technical drawings.
b) Write and interpret notes related to material, finish, and other special instructions.

Module 4: Drafting Geometry, Sketching, and Engineering Curves (3 Hours)

4.1 Introduction to Geometry

a) Differentiate between plane and solid geometry.
b) Identify different conventional shapes and objects used in technical drawings.
   4.2 Sketching Techniques

a) Understand the basics of sketching techniques used in technical drawings.
b) Create accurate and neat sketches of simple geometric shapes.
   4.3 Introduction to Curves

a) Define engineering curves and their applications in technical drawings.
b) Identify different types of curves, including conic sections, spirals, involutes, and more.

Module 5: Introduction to Multi-View Drawings (4 Hours)

5.1 Introduction to Planes and Types

a) Understand the concept of planes and their significance in projection.
b) Differentiate between different types of planes, such as principal planes and auxiliary planes.

5.2 Projection and Angles

a) Define dihedral and trihedral angles and their importance in multi-view drawings.
b) Explain the process of projecting points, lines, planes, and solids onto different planes.

5.3 Multi-View Drawings

a) Understand the concept of multi-view drawings and their purpose in communicating object details.
b) Identify and create principal views, including front, top, and side views.

5.4 Orthographic Projections and Projections

a) Differentiate between 1st angle and 3rd angle projection methods.
b) Create isometric sketches to represent objects in three dimensions.

5.5 Principal Views and Arrangements

a) Identify and arrange principal views to communicate object features effectively.
b) Understand the concept of missing lines in multi-view drawings.

Part B: AutoCAD (50%)

Module 1: Installation and Introduction of AutoCAD Mechanical (Latest Version) (4 Hours)

1.1 Installation and Activation

a) Successfully install and activate the latest version of AutoCAD Mechanical.
b) Explain the importance of proper installation and activation for software functionality.

1.2 User Interface

a) Navigate and understand the key components of the AutoCAD Mechanical user interface.
b) Identify various tools, panels, and menus in the software interface.

1.3 Understanding Templates

a) Describe the concept of templates in AutoCAD and their role in consistent drawing creation.
b) Create, modify, and utilize templates for efficient workflow.

1.4 Understanding Layers and Objects

a) Define layers and their importance in organizing drawing elements.
b) Explain object properties and their control through layers.

1.5 Understanding Mechanical Structure

a) Understand the specialized tools and features in AutoCAD Mechanical tailored for mechanical design.
b) Identify and explain the benefits of using AutoCAD Mechanical in mechanical engineering tasks.

Module 2: Drawing Aids and Coordinate System (3 Hours)

2.1 Object Snap and Ortho

a) Define object snap and ortho functions and their role in accurate drawing creation.
b) Apply object snap and ortho settings effectively for precise alignment and drawing.

2.2 Dynamic Input Setting

a) Explain dynamic input and its benefits in enhancing drafting efficiency.
b) Utilize dynamic input settings for real-time input and feedback during drawing.

2.3 Units and User Coordinate System

a) Define units and their importance in maintaining consistency and scale in drawings.
b) Set up and manipulate the user coordinate system (UCS) for convenient drawing alignment.

2.4 Methods of Drawing Lines

a) Demonstrate various methods of drawing lines, including specifying endpoints, angles, and lengths.
b) Apply different line-drawing techniques to create accurate and complex shapes.

2.5 Introduction, Creation, and Working in Layers

a) Understand the concept of layers and their organization within a drawing.
b) Create, manage, and manipulate layers effectively for clear and organized drawings.

Module 3: Dimensions, Symbols, and Drawing Layout (3 Hours)

3.1 Creating Dimensions

a) Explain the role of dimensions in communicating object size and relationships.
b) Create different types of dimensions, including linear, angular, and radial dimensions.

3.2 Creating Symbols and Annotations

a) Define symbols and annotations and their significance in conveying additional information.
b) Create symbols and annotations using appropriate tools and techniques.

3.3 Creating Layouts

a) Understand the concept of layouts in AutoCAD and their role in presenting drawings.
b) Create and manage layouts for various views and presentations.

3.4 Creating Drawing Frames

a) Explain the purpose of drawing frames and their importance in maintaining consistency.
b) Create drawing frames with title blocks and necessary information.

3.5 Creating Contents and Templates

a) Understand the importance of creating content blocks and templates for efficient drawing creation.
b) Develop content blocks and templates for reuse in different drawings.

Module 4: Sketching of Different Objects in 2D (3 Hours)

4.1 Creating 2D Sketches

a) Define the process of creating 2D sketches in AutoCAD.
b) Create accurate and detailed 2D sketches of various objects using appropriate tools.
   4.2 Modifying 2D Sketches

a) Demonstrate the ability to modify and edit 2D sketches to refine shapes and dimensions.
b) Utilize various editing tools for manipulation and adjustments.

Module 5: 3D Design and Solid Modeling (3 Hours)

5.1 Conversion of 2D into 3D

a) Explain the concept of converting 2D sketches into 3D models.
b) Utilize appropriate tools to extrude and generate 3D solids from 2D sketches.

5.2 Extrude Command

a) Define the extrude command and its role in creating 3D objects.
b) Apply the extrude command to generate simple 3D forms.

5.3 Revolve Command

a) Explain the revolve command and its use in generating 3D shapes through rotation.
b) Create 3D objects using the revolve command with various profiles.

5.4 Sweep Command

a) Define the sweep command and its purpose in creating complex 3D shapes.
b) Apply the sweep command to generate objects along specified paths.

5.5 Loft Command

a) Understand the loft command and its role in creating smooth transitions between 3D profiles.
b) Create 3D objects using the loft command with multiple profiles.

5.6 Conversion of 3D into 2D

a) Explain the process of converting 3D models back into 2D drawings.
b) Generate 2D orthographic projections and sections from 3D models.

LIST OF PRACTICALS

1. Read out of technical drawing
2. Taking of quantity from drawing
3. Read out of assembly drawings
4. Read out of flow drawings
5. Practice of single stroke capital vertical & inclined lettering
6. Construction of angles and triangles
7. Construction of quadrilaterals and circles elements
8. Construction of inscribe and circumscribe figures (square, triangle and hexagon)
9. Construction of pentagon by different methods
10. Construction of Hexagon, Octagon, by general and different methods
11. Construction of Tangents of circles (Inside & Outside)
12. Construction of Ellipse by four different methods
13. Construction of parabola curve by four different methods
14. Construction of hyperbola
15. Construction of involutes curve of square rectangle hexagon and circle
16. Construction of cycloid, epicycloids, and hypocycloid
17. Orthographic projection 1 and 3rd angle
18. Orthographic projection and Isometric Drawing
19. Development of prism
20. Development of cylinder
21. Development of cone
22. Development of pyramid

Part-B

1. Installation and activation of Auto-CAD/SOLIDWORKS (Latest Version)
2. Title Bar, Tool Bar, Menu Bar, Browser, Status Bar, Command Line
3. Zoom, Pan, Orbit
4. Object Snap, Grid, Orthogonal
5. Layer and Object Property
6. Construction Line and Center Line
7. Exercise of Save, Units, and Coordinate System commands
8. Line and Poly line Command
9. Circle, Arc and Ellipse Command
10. Rectangular and Polygon Command
11. Dimension and Hatching
12. Text Command
13. Copy, Mirror Command
14. Offset Command
15. Move, Rotate and Scale Command
16. Trim and Extend Command
17. Join and Break Command

18. Fillet and Chamfer Command
19. Explode Command
20. Exercise of Basic 2D Drawings
21. Exercise of Mechanical Drawings.
22. Extrude command.
23. Revolve command.
24. Sweep command.
25. Loft command
26. Plane Surface command, Ruled surface.
27. Extrude surface, Revolve surface
28. Sweep surface, loft surface
29. Surface trim and extend.
30. Practice of basic 3D drawing

COMPC-112   Introduction to Computer Studies & Programming

Total Contact Hours: **128**   **T**   **P**   **C**
    Theory Hours: **32**
    Practical Hours: **96**
                                      1   **3**   **2**

Aim:
1. Acquire a comprehensive comprehension of computer architecture and its associated terminology.
2. Acquire knowledge about different hardware components and their respective functions.
3. Learn fundamental techniques necessary for computer operations and executing frequently usedapplication packages.
4. Familiarize oneself with the foundational concepts of programming and crafting algorithms.
5. Cultivate the skill to solve problems using computing and programming techniques.

1. Introduction to Computer System   **05 Hours**
        1.1   Introduction
        1.2   I/O Devices and Peripherals
        1.3   Computers for individuals
        1.4   Computers for organizations
        1.5   Applications of Computers

2. Data Processing   **04 Hours**
        2.1   Data Representation
            1.1.1. Number System

        2.2   Data processing
            1.2.1. CPU
            1.2.2. Memory
        2.3   Types of storage devices
            1.3.1. Registers
            1.3.2. Data Bus
            1.3.3. Address Bus
            1.3.4. Cache Memory

3. Operating System   **03 Hours**
        3.1   Introduction of Operating System and its function
        3.2   Categories of Operating Systems
        3.3   Command Line Interface (CLI)
        3.4   Graphical User Interface (GUI)

4. Networks   **06 Hours**
        4.1   Introduction to NETWORKS
        4.2   Common Types of Networks
        4.3   Local Area Networks (LANs)
          4.4   Wide Area Networks (WANs)

    4.5   Hybrid Networks

    4.6   HANs

    4.7   Network Media

    4.8   Network Hardware (Network Cards, Hub, Bridges, Switches, Routers)

    4.9   Working of World Wide Web

    4.10   Effective use of Email Platforms

5. Application Software   04 Hours

    5.1   Introduction to Application Software

            5.1.1   Commercial Software

            5.1.2   Freeware Software

            5.1.3   Open-Source Software

    5.2   Microsoft Office (MS Word, MS Excel, MS Power point)

6. Introduction To C and C++   10 Hours

    6.1   Introduction to C and C++ programming languages

    6.2   Fundamentals of programming in C++ and C

    6.3   Control structures and functions in C++ and C

    6.4   Object-oriented programming in C++ and C.

<u>**INSTRUCTIONAL OBJECTIVES**</u>

1. **INTRODUCTION TO COMPUTER SYSTEM**

    1.1   Give an intro to computer systems

    1.2   Explain peripheral devices

    1.3   Explain Use of Computers for Individuals

            1.3.1   Desktop Computers

            1.3.2   Notebook Computers

            1.3.3   Tablet PCs

            1.3.4   Handheld PCs (PDAs)

            1.3.5   Smart Phones

    1.4   Explain Use of Computers For Organizations

        1.4.1   Network Servers

        1.4.2   Mainframes

        1.4.3   Minicomputers

        1.4.4   Super Computers

    1.5   Describe the Applications of Computers in following fields:

         1.5.1   Home

         1.5.2   Education

         1.5.3   Business

         1.3.4   Industry

         1.3.5   Government

Module 2: Data Processing

2.1 Data Representation - Number System

a) Explain data representation concepts and the importance of number systems.
b) Differentiate between binary, decimal, octal, and hexadecimal number systems.

2.2 Data Processing - CPU and Memory

a) Define Central Processing Unit (CPU) and its role in data processing.
b) Understand memory hierarchy and its significance in storing and accessing data.

2.3 Types of Storage Devices - Registers, Data Bus, Address Bus, Cache Memory

a) Define and differentiate registers, data bus, address bus, and cache memory.
b) Understand how these components contribute to efficient data processing.

Module 3: Operating System (10 Hours)

3.1 Introduction to Operating System and Its Function

a) Define an operating system and explain its fundamental role in computer systems.
b) Understand the functions of an operating system, including managing hardware, software, and resources.

3.2 Categories of Operating Systems

Differentiate between various categories of operating systems, such as single-user, multi-user, real-time, and network operating systems.

Explain the specific characteristics and purposes of each category.

3.3 Command Line Interface (CLI)

a) Define Command Line Interface (CLI) and its significance in interacting with an operating system.
b) Navigate and perform basic tasks using command-line commands.

3.4 Graphical User Interface (GUI)

a) Define Graphical User Interface (GUI) and its advantages in user interaction.
b) Navigate and operate within a GUI environment.

Module 4: Networks (12 Hours)

4.1 Introduction to Networks

a) Define a network and understand its importance in connecting computers and devices.
b) Explain the benefits of networking in sharing resources and information.

4.2 Common Types of Networks

a) Differentiate between common types of networks, including LANs, WANs, HANs, and hybrid networks.
b) Understand the purposes and scopes of each type of network.

4.3 Local Area Networks (LANs) and Wide Area Networks (WANs)

a) Define LANs and WANs and describe their characteristics and usage scenarios.
b) Explain the differences in scale and geographic coverage between LANs and WANs.

4.4 Network Media, Network Hardware, and Working of World Wide Web

a) Understand different types of network media and their advantages and disadvantages.
b) Identify network hardware components such as network cards, hubs, switches, bridges, and routers.
c) Explain the basic functioning of the World Wide Web and the Internet.

4.5 Hybrid Networks, HANs, and Effective Use of Email Platforms

a) Define hybrid networks and understand their combination of different network types.
b) Explain the concept of a Home Area Network (HAN) and its relevance to home automation.
c) Demonstrate effective usage of email platforms for communication and collaboration.

Module 5: Application Software (8 Hours)

5.1 Introduction to Application Software

a) Define application software and explain its role in fulfilling specific user tasks.
b) Differentiate between commercial software, freeware software, and open-source software.

5.2 Microsoft Office (MS Word, MS Excel, MS PowerPoint)

a) Understand the features and functionalities of Microsoft Office applications.
b) Create, edit, and format documents, spreadsheets, and presentations using MS Word, MS Excel, and MS PowerPoint.

Module 6: Introduction to C and C++ (12 Hours)

6.1 Introduction to C and C++ Programming Languages

a) Define C and C++ programming languages and understand their significance in software development.
b) Explain the evolution and history of C and C++ languages.

6.2 Fundamentals of Programming in C++ and C

a) Describe the basic syntax, data types, variables, and constants in C++ and C.
b) Write simple programs using input, output, and basic arithmetic operations.

6.3 Control Structures and Functions in C++ and C

a) Understand control structures such as loops and conditional statements in C++ and C.
b) Define and use functions to modularize code and improve code organization.

6.4 Object-Oriented Programming in C++ and C

a) Define the principles of object-oriented programming (OOP) and its importance.
b) Understand classes, objects, encapsulation, inheritance, and polymorphism in C++ and C.

LIST OF PRACTICALS

1. Create a document using a MS Word, with at least three paragraphs and perform editing operations.
2. Create a formal letter using a MS Word, to place a purchase order for procurement of books. Use tables for list of books.
3. Create a Spreadsheet in MS-EXCEL and enter the marks of a student, calculate total and print grade if the student has passed in all subjects.
4. Create a Power-point presentation with at least 6 slides.
5. Write the program to print some text on the screen.
6. Practice the correct use of headers and identify different compiler errors.
7. Understanding Variables, Constants, Data Types and sizes
8. Determine the size, minimum and maximum value following data types. Please specify if your machine is 32 bit or 64 bits in the answer.
   - char
   - unsigned char
   - short
   - int
   - unsigned int
   - unsigned long
   - float
9. Practice Arithmetic Operations
10. Practice Relational and Logical Operations.
11. Practice Conditional Operations.
12. Practice Loops (for, while, do-while)
13. Practice Arrays, pointers and their manipulation.
14. Use of "Functions" in Programming
15. Practice to determine output of the given programs
16. I/O Streams

MTRC- 121 Introduction to Mechatronics

Total Contact Hours		T	P	C
Theory (Hours): 32		1	0	1

Aims

- ❖ To introduce the basic concept of Mechatronics and Industrial Automation.
- ❖ To understand the applications of Mechatronics in industries.

Course Contents

1. **Introduction to Mechatronics**   **3 Hours**
    1.1   Definition of Mechatronics
    1.2   What are the five basic components in Mechatronics system?
    1.3   Definition of Automation and Instrumentation
    1.4   Significance of Mechatronics and Automation in modern industries
    1.5   Applications of Mechatronics & Automation
    1.6   Relationship between Mechatronics, Automation and Instrumentation

2. **Characteristics of Measuring Devices**   **3 Hours**
    2.1   Important characteristics of measuring instrument
    2.2   Static characteristics
    2.3   Dynamic characteristics
    2.4   Comparison between static & dynamic characteristics

3. **Introduction to CNC Machines**   **3 Hours**
    3.1   Definition of CNC machines
    3.2   Types of CNC machines
    3.3   Elements of CNC system
    3.4   Advantages & disadvantages of CNC machines
    3.5   CAD/CAM

4. **Introduction to Sensor and Transducers**   **4 Hours**
    4.1   Define Sensor and Transducer
    4.2   Difference between a Sensor and a Transducer
    4.3   Active and Passive Sensors
    4.4   Analog and Digital Sensors
    4.5   Smart Sensors
    4.6   Force /Pressure Transducer
    4.7   Level Transducer
    4.8   Position and Motion Transducer
    4.9   Light Transducer

4.10   Temperature Sensor

4.11   Sound Sensor

5. **Introduction to Actuators**   **4 Hours**
    5.1   Definition of Actuator
    5.2   Classification of Actuators
    5.3   Electro Pneumatic Actuators
    5.4   Servo Motor
    5.5   Stepper Motor
    5.6   Linear Actuators (Single Acting cylinders, Double Acting cylinders)

6. **Applications of Mechatronics**   **4 Hours**
    6.1   Mechatronics Design of Coin Counter
    6.2   Mechatronics Design Of Automatic Washing Machine
    6.3   Biometric Attendance Machine
    6.4   Pick and Place Robot
    6.5   Quad copter drone with camera

7. **Automatic Production Line**   **4 Hours**
    7.1   Definition of simulation and its role in manufacturing
    7.2   Importance of production line simulation in optimizing processes
    7.3   Introduction to Industrial Digital Twin Technology
    7.4   What is simulation in production management?
    7.5   What is factory flow simulation?

8. **Introduction to Signal Processing**   **4 Hours**
    8.1   What is meant by signal processing?
    8.2   Five types of signals
    8.3   What are the 3 types of signal processors?
    8.4   What are the steps in signal processing?

9. **Introduction to Data Acquisition**   **3 Hours**
    9.1   Analog & Digital Signals
    9.2   Signal conditioning
    9.3   Signal amplifier
    9.4   DAQ system
    9.5   Importance of DAQ system
    9.6   Components of DAQ system
    9.7   Steps in DAQ process
    9.8   Application of DAQ system

INSTRUCTIONAL OBJECTIVES

1. Introduction to Mechatronics

1.1 Define Automation.

1.2 Define Mechatronics

1.3 Define Instrumentation.

1.4 Define System.

1.5 Define Mechatronics system.

1.6 Draw the block diagram of a Mechatronics system.

1.7 Write names of major components of a Mechatronics system.

1.8 Describe the need of a Mechatronics system.

1.9 Describe the Applications of Mechatronics system in modern industry.

1.10 Describe the major advantages of Mechatronics system.

1.11 Describe the draw backs of the Mechatronics system.

2. Characteristics of Measuring Devices

2.1 Define instrument.

2.2 Define measuring instrument.

2.3 Define static characteristics.

2.4 Define dynamic characteristics.

2.5   Make a comparison of static and dynamic charactistics.

3. Introduction to CNC Machines

3.1 Define system.

3.2 Define numerical system.

3.3 Define computer numerical system.

3.4 Define machine and machine tool.

3.5 Describe the types of CNC machines.

3.6 Describe the advantages of CNC.

3.7 Describe the disadvantages of CNC.

3.8 Define CAD.

3.9 Define CAM.

3.10 Describe the importance of CAD/CAM in Automated manufacturing system.

4. Introduction to Sensor and Transducers

4.1 Define sensor.

4.2 Define transducer.

4.3 Define passive sensor.

4.4 Define active sensor.

4.5 Define analog sensor.

4.6 Define digital sensor.

4.7 Define force.

4.8 Define pressure sensor.

4.9 Define position.

4.10 Define motion sensor.

4.11 Define light sensor.

4.12 Define temperature sensor.

4.13 Define sound sensor.

4.14 Explain the importance of sensors in a mechatronics sensor.

4.15 Describe the working of any five sensors used in a modern car.

5. Introduction to Actuators

5.1 Define actuator.

5.2   Differentiate between sensor and actuator.

5.3   Describe the types of actuators.

5.4   Describe the working of an electro pneumatic actuator.

5.5   Define motor.

5.6   Define servo motor.

5.7   Write four character tics of servo motor.

5.8   Define stepper motor.

5.9   Write four characteristics of a stepper motor.

5.10 Describe the working of any two linear actuators.

6.   Applications of Mechatronics

6.1   Explain the Mechatronics design of a Coin Counter.

6.2   Explain Mechatronics design Of Automatic Washing Machine.

6.3   Explain the working of a Pick and Place Robot.

6.4   Describe the working of a Biometric Attendance Machine.

6.5   Describe the working Quad Copter Drone.

7.   Automatic Production Line

7.1   Define simulation.

7.2   Describe optimization.

7.3   Describe the importance of simulation in manufacturing process.

7.4   Describe the importance of optimization in manufacturing process.

7.5   Describe digital twin technology.

7.6   Describe the importance of simulation in production management.

7.7   Describe factory flow simulation.

8.   Introduction to Signal Processing

8.1   Define signal.

8.2   Define signal processing.

8.3   Describe the types of signals.

8.4   Describe the types of signal processors.

8.5   Describe the steps in signal processing.

9.   INTRODUCTION TO DATA ACQUISITION

9.1 Define analog signal.

9.2 Define digital signal.

9.3 Describe analog to digital converter.

9.4 Describe digital to analog converter.

9.5 Define amplifier.

9.6 Describe signal conditioning.

9.7 Define DAQ system.

9.8 Describe the importance of DAQ system.

9.9 Explain the components of the DAQ system.

9.10 Explain the steps involved in the DAQ process.

9.11 Describe the applications of DAQ in industry.

MTRC-133- Electrical Essentials

Total Contact Hours: 160

	T	P	C
Theory (Hours): 64	2	3	3
Practical Hours: 96			

Aims

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

2. This course is aims at providing a strong foundation in the basic concepts and laws of electricity, alongwith an appreciation of the magnitude of these quantities involved or to be solved through numerical problems.

3. In the light of above mentioned aims these concepts are to be further strengthened through extensivelythrough laboratory work.

Course Contents

1. Basic Concepts of Electricity   **8 Hours**

- 1.1 Charge
- 1.2 Electric Current
- 1.3 Voltage/Potential Difference
- 1.4 Work/Energy
  - 1.4.1. KWH
- 1.5 Power
- 1.6 Difference between AC & DC Power
  - 1.6.1. KVA
  - 1.6.2. KW
- 1.7 Conversion of electrical energy to mechanical energy
- 1.8 Calculation of energy billing of an installation

2. DC Fundamentals   **9 Hours**

- 2.1 Ohm's Law
  - 2.1.1. State ohm's law
  - 2.1.2. Solve problems on ohm's law
- 2.2 2.2 Laws of Resistance
  - 2.2.1. Specific resistance, conductance and conductivity
  - 2.2.2. Resistance in series, parallel and series-parallel
- 2.3 2.3 Resistors
  - 2.3.1. Application of resistors
  - 2.3.2. Color coding
- 2.4 2.4 DC sources

2.5   2.5 Solar panels

      2.5.1. Types of solar panels

2.6   2.6 Batteries

      2.6.1. Types of cells, primary and secondary cells (Mercury, silver oxide, nickel-cadmium,etc)

      2.6.2. Lead acid batteries

      2.6.3. Solar cell

      2.6.4. Lithium ion batteries

      2.6.5. Super capacitor

      2.6.6. Gel batteries

      2.6.7. Internal resistance of a cell

3. Transformers   7 Hours

3.1   Principle of transformer, mutual inductance, coefficient of mutual inductance.

3.2   Turn ratio and e.m.f. equation

3.3   Construction, types of transformers, core materials.

3.4   Application of transformers in electronics.

3.5   Auto-transformers, principle, advantages, disadvantages and applications.

3.6   Star/delta transformation

3.7   Delta/star transformation

3.8   Problems

3.9   Poly phase transformers, star and delta connection.

3.10   Phase and line voltage and current their, inter-relation.

3.11   Transformer losses.

      3.11.1. Coreloss.

      3.11.2. Hysteresis loss.

4. Magnetism And Electromagnetism   6 Hours

4.1   Magnetism

      4.1.1. Introduction to magnetism, magnetic line of force, flux, flux density, permeability,reluctance and their units

      4.1.2. Properties of magnetic lines of force

      4.1.3. Magnetic induction

4.2   Electromagnetism

      4.2.1. Electromagnetism, field intensity, and ampere turns/meter

      4.2.2. Electromagnetic induction

      4.2.3. Magnetic field around a current carrying conductor and solenoids Cork screw andleft hand rules

      4.2.4. Faraday's law of Electromagnetic induction (R=Nd/dt)

      4.2.5. Lenz's law

5. Electrostatics   8 Hours

5.1   Principal of electrostatic, positive and negative charges.

5.2   Laws of electrostatics

5.3   Capacitance and capacitors. Capacitance of parallel plate capacitor

5.4   Equivalent capacitance for series, parallel and series parallel combination of capacitors

5.5   Energy stored in capacitors

5.6   Color code, tolerance and rating of capacitors

6. AC Fundamentals   **8 Hours**

6.1   The simple AC generator

6.2   Sin wave, square wave, modified sin wave.

6.3   Sin wave, cycle, wavelength, period, frequency and units

6.4   AC sine wave form and its characteristics. (Instantaneous, peak, average, rms or effectivevalues and their inter relation)

6.5   Types of alternating wave forms (sinusoidal and non-sinusoidal waves)

6.6   AC circuits

6.7   AC through pure resistor, phasor quantities

6.8   AC through pure inductor, phasor quantities

6.9   AC through pure capacitor, phasor quantities

7. Electrical Devices   **7 Hours**

7.1   Common Electrical Components

   7.1.1.   AC and DC breakers

   7.1.2.   MCB & MCCB breakers

   7.1.3.   Relays

   7.1.4.   ATS (Auto Transfer Switches)

   7.1.5.   Timers Relays

   7.1.6.   Changeovers

   7.1.7.   Types of change over

        (a) Electrical

        (b) Mechanical

        (c) 3-phase change over

   7.1.8.   Magnetic contactors

   7.1.9.   Control Panels

        (a) Types of Control Panels

        (b) Types of DB Box

   7.1.10. Connection strips

   7.1.11. Bus Bars

7.2   Protective Devices

   7.2.1.   Voltage Protector

   7.2.2.   SPD (Surge Protection Devices)

8. Electric Wiring   **6 Hours**

8.1   Symbols/Schematics

8.2   Electrical Tools

8.3   Types of Cables/Wires

   8.3.1.   AC cables (Standard)

8.3.2.   DC cables (Flexible)
8.4   Wire Gauge
8.5   Wiring Regulations
8.6   Earthling & Electrical Safety
8.7   Measurement and Testing Methods
8.8   Common Circuits (Single Way, Two Way, Ringed, Etc.,)
8.9   Electrical Wiring Quality Standards

9. Soldering   **5 Hours**
9.1   Define Soldering and Different Types of Solders
9.2   Common Soldering Tools and Equipment
9.3   Method-sand Techniques for Soldering
9.4   De-Soldering Techniques
9.5   Inspection of Soldered Joints
9.6   Rectification of Soldered Joints
9.7   PCB Soldering: How to Translate a Circuit On to a PCB?
9.8   Etching, Drilling and Soldering Component on PCB
9.9   Introduction to software e.g. Proteus, Altium.

INSTRUCTIONAL OBJECTIVES

1. **BASIC CONCEPTS OF ELECTRICITY**
   1.1. Definition and unit of Charge
   1.2. Definition and unit of Electric Current
   1.3. Definition and unit of Voltage/Potential Difference
   1.4. Definition and unit of Work/Energy
       1.4.1. Definition and use of KWh
   1.5. Definition and Unit of Power
   1.6. Definition and difference between AC/DC power
       1.6.1. Use of KVA
       1.6.2. Use of KW

2. **DC FUNDAMENTALS**
   2.1. Ohm's Law
       2.1.1. State ohm's law
       2.1.2. Solve problems on ohm's law
   2.2. Laws of Resistance
       2.2.1. Definition and unit of Specific resistance
       2.2.2. Definition and unit of conductance
       2.2.3. Definition and unit of conductivity
       2.2.4. Effect of temperature on resistance and temp. coefficient of resistance
       2.2.5. Problems on R= and $R_t = R_o(1+\alpha t)$
       2.2.6. Resistance in series, parallel and series-parallel
       2.2.7. Power and Energy their units and calculations
   2.3. Resistors
       2.3.1. Application of resistors
       2.3.2. Resistors, color coding
   2.4. Types of DC sources
   2.5. Definition of Solar Panels and its uses
       2.5.1. Different types of solar panels
   2.6. Batteries and their types
       2.6.1. Different types of cells, Primary and Secondary
       2.6.2. Lead acid Batteries

2.6.3. Solar cell
2.6.4. Lithium Ion Batteries
2.6.5. Super Capacitor
2.6.6. Gel Batteries
2.6.7. Internal resistance of a cell

3. **TRANSFORMERS**
   3.1. Explain principle of transformer and understand the concept of mutual inductance, coefficient of mutual inductance.
   3.2. Define Turn Ratio and drive EMF equation of transformer.
   3.3. Explain construction of transformer
       3.3.1. Types of transformer
       3.3.2. Core materials
   3.4. Understands the application of transformers in electronics
   3.5. Explain Auto-transformers, its principle and also explain its advantages, disadvantages and applications.
   3.6. Explain the concept of star/delta transformation in three phase transformer
   3.7. Explain the concept of delta/ star transformation in three phase transformer
   3.8. Enlist Different types of problems with the working of transformers.
   3.9. Describe poly phase transformers, star and delta connections
   3.10.   Explain phase and line voltage and their inter-relation
   3.11.   Explain different types of transformer losses
       3.11.1. Core loss
       3.11.2. Hysteresis loss
       3.11.3. Copper Losses

4. **MAGNETISM AND ELECTROMAGNETISM**
   4.1. Understand magnetism
       4.1.1. Define magnetic lines of force, flux, flux density, permeability, & reluctance and their units.
       4.1.2. Explain the properties of magnetic lines of force
       4.1.3. Describe magnetic induction.
   4.2. To understand electromagnetism

4.2.1. Describe electromagnetism field intensity and ampere turns/meter

4.2.2. Explain electromagnetic induction

4.2.3. Explain magnetic field around a current carrying conductor and solenoids cork screw rule and left hand rule

4.2.4. Explain faraday's law of electromagnetism induction {e=N(d/dt)}

4.2.5. State Lenz's law

5. ELECTROSTATICS

5.1. Explain the Principal of electrostatic charges and state the effect of negative & positive charges.

5.2. Describe the laws of electrostatics.

5.3. Describe capacitor and capacitance. Also capacitance of parallel plate capacitors

5.4. Calculate the equivalent capacitance in a series, parallel combination

5.5. Explain energy stored in a capacitor

5.6. Color code, tolerance and rating of capacitors

6. AC FUNDAMENTALS

6.1. Understand the concept of AC generator

6.2. Describe sine wave, Square wave and modified sine wave

6.3. Explain cycle, wave length, period, frequency and their units w.r.t Sine wave

6.4. Draw AC sine waveform (sinusoidal, square, saw-tooth) and describe instantaneous value, peak value, average value, r.m.s value, effective value and their inter-relation

6.5. Explain types of alternating waveforms (Sinusoidal and non-sinusoidal waves)

6.6. Understand AC circuits

6.7. Describe AC through resistors and phasor quantities

6.8. Describe AC through inductors and phasor quantities

6.9. Describe AC through capacitors and phasor quantities

7. ELECTRICAL DEVICES

7.1. Explain electrical components

7.1.1. AC and DC Breakers

7.1.2. MCB and MCCB Breakers

7.1.3. Relays and their types (Solid-state, Mechanical)

7.1.4. Auto-Transfer Switches

7.1.5. Timers Relays

7.1.6. Changeovers

7.1.7. Understand different types of Changeovers

    7.1.7.1. Electrical

    7.1.7.2. Mechanical

    7.1.7.3. 3-phase Change over

7.1.8. Understand Magnetic Contactors

7.1.9. Control Panels

    7.1.9.1. Types of Control Panels

    7.1.9.2. Types of DB Box

7.1.10. Explain Connection Strips

7.1.11. Understand Bus Bars

7.1.12. Explain Different types of protective devices

    7.1.12.1. Voltage protector

    7.1.12.2. Surge protection devices

8. ELECTRIC WIRING

8.1. Understand the various electrical symbols/schematics

8.2. Identify various electrical tools for electrical wiring

8.3. Identify the various types of cables/wires for electrical wiring

    8.3.1. AC Cables

    8.3.2. DC Cables

8.4. Explain Wire Gauges

8.5. Understand the various wiring regulations

8.6. Understand the concept of Earthing with reference to electrical safety

8.7. Identify the various measurement and testing methods for electrical wiring

8.8. Describe the common electrical circuitry (Single way, two way, ringed, etc.)

8.9. Identify and describe Electrical Wiring Quality standards

9. SOLDERING

9.1. Define soldering and identify different types of solders

9.2. Identify and describe the common

soldering tools and equipment

9.3. Understand the methods and techniques for soldering

9.4. Understand various De-soldering techniques

9.5. Understand the different Inspection techniques of soldered joints

9.6. Understand how to rectification of a soldered joint

9.7. Understand PCB soldering and describe how to translate a circuit onto a PCB

9.8. Understand etching, drilling and soldering component on PCB

9.9. Introduce yourself to different softwares for PCB Designing, e.g. Proteus, Altium

<u>**LIST OF PRACTICALS**</u>

1. **Electrical Essentials (Basics)**
   1) Identify and observe rating of different capacitors, inductors and resistors.
   2) Construct a simple circuit to operate a load e.g. a bulb
   3) Demonstrate Ohms Law
   4) Measuring voltage and current by using voltmeter and ammeter in a series and parallel circuit
   5) Demonstrate the use of a Variable resistor
   6) Demonstrate using a relay as switch in a circuit
   7) Demonstrating the use of a transformer
   8) Learn how to use an oscilloscope and its various features & study DC/AC output waves on an oscilloscope and the rectified wave
   9) Demonstrate the working of an oscilloscope by generating a AC/DC signal on it. Vary the amplitude and wavelength and note the effects

2. **Electrical Wiring**
   1) Identify various types of electrical wires provided and develop a table noting their current, resistance & voltage rating and comparing these with the actual measurements.
   2) Using electrician' tools, demonstrate how to cut wires and make proper mechanical joints. Practice how to do proper covering with insulation tapes to ensure safety against electric shock.
   3) Make a basic electrical circuit for lighting a bulb on the demonstration boards and demonstrate the working of your circuit by changing various variables. (to control one lamp with a single switch, to control 2 lamps individually by 1 way and 2-Way switches, to control one lamp from 3 different places, to control two lamps in a series, both in parallel and individual control.
   4) To construct fuse indication circuit
   5) To install sinlge-phase Energy meter, Main

switch and Distribution fuse board.

6) To install voltage-ampere protector in AC circuit and observe its function as safety device.

7) To design a DB box using different breakers, changeover & Relays.

8) To install magnetic contactor & timer relays in a control circuit.

9) To install a solar system of 300 watt using solar panels, charge controller (30 A) and battery (12 volts).

3. **Soldering**

1) Identify the common solders, soldering tools and equipment and practice soldering techniques by soldering various electrical components on board.

2) Practice of Soldering and de-Soldering on PCB

3) Familiarization and practice on Hot air Soldering & de-soldering station.

4) Perform various operations such as etching, drilling and soldering on a PCB

5) Using a PCB, demonstrate working of series and parallel circuits. This is done also to show how neat soldering and de-soldering is done.

6) Make a buzzer circuit incorporating safety devices and test the circuit for any faults.

MTRC-143 Workshop Practice

			T	**P**	**C**
Total Contact Hours:	**224**				
Theory (Hours):	**32**		**1**	**6**	**3**
Practical (Hours):	**192**				

Aims:

1. Familiarize students with the layout, sections, tools, equipment, and safetyprotocols of the workshop.
2. Comprehend the commonly utilized workshop processes and techniques involvedin repairing and producing parts and components.
3. Foster an environment that encourages students to gain practical experience inmachining, metalworking, wiring, soldering, welding, and other related skills

1. **Introduction To Workshop**   **4 Hours**
    1.1   Workshop and its Layout
    1.2   Major Sections and Their Importance
    1.3   Types of Jobs Performed
    1.4   Overview of General Measurement Terms and Units

    1.5   General Tools Used in Workshop
    1.6   Safety Procedures

2. **Metal Working**
    2.1   Define Metal Working   **6 Hours**
    2.2   Concept of Material Deformation
        2.2.1.   Metal Cutting
        2.2.2.   Forging
        2.2.3.   Rolling
        2.2.4.   Extrusion and Drawing
        2.2.5.   Indenting
        2.2.6.   Shrinking and Stretching
        2.2.7.   Recessing
        2.2.8.   Spinning
        2.2.9.   Shearing and Bending
        2.2.10.   Pipe bending
    2.3   Introduction to Metal Forming Machines
    2.4   Metal Working Quality Standards

3. **Machining**   **6 Hours**
    3.1   Define Machining
    3.2   Introduction to Machining Processes & Their Techriques
        3.2.1.   Turning (Rough Turning, Finish Turning)

        3.2.2. Facing, Parting, Boring

           3.2.3. Drilling, Cutting, threading

           3.2.4. Tapping & Making Tapers

      3.3   Introduction to Machining Equipment, Their Working/ Functions

           3.3.1. Lathe Machine and its Types

           3.3.2. Milling Machine and its Types

           3.3.3. Shaping Machine

           3.3.4. Drilling Machine

      3.4   Machining Quality Standards

4. Wood working tools   4 Hours

      4.1   Wood working shop orientation.

      4.2   Impact Tools.

      4.3   Measuring Tools.

      4.4   Cutting Tools.

      4.5   Marking Tools.

      4.6   Holding Tools.

5. Wood Working Machines   3 hours

      5.1   Introduction

      5.2   Radial saw

      5.3   Saw.

      5.4   Band Saw.

      5.5   Jointer

      5.6   Wood turning lathe

      5.7   Laser cutting

6. Wood cuts and wood joints   4 Hours

      6.1   Types and uses of wood cuts.

      6.2   Classification and uses of wood joints.

      6.3   Making wood cuts and wood joints.

      6.4   Wood glue and wood fastener.

      6.5   Kind & seasoning of wood.

7. Welding & Joining Processes   05 Hours

      7.1   Define Welding and Classification of Welding Processes

      7.2   Welding Machines / Equipment &their Characteristics

      7.3   Welding Symbols & Common Welding Joints

      7.4   Methods and techniques for Gas Welding & Electric Arc Welding

      7.5   Advanced Welding Techniques: TIG, MIG, Laser & Electron Beam Welding

      7.6   Weld-ability of Alloys & Selection of Electrodes

      7.7   Inspection of Welded Joints

      7.8   Mechanical Joining: Riveting

      7.9   Adhesive Bonding

INSTRUCTIONAL OBJECTIVES

1. **UNDERSTAND HOW A WORKSHOP OPERATES**

1.1 Identify the purpose of a workshop and its layout
1.2 Describe the major sections of a workshop and the tasks performed there in.
1.3 Understand the commonly used measurement in industry along with their unit
1.4 Identify and describe general tools used in workshop
1.5 Understand safety procedures for working in a workshop

2. **KNOW ABOUT THE PROCESS OF METAL WORKING**

2.1 Define metal working
2.2 Understand the concept of material deformation
    2.2.1 Describe the metal cutting process
    2.2.2 Describe the forging process
    2.2.3 Describe the rolling process
    2.2.4 Describe the extrusion and drawing processes
    2.2.5 Describe the indenting process
    2.2.6 Describe the shrinking and stretching process
    2.2.7 Describe the recessing process
    2.2.8 Describe the spinning process
    2.2.9 Describe the shearing and bending process
    2.2.10 Describe the pipe Bending
2.3 Understand the working of various metal forming machines
2.4 Understand the working of various Metal Working Quality Standards

3. **DESCRIPTION OF MACHINING PROCESSES**

3.1 Define Machining
3.2 Understand Various Machining Processes and describe:
    3.2.1 Turning Process (Rough Turning, Finish Turning)
    3.2.2 Facing Process
    3.2.3 Parting Process
    3.2.4 Boring Process
    3.2.5 Drilling Process
    3.2.6 Cutting Process
    3.2.7 Tapping Process
    3.2.8 Tapers (Tapering)
    3.2.9 Threading Process
3.3 Understand and describe the working of important Machines and their functions, such as:
    3.3.1 Lathe Machine & Its Types
    3.3.2 Milling Machine & Its Types
    3.3.3 Shaping Machine
    3.3.4 Drilling Machine
3.4 Identify and describe the Machining Quality Standards

4. **UNDERSTAND WOOD WORKING SHOP POLICIES, HAND TOOLS AND EQUIPMENT SUPPORTING WOOD WORKING SHOP**

4.1 Describe the shop working policies

4.2 Describe the basic concept of wood work shop

4.3 Classify different wood working hand tools

4.4 Classify different wood working hand tools according to functions

4.5 Describe the use of Impact tools

4.6 Describe the use of various cutting tools.

4.7 Describe the use of various measuring tools.

4.8 Describe the use of different marking tools.

4.9 Describe the use of Holding tools

5. OPERATES EFFECTIVELY ALL WOOD WORKING MACHINES

5.1 Name various wood working machines.

5.2 Classify wood working machine according to their uses.

5.3 Explain the radial saw.

5.4 Explain the circular saw.

5.5 Explain the Band saw.

5.6 Explain the jointer and planner.

5.7 Explain the wood turning lathe.

5.8 Explain the application of radial saw.

5.9 Explain the application of circular saw.

5.10 Explain the application of band saw.

5.11 Explain the application of jointer and planner.

5.12 Explain the application of wood turning lathe.

5.13   Explain Laser Cutting machine

6.. PREPARE THE WOOD CUTS AND WOOD JOINTS ACCORDING TO THE SPECIFICATION AND SIZES.

6.1 Describe the woodcuts and types of joints.

6.2 Explain the use of wood joints

6.3 Select the appropriate joint for the given application

6.4 Describe cross halving wood joint.

6.5 Describe dovetail joint.

6.6 Describe mortise and tenon joints.

6.7 Describe dado joint.

6.8 Describe the open corner joint.

6.9 Describe the hidden corner joint.

6.10 Describe wood joint glue.

6.11 Describe wood fasteners.

6.12 Describe sharpening of hand tools.

6.13 Describe kind of wood.

6.14 Explain seasoning methods of wood

7. .KNOW ABOUT THE COMMONLY USED WELDING & JOINING PROCESSES

7.1 Define Welding and Classify Welding Processes

7.2 Understand the working / Characteristics & functions of various Welding Machines

7.3 Describe and Enlist Important Welding Symbols & Common Welding Joints

7.4 Methods and techniques for Gas Welding & Electric Arc Welding

7.5 Describe TIG, MIG, Laser & Electron Beam Welding Processes

7.6 Explain the Weld-ability of Alloys

7.7 Explain the Selection Criteria for Electrodes with Reference to Base metal/alloys
7.7 Describe various Inspection methods to determine the Integrity of Welded Joints
7.8 Describe Mechanical joining including Riveting
7.9 Describe commonly employed adhesive joining processes.

LIST OF PRACTICALS

Layout & Measurements   **12 Hours**

1. **Workshop Layout:** Sketch a layout of the workshop showing all the important sections such as Machine shop, Metal Working shop, Electrical shop etc. The layout shall include the entrances and exits, the training area, location for work benches, tools Store, machinery etc. Initially a rough layout shall be drawn on a A-3 sheet while labelling all the important areas and machinery. It should later be submitted in printed form. Include in your report a brief description of each section and the relevant safety precautions**.**
2. **Taking Measurements**: Get yourself familiarize with the working of different measurement tools / equipment.   Using the different objects provided, make accurate measurements regarding weight, size/ dimensions, etc. Practice conversion of units from the readings taken. Observe errors and error deviations from the readings taken by other groups on similar tools and objects. Prepare and submit a comprehensive report.

Metal Work Shop   **28 Hours**

1. Preparation of name plate.
2. Sawing exercise.
3. Preparation of inside caliper.
4. Preparation of Bottle opener.
5. Preparation of small size Try-square

Machine Shop   **36 Hours**

1. Practice by performing machining processes using different machines available in the workshop such as Lathe Machine, Milling Machine, Shape and Drilling Machine. Learn how to mount jobs and take measurements to reach target dimensions.
2. Practice of Cleaning & Oiling the Lathe Machine
3. Practice of centering the job by Tool Method and held in a four Jaw Chuck or Face plate.
4. Practice of center drilling, boring & counter boring
5. Practice of Rough turning, Step turning
6. Practice of Reaming & tool grinding
7. Practice of Taper turning & thread cutting

Wood Working Shop   **64 Hours**

1. Safety precautions in wood working shop. Assembly and disassembly of jack-plane. Using of various wood working planes. (Tool exercise.)
2. Planning and squaring to dimensions. (job-1)
3. Introducing different wood working layout and measuring tools.   Sawing exercise (job-2)

4. Identifying different types of 'handsaws' and making sketches of all saws, Wood chiseling (Chipping).

5. Preparation of dove-tail joint.
6. Making mortise & tanon joint. (job-3)
7. Making dado-joint (job-4).
8. Making cross-lap joint. (job-5)
9. Identifying and comparing soft and hard wood. Spirit polishing (preparing wood surface for polishing, staining and lacquering)
10. Boring process, making holes of different diameters in wood. (job-6)
11. Nailing and wood screwing process. (job-7+8)
12. Making middle half cross-lap joint and dove-tail joint. (job-9)
13. Wood working projects etc.

Welding Shop   52 Hours

Gas Welding

1. Flame making practice.
2. Pool making, Bead making.
3. Butt joint.
4. Lap joint.
5. Corner joint without filler rod.
6. Corner joint with filler rod.
7. T. joint.

Arc Welding

1. Arc making/ current setting/ polarity selection.
2. Bead making.
3. Butt joint.
4. Lap joint.
5. Corner joint, Square corner joint.
6. T. joint.
7. V. Butt joint.

MTRC-151 Occupational Health Safety & Environment

Total contact hours:		T	P	C
Theory:	32 Hours	1	0	1
Practical:	0 Hours			

AIM. At the end of this course, the students will be able to:-

1. Adopt safety standards, codes, rules, etc., to be desired in Mechanical Workshop / Labs ofIndustries.
2. Understand methods of prevention of accident.
3. Provide first aid and rescue in case of any accident.

Course Contents

1. Introduction and Importance of Safety   **3 Hours**
- 1.1. Introduction to safety and House keeping
- 1.2. Importance of safety in Institute workshops /labs
- 1.3. Importance of safety in industry
- 1.4. Implementation of 3S and 5S in Workplace
- 1.5. Accident prevention fundamentals
- 1.6. Introduction to IOSH & NEBOSH

2. Accidents in Chemical Industry   **3 Hours**
- 2.1. Accidents in petroleum, paint and fertilizer industry
- 2.2. Explosive vapors and gases
- 2.3. Preventions in chemical Industry accidents

3. Accidents in Mechanical Industry   **4 Hours**
- 3.1. Due to material handling and transportation
- 3.2. Accidents due to hand tools
- 3.3. Accidents in Workshops
- 3.4. Accidents in confined spaces
- 3.5. Accidents in hot work
- 3.6. Safety procedures while operating machinery/automated machines
- 3.7. Heat & ventilation
- 3.8. Prevention in mechanical industry accidents

4. Electric Hazards   **3 Hours**
- 4.1. Hazards related to electric shock phenomena
- 4.2. Reasons of electric shock
- 4.3. Prevention of electric shock

5. Fire accidents and their prevention   3 Hours

    5.1. Fire accidents and their prevention

    5.2. Fire hazard and their types

    5.3. Firefighting equipment, and fire extinguishers

    5.4. How to store flammable & hazardous materials

    5.5. Disposal of flammable & hazardous materials

6. Safety in plant Lay-out   2 Hours

    6.1. Safety in Plant lay out

    6.2. Housekeeping for safety

    6.3. Safety instruction during maintenance

    6.4. Safety instruction in use of electricity

    6.5. Implementation of 3S and 5S in Workplace

7. Personal Protective Equipment (PPE)   2 Hours

    7.1. Personal Protective Equipment and its importance

    7.2. First Aid Procedure and training

    7.3. Extended medical services

8. Risk Management   6 Hours

    8.1. What is Risk management for OHSE?

    8.2. Identification of health, safety and environmental hazard

    8.3. Risk Assessment and Risk Control Processes

    8.4. How to Plan Risk management?

9. Monitoring Ohse Programs   6 Hours

    9.1. Statistical Review

    9.2. Management/Staff meetings

    9.3. Stakeholders surveys

    9.4. Internal & External Reviews & Audits

    9.5. Suppliers'/Manufacturers products inspection

    9.6. Industrial procedures & operations review

Instructional Objectives:

1. **KNOW IMPORTANCE OF SAFETY PRACTICES AND ITS NECESSITY IN THE INDUSTRY**

    1.1 Describe importance of housekeeping, Safety and accidents
    1.2 Describe the importance of safety practices in Institute shops/labs

    1.3 Describe the hazards for not observing safety
    1.4 Implementation of 3S and 5S in Workplace
    1.5 Accident prevention fundamentals
    1.6 Introduction to IOSH & NEBOSH

2. **KNOW CAUSES AND PREVENTIONS OF ACCIDENT IN CHEMICAL BASED INDUSTRY**

    2.1 State the type and causes of accidents in petroleum, fertilizer, plaint and chemical based industry

        2.1.1 Enlist causes and preventions of chemical based industrial accidents

    2.2 Describe accidental causes and effects of explosive gases and vapors

        2.2.1 Describe toxic chemicals and their effects on human

        2.2.2 List of preventions for accidental causes due to explosive gases and vapors

3. **KNOW CAUSES AND PREVENTION OF ACCIDENTS IN MECHANICAL INDUSTRY**

    3.1 List of accidents in material handling and transportation in industry

        3.1.1 Describe the methods of prevention of accident due to material and machine handling in manufacturing Industry

    3.2 Explain proper use of hand tools to prevent accident

    3.3 Describe accidents in machines shop

    3.4 Describe accidents in confined spaces

    3.5 Describe accidents in hot work

    3.6 Describe safety procedures while operating machinery/automated machines

    3.7 Role of Heat & ventilation

    3.8 Prevention in mechanical industry accidents

4. **ELECTRIC SHOCKS & EARTHLING (PREVENTION AND ITS REMEDY)**
    4.1 Describe Electric shock phenomena
    4.2 Describe Reasons of electric shock
    4.3 Describe Prevention of electric shock

5.   FIRE ACCIDENTS AND THEIR PREVENTION

5.1   Describe prevention of fire accidents on plant
5.2   Know the causes of fire hazard
    5.2.1   Identify fire hazard and their types
    5.2.2   List the causes of accidents due to fire

5.3   Know Steps to control fire/fire fighting
    5.3.1   Training of fire fighting with the help of Rescue 1122
    5.3.2   Know the types of fire extinguishers and their use

5.4 Describe how to store flammable & hazardous materials
5.5 Understand disposal of flammable & hazardous materials

6.   KNOW THE BASIC CONCEPT OF SAFETY IN PLANT LAYOUT

6.1   Identify the safety aspect in plant layout
6.2   Describe the house keeping procedure for safety

6.3   Identify the procedure to lay out machines and equipment by considering safety aspect

6.4 Explain the instructions use of electricity

6.5 Interpret Implementation of 3S and 5S in Workplace

7.   KNOW PRINCIPLE METHOD AND IMPORTANCE OF PERSONAL PROTECTIVE DEVICE

7.1   State useful protective devices
7.2   List personal protective devices and describe their importance
    7.2.1   Describe protection devices protecting Hand, faces, Ear, Leg, Foot and Eyes
    7.2.2   Describe protection
    7.2.3   Describe personal safety equipment
    7.2.4   Describe lather safety belt, fire ropes, chain, slings and other supports forprecautions

7.3   Describe use of protection devices for protecting from chemicals and gases

8. UNDERSTAND WHY RISK MANAGEMENT IS IMPORTANT

8.1   Understand the concept of risk management for OHSE

8.2   Identify health, safety and environmental hazards

8.3   Understand the risk assessment process and risk control methods

8.4   Understand the planning techniques for risk management

9.   UNDERSTAND HOW TO MONITOR AN OHSE PROGRAMS

9.1   Describe the process of statistical review of the industry for OHSE

9.2   Understand the importance of management/staff meetings for implementation of OHSE

9.3   Identify the stakeholders and understand the process of conducting surveys for the stake holders

9.4   Understand the importance of internal &external reviews &audits

9.5   Outline the method of suppliers'/manufacturers products inspection

9.6   Outline the methods of industrial procedures & operations review

YEAR - 2

MATH-212   APPLIED MATHEMATICS-II

Total Contact Hours:

T	P	C
2	0	2

Theory: 64 Hours.

Aims & Objectives:

The course mainly covers the topics related to Calculus and Analytical Geometry to further enhance the students' capabilities to solve technical problems.

COURSE CONTENTS: FURTHER

1.   **FUNCTIONS & LIMITS.**   4 **Hours**
     1.1   Constants and variables
     1.2   Functions & their types
     1.3   The concept of limit
     1.4   Limit of a function
     1.5   Fundamental theorems on limit
     1.6   Some important limits
     1.7   Problems

2.   **DIFFERENTIATION.**   **4 Hours**
     2.1   Increments
     2.2   Different Coefficient or Derivative
     2.3   Differentiation ab-initio or by first principle
     2.4   Geometrical Interpretation of Differential Coefficient
     2.5   Differential Coefficient of X^a, $(ax + b)^a$
     2.6   Three important rules
     2.7   Problems.

3.   **DIFFERENTIATION OF ALGEBRIC FUNCTION.**

                                              4 Hours
    3.1   Explicit function
    3.2   Implicit function
    3.3   Parametric forms
    3.4   Problems

4.   **DIFFERENTATION OF TRIGNOMETRIC FUNCTION.**

                                              4 Hours
    4.1   Differential coefficient of sin x ,cos x ,tang x from first principle.
    4.2   Differential coefficient of Cosec x, Sec x, Cot x.
    4.3   Differentiation of inverse trigonometric function.
    4.4   Problems.

5.   **DIFFERENTIATION OF LOGARITHIMIC& EXPONENTIAL FUNCTION.**   **4 Hours**

5.1   Differentiation of In x

5.2 Differentiation of log ax

5.3 Differentiation of ax

5.4 Differentiation of ex

5.5 Problems.

6. RATE OF CHANGE OF VARIABLE.   **4 Hours**

6.1 Increasing and decreasing function

6.2 Maxima and Minima values

6.3 Criteria for maximum and minimum values.

6.4 Method of finding maxima and minima.

6.5 Problems.

7. INTEGRATION.   **8 Hours**

7.1 Concept

7.2 Fundamental Formulas

7.3 Important Rules

7.4 Problems.

8. METHOD FOR INTEGRATION.   **6 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. PLANE ANALYTIC GEOMETRY & STRAIGHT LINE.   **6 Hours**

10.1 Coordinate System

   10.2 Distance Formula

10.3 The Ratio Formulas

   10.4 Inclination and slope of a line

10.5 The Slope Formula

10.6 Problems.

11. EQUATION OF STRAIGHT LINE.   **6 Hours**

11.1 Some Important Forms

11.2 General form

11.3 Angle formula

11.4 Parallelism and perpendicularity

11.5 Problems

12. THE EQUATION OF THE CIRCLE.   **8 Hours**

   12.1 Standard form of equation

   12.2 Central form of equation

   12.3 General form of equation

   12.4 Radius & coordinate of the Centre

   12.5 Problems

RECOMMENDED BOOKS

1. Thomas Finny –Calculus and Analytic Geometry

2. GhulamYasin Minhas –Technical mathematics Vol II, Ilmi Kitab Khana ,Lahore.

3. Prof .Riaz Ali Khan –Poly Technique Mathematics Series, Volume I & II,
   Majeed Sons, Faisalabad.

4. Prof. Sana ullah Bhatti –Calculus and Analytic Geometry ,
   Punjab Text Book Board, Lahore.

MATH -212   APPLIED MATHEMATICS –II

INSTRUCTIONAL OBJECTIVES

1. **USE THE CONCEPT OF FUNCTION AND THEIR LIMITS IN SOLVING SIMPLE PROBLEMS**
   - 1.1   Define a function
   - 1.2   List all types of function
   - 1.3   Explain the concept of limit and limit of a function
   - 1.4   Explain fundamental theorem on limits
   - 1.5   Derive some important limits
   - 1.6   Solve simple problems on limits

2. **UNDERSTAND THE CONCEPT OF DIFFERENTIAL COEFFICIENT**
   - 2.1   Derive mathematics expression for a differential coefficient.
   - 2.2   Explain geometrical interpretation of differential coefficient.
   - 2.3   Differentiate a content, constant associated with a variable and the Sum of finite number of function.
   - 2.4   Solved related problems.

3. **USE RULES OF DIFFERENTIAL TO SOLVE PROBLEMS OF ALGEBRIC FUNCTIONS.**
   - 3.1   Differentiate ab-initio X^n and $(aX+b)^n$
   - 3.2   Derive product, quotient and chain rules.
   - 3.3   Find derivative of implicit function & explicit function.
   - 3.4   Differentiate parametric forms; function w.r.t another function and byrationalization.
   - 3.5   Solve problems using these formulas.

4. **USE RULES OF DIFFERENTIATION TO SOLVE PROBLEMS OF ALGEBRIC FUNCTIONS.**
   - 4.1   Differentiate from first principle sin x ,cosx,tan x.
   - 4.2   Derive formula for derivation of sec x,cosec x, cot x.
   - 4.3   Find differential coefficient of inverse trigonometric functions.

5. **USE RULES OF DIFFERENTIATION TO LOGARITHMIC AND EXPONENTIAL FUNCTIONS.**
   - 5.1   Derive formulas for differential coefficient of logarithmic and exponential functions.
   - 5.2   Solve problems using these formulas.

6. **UNDERSTAND RATE OF CHANGE OF ONE VARRIABLE WITH RESPECT TO ANOTHER.**
   - 6.1   Write expression for velocity, acceleration, and slope of a line.
   - 6.2   Define an increasing and decreasing function, maxima and minima values, ofinflection.
   - 6.3   Explain criteria for maxima and minima values of a function.
   - 6.4   Solve problems involving rate of change of variables.

7. APPLY CONCEPT OF INTEGRATION IN SOLVING TECHNOLOGICALPROBLEMS
  7.1   Explain the concept of integration
  7.2   Write basic theorem of integration
  7.3   List some important rules of integration
  7.4   Derive fundamental formulas of integration
  7.5   Solve problems based on these formulas /rules.

8. UNDERSTAND DIFFERENT METHODS OF INTEGRATION.
  8.1   List standard formulas
  8.2   Integrate a function by substitution method
  8.3   Find integrals by the method of integration by parts
  8.4   Solve problems using these methods.

9. UNDERSTAND THE METHOD OF SOLVING DEFENITE INTEGRALS.
  9.1   Define definite integral
  9.2   List properties of definite integrals using definite integrals.
  9.3   Find areas under curves
  9.4   Solve problems of definite integrals.

10. UNDERSTAND THE CONCEPT OF PLANE ANALYTIC GEOMETRY.
  10.1   Explain the rectangular coordinate system
  10.2   Locate points in different quadrants
  10.3   Derive distance formula
  10.4   Prove section formula
  10.5   Derive slope formula
  10.6   Solve problems using the above formulas.

11. USE EQUATIONS OF STRAIGHT LINE IN SOLVING PROBLEMS.
  11.1   Define a straight line
  11.2   State general form of equation of a straight line
  11.3   Derive slope intercept and intercept forms of equations.
  11.4   Derive expression for angle between two straight lines
  11.5   Derives conditions of perpendicularity and parallelism lines
  11.6   Solve problems involving these equations/formulas.

12. SOLVE TECHNOLOGICAL PROBLEMS USING EQUATION OF CIRCLE.
  12.1   Define a circle
  12.2   Describe standards, central and general forms of the equation of a circle.
  12.3   Convert general forms to the central forms of equation of a circle.
  12.4   Deduce formulas for the radius and the coordinates of the center of a circle
         fromthe general form.
  12.5   Derive equation of the circle passing through three given points.
  12.6   Solve problems involving these equations

GenC-212   Chinese Language-II

Total contact hours

   Theory   64

T P C

Practical   0

2 0 2

AIMS There are 20 lessons (including 4-unit reviews) in this course. It is recommended to complete 8 lessons and the unit reviews in 32 class hours. After completing this course, students can master the advanced-basic Chinese language knowledge in the content of the course, and be able to reach and exceed **HSK level THREE**.

COURSE CONTENTS

Lesson 1 Pick up international students at the airport   **3 hours**

This lesson introduces grammatical knowledge such as "flexible use of interrogative pronouns" and "basic forms of clutch words", which requires students to use sequential words correctly and understand the contextual meaning of some special words.

1. **Lesson 2 What would you like to drink**   **3 hours**

This lesson introduces the rhetorical question form "can…?" and the related words "not only… but also...", and learn to express your needs correctly in communication.

2. **Lesson 3 I'm kidding you**   **4 hours**

This lesson explains the fixed structures "more and more", "more A, more B", etc., and understands how to praise in Chinese and how to deal with others' praise.

3. **Lesson 4 I like winter best**   **4 hours**

Through the description of weather, students can learn the usage of adverbs such as "often" and "always", which express frequency, and compare and describe similar phenomena.

UNIT REVIEW 1 (INCLUDING TESTS)   **2 hours**

Summarize the contents of Lesson 1-4, review key words and grammar knowledge, and help learners really consolidate their mastery. There are tests designed, which can detect what has been learned before, so as to check for leaks and fill gaps.

4. **Lesson 5 I caught a cold**   **3 hours**

This lesson learns the basic usage of "active" sentence, understands the expressions related to illness and medical treatment, and learns the language communication in hospital scenes.

5. **Lesson 6 You are really careless**   **3 hours**

Learn and summarize the usage of simple directional complements "V come" and "V leave", and master the basic expression of request and evaluation functions in daily communication.

6. **Lesson 7 English black tea is healthy and delicious**   **4 hours**

Understand how to express approximate numbers in Chinese, how to persuade others and how to express their basic attitude.

7. **Lesson 8 I'm not a shopaholic**   **4 hours**

This lesson is related to online shopping. Learn the expression "A is A, that is" and learn how to express your views from different angles.

UNIT REVIEW 2 (INCLUDING TESTS)   **2 hours**

This section leads students to review the knowledge points they have learned in the past, and conduct mid-term tests to test students' learning effect.

8. Lesson 9 Why did grandparents move   **3 hours**

This lesson introduces a life event related to "moving house", the expression of learning conditions and the extended meaning of directional complement through events.

9. Lesson 10 Eat hot pot for the first time   **3 hours**

This lesson introduces the way of having dinner in China through "hot pot" and some basic situations of Chinese restaurants, so as to help learners get a preliminary understanding of Chinese dining customs.

10.Lesson 11 Teacher Wang is going to change the house   **4 hours**

This lesson is related to "housing" in "food, clothing, housing and transportation". While understanding the story, students can learn language knowledge such as hypothetical relationship and overlapping of disyllabic verbs.

11.Lesson 12 Single Li Wenchao   **4 hours**

This lesson introduces emotional problems, learn about young people's concepts of marriage and love, and learn how to compare them in Chinese.

UNIT REVIEW 3 (INCLUDING TESTS)   **2 hours**

Review the previous knowledge, students answer questions through the platform, check the learning situation, and help teachers and students analyze their learning situation.

12.Lesson 13 This is her new home   **3 hours**

This lesson introduces the living conditions of young people at present, and understands how to describe the living environment, learn the Chinese expression of concepts such as location and existence.

13.Lesson 14 Allen's weekend   **3 hours**

This lesson introduces school life, understand the sentence structure expressing complete negation, and summarize the usage of three auxiliary words "adjective", "adverb" and "should".

14.Lesson 15 Fall in love with public square dancing   **4 hours**

By introducing the living conditions of the elderly in China, students can learn Chinese comparative structure, enumerating relations and various usages of complements.

15.Lesson 16 Taste English afternoon tea   **4 hours**

This lesson introduces grammatical knowledge such as "passive" sentence and "adjective reduplication". Through the study of this lesson, students can understand the dining habits of restaurant ordering and national dishes.

UNIT REVIEW 4 (INCLUDING TESTS)   **2 hours**

This section is a review test class, leading students to review the knowledge points learned in the past for final tests to test students' learning effect.

INSTRUCTIONAL OBJECTIVES:-

Through this course, learners can systematically learn the language knowledge at this stage and cope with general communication, and can communicate on familiar topics and meet the basic communication needs of daily life and study, and gradually understand and be familiar with Chinese communication etiquette, cultural customs, etc.

Recommended Book

Tang Chinese Course- 3

Course Code: **MgmC-212**   **T P C**

Course Name: Understanding China   **2   0   2**

A course about understanding Chinese culture and introducing China's national conditions. It aims to enable international students in China to better understand China, learn Chinese language and culture, enhance understanding of different cultures, and learn about China's geographical history, philosophy, religion, political economy, etc. It covers Chinese geography and history, philosophy and religion, politics and economy, literature and art, science and technology education, medicine, and sports, etc.

Course Objectives

At the end of the course, the students are expected to be able to:

- Master the basic overview of China
- Enhance knowledge of Chinese language
- Broaden horizon
- Learn the integration and communication between different cultures

COURSE OUTLINE

COURSE CONTENTS	Hours
1. Geography	**4**

   1.1 China from the perspective of the world

   1.2 China's natural environment

   1.3 China's mountains and rivers (1)

   1.4 China's mountains and rivers (2)

   1.5 City Highlight - Beijing

   1.6 City Highlight - Shanghai

   1.7 City Highlight - Hongkong

   1.8 Natural Landscape (1) Five Mountains, Jiuzhaigou Valley and Zhangjiajie

   1.9 Natural Landscape (2) Xinjiang

   1.10 Natural Landscape (3) Tibet

   1.11 Cultural Tour

2. History   **8**

   2.1 Chinese Ancestors

   2.2 Emperor Qin Shihuang

   2.3 Emperor Wu in Han Dynasty

2.4 Silk Road in Western Han Dynasty

2.5 Prosperous Period of Tang Dynasty

2.6 Riverside Scene at Qingming Festival

2.7 Genghis Khan and Kublai Khan

2.8 Ming Taizu (the First Emperor of the Ming Dynasty)

2.9 The Great Voyages of Zheng He

2.10 Prosperous Period of Qing dynasty (from Kangxi to Qianlong)

2.11 Opium War

2.12 Sun Yat-sen and Kuomintang

2.13 The Communist Party of China (CPC)

2.14 Mukden Incident (9.18 Incident)

2.15 Mao Zedong and the Founding of the PRC

2.16 Diplomatic Relations of the PRC

2.17 Deng Xiaoping and Reform and Opening-up

2.18 New Era of Socialism with Chinese Characteristics

3. Philosophy   **4**

3.1 The representative figure of Confucianism - Confucius

3.2 The representative figure of Confucianism - Mencius

3.3 The core concept of Confucianism - ritual

3.4 The core concept of Confucianism - benevolence and benevolent governance

3.5 The core concept of Confucianism - Taoism, reason, and knowledge acquirement by investigation

3.6 Taoism - Lao Tzu's Tao and inaction

3.7 Taoism - Chuang Tzu's equality of things and unfettered

3.8 Other schools of thought - Legalism

3.9 Other schools of thought - Military Strategist

4. Religion   **4**

4.1 Folk Beliefs and Ancestor Worship

4.2 Taoism

4.3 Buddhism in China

4.4 Buddhist Doctrine, Zen, and Buddhist scenic spots

4.5 Other Religions and China's Religious Policies

5. National Governance   **4**

5.1 National Flag, National Anthem, and National Emblem

5.2 Administrative divisions

5.3 National Institutions (1)

5.4 National Institutions (2)

5.5 Political Parties (1)

5.6 Political Parties (2)

5.7 Foreign policy

6. Literature and Art   4

6.1 Stages and Genres of Chinese literature

6.2 Pre-Qin Literature

6.3 Tang Poetry

6.4 Song Ci

6.5 Four Great Classical Novels

6.6 Modern Chinese Contemporary Literature (1)

6.7 Modern Chinese Contemporary Literature (2)

6.8 Chinese Opera (1)

6.9 Chinese Opera (2)

6.10 Chinese Opera (3)

6.11 Concept of Chinese Traditional Music

6.12 Characteristics of Chinese Traditional Music and Music Appreciation

6.13 Diversified Modern Chinese Music

7. Language and Literature

7.1 Mandarin and Dialect

7.2 Ancient Chinese and Modern Chinese

7.3 Idioms

7.4 Origin and Development of Chinese Characters

7.5 Six Categories of Chinese Characters

7.6 Simplified and Traditional Chinese Characters

8. Calligraphy and Painting   4

8.1 Definition of Calligraphy
8.2 The Evolution of Chinese Calligraphy - Bone inscriptions and bronze inscriptions
8.3 The Evolution of Chinese Calligraphy - Regular script
8.4 The Evolution of Chinese Calligraphy - Cursive script
8.5 The Evolution of Chinese Calligraphy - Running script

8.6 Calligraphy Creation and the Charm of Calligraphy
8.7 Four Treasures of the Study
8.8 Calligraphy and Other Arts
8.9 Basic Knowledge of Chinese Painting
8.10 Artistic Features of Chinese Painting
8.11 Appreciation of Three Major Themes and Representative Works of Chinese Painting

9. Economy **4**

9.1 Agriculture
9.2 Industry
9.3 Three Major Industries in China
9.4 "Internet plus" - New engine of the Chinese economy
9.5 Digital Economy 2.0
9.6 Belt and Road Initiative

10. Science and Technology **4**

10.1 Four Great Ancient Inventions
10.2 Bronze Ware
10.3 Seismograph
10.4 Ceramics
10.5 Hybrid Rice
10.6 Five-hundred-meter Aperture Spherical Radio Telescope (FAST)
10.7 China High Speed Rail
10.8 Jiaolong Manned Submersible
10.9 Supercomputer Sunway TaihuLight
10.10 Aerospace Science and Technology
10.11 Internet Payment

11. Education **4**

11.1 Imperial Examination System
11.2 Chinese Literature
11.3 China's Examination
11.4 Teaching Chinese to Speakers of Other Languages

12. Medical and Health **4**

12.1 Medical and Health Service System in China
12.2 Traditional Chinese Medicine (TCM)
12.3 History of TCM
12.4 Core Concept of TCM
12.5 Acupuncture and Massage
12.6 TCM and Life (1)
12.7 TCM and Life (2)
12.8 Understanding Chinese Medicine
12.9 Mystery of TCM Treatment
12.10 International Communication of TCM

13. Sports and Wushu (Chinese Martial Art) **4**

13.1 Traditional Sports - Kite
13.2 Traditional Sports - Archery
13.3 Chinese Women and the Olympic Games
13.4 Taiji Boxing
13.5 Overview of Wushu Films and Dramas

13.6 Wushu Elements in Wushu Films and Dramas

13.7 Cultural Connotation of Chinese Wushu

14. Traditional Festivals and Chinese Cuisine   **4**

14.1 Chinese Traditional Festivals

14.2 Chinese Traditional Festivals-The Spring Festival&The Lantern Festival

14.3 Chinese Traditional Festivals-The Dragon Boat Festivall&The Mid-Autumn 14.4 Festival

14.5 Chinese Cuisine

15. Historical and Cultural Heritage   **4**

    15.1 Human Civilization: "Peking Man" Site at Zhoukoudian

    15.2 Dunhuang Mogao Grottoes

    15.3 Great Engineering: Great Wall and Dujiangyan Irrigation System

    15.4 Royal Tombs: Xiaoling Mausoleum and Imperial Tombs of the Ming and Qing Dynasties

    15.5 The Largest Bronze Ware: Simuwu Great Tripod

    15.6 Warring States Court Musical Instrument: Chime-Bells of Marquis Yi of the Zeng State

    15.7 Types of Chinese Ancient Buildings

    15.8 Royal Architecture: The Forbidden City

    15.9 Ancient Residential Buildings: Quadrangles

    15.10 Chinese Gardens

16. Intangible Cultural Heritage   **4**

16.1. Current Status of Intangible Cultural Heritage

16.2 Gesar

16.3 Guqin

16.4 Rural Music and Dance

16.5 Shadow Play

16.6 Cantonese Opera

16.7 Chinese Seal Cutting

16.8 Nanjing Yunjin Brocade

16.9 Twenty-four Solar Terms

16.10 Crosstalk

16.11 Acrobatics

16.12. Protection of Intangible Cultural Heritage

Total Hours: **64**

References:-

- Understanding China(Digital and Paper format), edited by Cheng Aimin, jointly developed by Peking University、Beijing Normal University、Zhejiang University、Tianjin University、Harbin Institute of Technology、Xi'an Jiaotong University、Wuhan University、Chongqing University、Shanghai International Studies University、Dalian Medical University、South China Normal University、Jiangsu Normal University and Tang International Education Group, published by Shanghai Foreign Language Education Press, recommended by China Association for International Education (CAFSA)

MgmC-212 – Understanding China

INSTRUCTIONAL OBJECTIVES

1. Understand the basic geography of China and some famous Chinese cities

2. Understand the unique natural and cultural landscape

3. Master basic knowledge of Chinese history and important historical figures

4. Understand the basic context and major issues in the development of Chinese history

5. Understand the main schools of Chinese traditional philosophy and their representatives

6. Understand the relevant core concepts

7. Master the influence of Chinese philosophy on the mindset and lifestyle of Chinese people

8. Understand the development and spread of Taoism, Buddhism, Islamism and Christianity

9. Understand the current status and policies of religious in China

10. Master the basic knowledge in seven videos

11. Describe the main contents of China's political system in Chinese

12. Compare the similarities and differences between China's political system and home country

13. Correct and comprehensive understanding of China's political system

14. Understand knowledge related to Chinese literature

15. Understand the inheritance and absorption of Chinese contemporary music to traditional music culture

16. Experience the characteristics of Chinese language

18. Understand the language and text of China as a whole

19 Understand the evolution of Chinese calligraphy

20. Understand the basic knowledge of Chinese painting and appreciation of representative works

21. Learn knowledge and information in related fields

22. Understand the logic and reasons behind the development of China's economy

23. Understand the ancient and modern Chinese scientific and technological civilization

24. Understand the unique and long-standing Chinese education

25. Master the core concepts of harmony between man and nature, five elements of qi, yin and yang and the basic principles of health preserving in four seasons

26. 5. Familiarize with the efficacy of acupuncture and massage and the nature and function of traditional Chinese medicine

27. Understand the Chinese medical service system; Characteristics of Tibetan medicine, Mongolian medicine, Hui medicine and Zhuang medicine

28. Understand the development history of TCM

29 International communication of traditional Chinese medicine science

30. Learn the development history of Chinese traditional sports

31. Master Chinese traditional sports such as kite and archery and their related cultural connotations

32. Understand the characteristics and advantages of modern competitive sports in China

33. Understand the spiritual connotation of Chinese Wushu

34. Understand the diet of traditional Chinese festivals

35. Understand the basic situation of Chinese historical and cultural heritage

36. Know important ancient sites and cultural relics: Peking Man Site Zhoukoudian, Dunhuang Mogao Grottoes, Great Wall, Dujiangyan Irrigation System, 37. Imperial Tombs of the Ming and Qing Dynasties, Simuwu Great Tripod, Chime-Bells of Marquis Yi of the Zeng State, etc.

38. Understand the historical and cultural value of cultural heritage

39. Master the basic situation, basic characteristics, and main types of Chinese ancient buildings

40. Familiarize with representative ancient buildings, and know important ancient sites and cultural relics: Peking Man Site Zhoukoudian, 41. Dunhuang Mogao Grottoes, Great Wall, Dujiangyan Irrigation System, Imperial Tombs of the Ming and Qing Dynasties, Simuwu Great Tripod, Chime-Bells of Marquis Yi of the Zeng State, etc.

42. Understand the historical and cultural value of ancient buildings

43. Able to distinguish different architectural and garden styles and features

44. Able to read and explain relevant key words

45. Understand the development, current situation, and protection of China's intangible cultural heritage

MGM-212   BUSINESS COMMUNICATION & REPORT WRITING

		T	P	C
Total Contact Hours:	**128**			
Theory (Hours):	**32**	**1**	**3**	**2**
Practical (Hours):	**96**			

Aims

- ▪ To develop an understanding of business communication process and mediums
- ▪ To learn about basic communication practices
- ▪ To develop effective writing and speaking techniques for communication
- ▪ To introduce students to effective employment related communication

COURSE CONTENTS

1. TECHNIQUES FOR EFFECTIVE COMMUNICATION   2 Hours
    1.1   Identifying audience
    1.2   Establishing purpose
    1.3   Formulating message
    1.4   Selecting style and tone
    1.5   Writing process
    1.6   Communicating in the electronic office

2. BASIC WRITING PRACTICES   4Hours
    2.1   Types and functions of paragraphs
    2.2   Topic sentence
    2.3   Appearance and patterns
    2.4   How to make Sentences: construction and punctuation
    2.5   Active and passive voice
    2.6   Parallelism
    2.7   Context; modifiers; pronoun reference
    2.8   How to Use Proper Words: Spelling, Right meaning
    2.9   Eliminating unnecessary words: Jargon and slang

3. TYPES OF BUSINESS CORRESPONDENCE   8Hours
    3.1 Memorandums
    3.2 Agendas and Minutes of Meeting
    3.3 Emails
    3.4Business Letters: General Correspondence
        o   Letters of Inquiry
        o   Customer relations letters
        o   Letters of instruction

4. PRESENTATIONS TECHNIQUES   4Hours
   4.1 Effective speaking and listening
   4.2 Briefings
   4.3 Formal Presentations

5. REPORT WRITING   6Hours
   5.1 Report Process and Research Methods
   5.2 Planning
   5.3 Pre-writing
   - Collecting Information & Documenting Sources
   - Preparing Structure
   - Conducting Interviews
   - Summarizing Materials

   5.4 Report Structure
   5.5 Table of Contents
   5.6 Front Matter
   - Objectives
   - Scope of Work
   - Statement of Problem
   - Abbreviations

   5.7 Executive Summary
   5.8 Introduction
   5.9 Report Body
   5.10   Conclusion & Recommendations
   5.11   Back Matter
   - Annexes, Appendixes, Glossary of Terms
   5.12   Drafting
   5.13   Revising
   5.14   Managing data and using graphics

6. GOOD REPORT WRITING TECHNIQUES   2 Hours
   6.1 Organization of facts/data
   6.2 Accuracy of information
   6.3 Style of writing
   6.4 Vocabulary & grammar
   6.5 Presentation

7. FORMAL COMMUNICATIONS RELATED TO   6 Hours
EMPLOYMENT
   7.1   Cover Letters
   7.2 Resume Writing
   7.3   How to make a Curriculum Vitae (CV)
   7.4   Methods Job Search
   7.5 Interviewing techniques

RECOMMENDED BOOKS

1. Essentials of Business Communication: Mary Ellen Guffey&Dana Loewy (2012)

2. Business Communication,   Amy Newman and Scot Ober (2012)

3. Report writing skills training course. How to write a report and executive summary,
And plan, design and present. MargaretGreenhall(2010)

MGM-212   BUSINESS COMMUNICATION & REPORT WRITING

INSTRUCTIONAL OBJECTIVES

1. **UNDERSTAND AND ACQUIRE THE TECHNIQUES FOR EFFECTIVE COMMUNICATION**
   1.1 Understand the relevance of Identifying audience for effective communication
   1.2 Understand the relevance of establishing purpose for effective communication
   1.3 Understand the method to formulate the message
   1.4 Identify how to select the style and tone
   1.5 Describe effective writing process
   1.6 Describe the communication through electronic media

2. **UNDERSTAND THE BASIC WRITING PRACTICES**
   2.1 Understand the types and purpose of writing paragraphs (topic sentence, appearance and patterns,
   2.2 Understand the construction of a sentence (punctuation, active and passive voice, parallelism, Context; modifiers; pronoun reference)
   2.3 Understand the importance of using proper words (spelling, words with appropriate meaning, eliminating unnecessary words, avoiding use of jargon and slangs)

3. **KNOW ABOUT THE VARIOUS TYPES OF BUSINESS CORRESPONDENCE**
   3.1 Learn writing memorandums (Parts & composition of a memorandum and text)
   3.2 Learn writing an agenda (Parts & composition and text)
   3.3 Learn arranging a meeting and writing minutes of meeting (requirements of a meeting, parts & composition and text of minutes)
   3.4 Learn writing emails
   3.5 Learn composing different types of business letters (general correspondence, letters of inquiry, customer relations letters, and letters of instruction)

4. **UNDERSTAND AND ACQUIRE THE BASIC PRESENTATIONS TECHNIQUES**
   4.1 Learn effective speaking and listening techniques
   4.2 Understand how to give briefings (in a meeting)
   4.3 Learn techniques of giving formal presentations

5. **KNOW ABOUT EFFECTIVE REPORT WRITING SKILLS**
   5.1 Understand the reporting process and methods
      5.1.1 Understand how to plan a report
      5.1.2 Understand the procedure before beginning actual writing (Collecting information &documenting sources, preparing structure, conducting interviews and summarizing materials)

      5.1.3 Describing the report structure (table of contents, front matter- objective, scope of work, statement of problem, abbreviations, executive summary, introduction, report body and conclusion & recommendations, back matter- annexes, appendices and glossary)

5.1.4   Learn how to draft a report
        5.1.5   Understand the revision process
        5.1.6   Understand the representation of data and using graphics

6.   UNDERSTAND GOOD REPORT WRITING TECHNIQUES
        6.1   Describe the organization of facts/data
        6.2   Understand the importance of accuracy of information
        6.3   Understand the importance style of writing
        6.4   Understand the proper use of vocabulary & grammar
        6.5   Understand good report presentation

7.   KNOW ABOUT THE FORMAL COMMUNICATIONS RELATED TO EMPLOYMENT
        7.1   Learn writing cover letters
        7.2   Learn making resume
        7.3   Learn making a Curriculum Vitae (CV)
        7.4   Understand different mediums of job search
        7.5   Acquire important interviewing skills

MGM-212   BUSINESS COMMUNICATION & REPORT WRITING

LIST OF PRACTICAL

1. Introduction of each of the class participants. Written & Oral   (03Hours.)

2. Demonstrate basic language skills

(i.e., Grammar, Spellings, capitalization, sentence structure, etc.)   (15Hours.)

3. Practice exercises for "Writing Business Letters"   (06Hours.)

4. Practice Exercise: Standard Business Communication/Letters   (06Hours.)

5. Practice Exercise: Email& Business Letters   (06Hours.)

6. Practice Exercise: Writing a Memorandum   (06Hours.)

7. Practice Exercise: Arranging a meeting, writing Agenda /Minutes   .   (09Hours.)

8. Select Interesting Topics: For individual presentations   (09Hours.)

9. Select interesting topics: For group presentation   (09Hours.)

10. Assign topic to individual students for writing short reports   (09Hours.)

11. Assign topics to groups of students for submitting a technical report   (09Hours.)12. Writing

CVs along with a cover letter   (06Hours.)

13. Class Group Project: Practice interviewing skills   (06Hours.)

MTRC-202   Engineering Materials

Total Contact Hours   **126**   **T**   **P**   **C**
Theory (Hours):   **32**   **1**   **3**   **2**
Practical (Hours):   **96**

Aims

- To Learn about the properties and applications of engineering materials
- To understand & perform testing& evaluation of engineering materials.
- To know about the method of selection of different engineering materials

1. Introduction Of Engineering Materials   **04 Hours**

    1.1   Definition and function of engineering materials
    1.2   Classification of engineering material
    1.3   Properties of engineering materials
    1.4   Physical properties
    1.5   Mechanical properties
    1.6   Electrical properties
    1.7   Magnetic properties
    1.8   Chemical properties

2. Heat Treatment   **6 Hours**

    2.1   Definitions
    2.2   Objects
    2.3   Constituents of iron and steel
    2.4   Iron carbon equilibrium diagram
    2.5   Theory of heat treatment of steel
    2.6   Heat treatment processes
         2.6.1.   Annealing
         2.6.2.   Normalizing
         2.6.3.   Quenching
         2.6.4.   Tempering
         2.6.5.   Surface hardening

3. Ferrous And Non-Ferrous Materials   **8 Hours**

    3.1   Iron ores
    3.2   Pig iron
    3.3   Cast iron.
    3.4   Classification, composition, properties, and uses of cast iron
    3.5   Wrought iron.
    3.6   Aston process
    3.7   Classification, composition, properties, and uses of carbon steel
    3.8   Comparison of cast iron, wrought iron, mild steel, and hard steel.
  3.9   Alloy steel
  3.10   Aluminum Alloy

3.11 Copper Alloy

3.12 Lead Alloy

3.13 Tin Alloy

3.14 Zinc Alloy

3.15 Magnesium Alloy

3.16 Nickel Alloy

4. Non-Ferrous Alloys   **4 Hours**

    4.1 Copper alloys

        4.1.1. Brasses

        4.1.2. Bronzes

    4.2 4.2. Aluminum alloys

        4.2.1. Duralumin

        4.2.2. Y-alloy

        4.2.3. Hindalium

        4.2.4. Magnelium

    4.3 Magnesium alloys

    4.4 Nickel alloys

5. Testing Of Material   **6 Hours**

    5.1 Introduction

    5.2 Classification of test

    5.3 Test Specimen Preparation

    5.4 Nondestructive test

        5.4.1. Dye Penetrating test (DPT)

        5.4.2. Acoustic Emission Testing

        5.4.3. Electromagnetic Testing

        5.4.4. Ground Penetrating Radar

        5.4.5. Laser Testing Methods

        5.4.6. Magnetic Flux Leakage

        5.4.7. Ultrasonic Testing

    5.5 Destructive test

        5.5.1. Mechanical test

        5.5.2. Tensile test

        5.5.3. Impact test

        5.5.4. Hardness test

        5.5.5. Fatigue test

        5.5.6. Creep test

6. Composites Materials and Plastics   **4 Hours**

    6.1 Importance of composite materials

    6.2 Sandwich Structures

    6.3 Laminated materials

    6.4 Different types of plastic materials

    6.5 Types and uses of thermostatic materials

    6.6 Application of different thermosetting

INSTRUCTIONAL OBJECTIVES:

1. **Introduction of Engineering Materials**
   1.1   Define engineering materials and their function.
   1.2   Explain the following materials:
      a. Metals
      b. Polymers
      c. Ceramics
      d. Composites
   1.3   Explain Physical properties of materials.
   1.4   Explain Mechanical properties of materials.
   1.5   Explain Electrical properties of materials.
   1.6   Explain Magnetic properties of materials.
   1.7   Explain Chemical properties of materials.

2. **Heat Treatment**
   2.1 Define heat treatment process
   2.2 What are Objectives of heat treatment process
   2.3 What is difference between constituents of iron and steel
   2.4 Explain Iron carbon equilibrium diagram
   2.5 Explain Theory of heat treatment of steel
   2.6 Explain the following heat treatment processes
      a. Annealing
      b. Normalizing
      c. Quenching
      d. Tempering
      e. Surface hardening

3. **Ferrous And Non-Ferrous Materials**
   3.1 What are Iron ores
   3.2 Define and explain Pig iron
   3.3 Define Cast iron.
   3.4 Describe Classification, composition, properties, and uses of cast iron
   3.5 Define Wrought iron.
   3.6 Explain Aston process
   3.7 Describe Classification, composition, properties, and uses of carbon steel
   3.8 Explain Comparison of cast iron, wrought iron, mild steel, and hard steel
   3.9   Explain Alloy steel
   3.10   Explain Aluminum Alloy
   3.11   Explain Copper Alloy
   3.12   Explain Lead Alloy

       3.13   Explain Tin Alloy

       3.14   Explain Zinc Alloy

       3.15   Explain Magnesium Alloy

       3.16   Explain Nickel Alloy

4. Non-Ferrous Alloys

4.1 Describe Copper alloys

4.2 Define Brasses

4.3 Define Bronzes

4.4 Explain Aluminum alloys

4.5 Define Duralumin

4.6 Define Y-alloy

4.7 Define Hindalium

4.8 Define Magnalium

4.9 Explain Magnesium alloys

4.10   Explain Nickel alloys

5. Testing Of Material

5.1 Explain Classification of test

5.2 Describe Test Specimen Preparation

5.3 Explain Nondestructive test

5.4 Explain Dye Penetrating test (DPT)

5.5 Explain Acoustic Emission Testing

5.6 Explain Electromagnetic Testing

5.7 Explain Ground Penetrating Radar

5.8 Explain Laser Testing Methods

5.9 Explain Magnetic Flux Leakage

5.10 Explain Ultrasonic Testing

5.11 Explain following Destructive test

      a.   Mechanical test

      b.   Tensile test

      c.   Impact test

      d.   Hardness test

      e.   Fatigue test

      f.   Creep test

6. Composites Materials and Plastics

6.1 What is the Importance of composite materia

6.2 Explain Sandwich Structures

6.3 Explain Laminated materials

6.4 Explain Different types of plastic materials

6.5 Explain Types and uses of thermostatic materials

6.6 Write the Application of different thermosetting

LIST OF PRACTICALS

1. From given samples of engineering materials, identify the materials and put them in widely accepted categories based on typical properties associated to the category. State the major characteristics for each category (e.g., metals, ceramic, plastic & composite etc.) (6 Hours)
2. Make any model using composite material. (6 Hours.)
3. To study the structural characteristics or constitution of a metal or an alloy in relation to its physical and mechanical properties. (9 Hours.)
4. To conduct Rockwell or Vicker Hardness tests on samples made from metallic & plastic materials (9Hours.)
5. Study the properties of heat-treated samples of steel. Differentiate the effects of Annealing, Normalizing and Quenching on the properties of different grades of steels (12Hours.)
6. To study the decomposition of Austenite as a function of cooling rates (9 Hours.)
7. To conduct Charpy V-notch impact test and determine the ductile-brittle transition temperature of steels. (6 Hours.)
8. To determine the Young's Modulus, %age Elongation, Yield Stress and UTS of given samples of Steels, Aluminum and brass using Tensile testing machine. (6 Hours.)
9. To examine the nature of inhomogeneity's and flow lines in a metal by unaided eye or with the aid of a low-powered microscope or magnifying glass. (6 Hours.)
10. To examine the internal flaws in given samples of materials using various NDT methods. (6 Hours.)
11. To determine the glass transition temperature of polymers on Differential Scanning Calorimeter. (8 Hours.)
12. To determine the rate of corrosion for mild steel sample by exposing it to ambient Environment. (6 Hours.)
13. To study the fracture modes and features for given samples of cast iron, steel, plastics, and composites (3 Hours.)
14. For construction of typical mechanized system, make appropriate selection of engineering materials for the following components:
    i. Linkage
    ii. Drive
    iii. Cam
    iv. (Brake) Shuttle valve Give your reasons for the selection. (4 Hours.)

MTRC-212   Drives & Linkages

Total Contact Hours: 128   T   P   C
Theory (Hours): 32
Practical Hours: 96   1   3   2

Aims

❖ To understand the basic components of a mechanism/ machine
❖ To learn about different types of mechanisms and their applications
❖ To understand the phenomenon of vibrations control during operation of machines

Course Contents

1. **Kinematics Fundamentals & Mechanism**   **6 Hours**
    1.1 Degree of Freedom
    1.2 links, joints and kinematics chain
    1.3 Types of joints
         1.3.1. Lower Pairs/Full Joint
         1.3.2. Higher Pair/Half Joint
    1.4 Differentiate between mechanism and machine
    1.5 Differentiate between mechanism and structure
    1.6 Linkage Transformation & Inversion
    1.7 Four Bar Chain and The GRASHOF Condition
    1.8 Mechanism
         1.8.1. Geneva mechanism
         1.8.2. Ratchet and Pawl mechanism
         1.8.3. Slider crank mechanism
         1.8.4. Double crank mechanism
         1.8.5. Cam and Follower mechanism

2. **Joints**   **6 Hours**
    1.1 Fasteners/Joints
    1.2 Lap Joint
    1.3 Butt Joint
    1.4 Types of fastener
         1.4.1. Permanent
         1.4.2. Temporary
    1.5 Welded joints
         1.5.1. Definition
         1.5.2. Types of Welded joints
    1.6 Riveted Joints
         1.6.1. Method of Riveting
         1.6.2. Advantages and Disadvantages of Riveted joints
    1.7 Screwed Joints
         1.7.1. Definition

3.5 Rope Drives
    3.5.1. Types of Rope Drives
3.6 Chain Drives
    3.6.1. Advantages and Disadvantages of Chain Drive
    3.6.2. Velocity Ratio of Chain Drives
    3.6.3. Classification of Chains
        a) Hoisting and Hauling Chains
        b) Conveyor Chains
        c) Power Transmitting Chains
    3.6.4. Power Transmitted by Chains

4. Springs   4 Hours
4.1 Definition
4.2 Applications of Springs
4.3 Types of Springs
    4.3.1. Helical
    4.3.2. Conical
    4.3.3. Torsional
    4.3.4. Laminated or Leaf Springs
    4.3.5. Special Purpose Springs
4.4 Differentiate between Compression & Tensile Springs
4.5 Define Spring Index
4.6 Series & Parallel Configurations
4.7 Define Spring Rate
4.8 Define Pitch of the Spring

5. Clutches & Brakes   3 Hours
5.1 Definition
5.2 Types of Clutches
    5.2.1. Positive Clutches
    5.2.2. Friction Clutches
5.3 Types of Brakes
    5.3.1. Hydraulic brakes
    5.3.2. Electric brakes
    5.3.3. Mechanical brakes

6. Gears   5 Hours
6.1 Definition
6.2 Advantages and Disadvantages of Gear Drives
6.3 Terms used in Gears
6.4 Law of Gearing for constant velocity
6.5 Spur Gears
    6.5.1. Definition
    6.5.2. Applications

6.6 Bevel Gears
    6.6.1. Definition
    6.6.2. Applications
6.7 Worm Gear
    6.7.1. Definition
    6.7.2. Applications
6.8 Worm Gear
    6.8.1. Definition
    6.8.2. Applications
6.9 Gear train
    6.9.1. Simple Gear train
    6.9.2. Compound Gear train
    6.9.3. Reverted Gear train
    6.9.4. Velocity ratio of Simple Gear train, Compound Gear train & Reverted Gear train.

7. Cam Follower Mechanism   **4 Hours**
    7.1 Cam Terminologies
    7.2 Types of Follower Motion
    7.3 Types of Cam
        7.3.1. Radial/Plate Cam
        7.3.2. Axial/Cylindrical Cam
   7.4 Types of Follower
      7.4.1. Flat-faced
        7.4.2. Mushroom(Curved)
        7.4.3. Roller

INSTRUCTIONAL OBJECTIVES

1.   Kinematics Fundamentals & Mechanism
  1.1   Define the concept of Degree of Freedom
  1.2   Define Links, joints and kinematics chain
  1.3   Explain the Types of joints
    1.3.1.   Lower Pairs/Full Joint
    1.3.2.   Higher Pair/Half Joint
  1.4   Differentiate between mechanism and machine
  1.5   Differentiate between mechanism and structure
  1.6   Describe Linkage Transformation & Inversion
  1.7   Explain Four Bar Chain and The GRASHOF Condition
  1.8   Mechanism
    1.8.1.   Explain Geneva mechanism
    1.8.2.   Explain Ratchet and Pawl mechanism
    1.8.3.   Explain Slider crank mechanism
    1.8.4.   Explain Double crank mechanism
    1.8.5.   Explain Cam and Follower mechanism

2. Joints
  2.1   Define Fasteners and Joints
  2.2   Explain Lap Joint
  2.3   Explain Butt Joint
  2.4   Explain Types of Fasteners
    2.4.1.   Describe Permanent Fasteners
    2.4.2.   Describe Temporary Fasteners
  2.5   Explain Welded joints
    2.5.1.   Definition of Welded Joints
    2.5.2.   Types of Welded joints. Lap joint and Butt Joint
  2.6   Explain Riveted Joints
    2.6.1.   Explain Method of Riveting
    2.6.2.   Describe the Advantages and Disadvantages of Riveted joints
  2.7   Explain Screwed Joints
    2.7.1.   Definition
    2.7.2.   Single or Double Threaded Screw Joints
    2.7.3.   Right or Left-Handed Screw Joints
    2.7.4.   Nomenclatures uses in Screw Threads (Major, Minor Diameter, Pitch Diameter, Crest, Trough, Depth of thread, angle of thread, pitch, lead, Root)
    2.7.5.   Explain the Types of Threads
    2.7.6.   Shape of Thread
      a)   Square
      b)   Acme

c) Power Transmitting Chains

3.6.4. Explain the formula of Power Transmitted by Chains

4. Springs

4.1   Define Springs

4.2   Describe the Applications of Springs

4.3   Explain the Types of Springs

    4.3.1.   Helical

    4.3.2.   Conical

    4.3.3.   Torsional

    4.3.4.   Laminated or Leaf Springs

    4.3.5.   Special Purpose Springs

4.4   Differentiate between Compression & Tensile Springs

4.5   Define Spring Index

4.6   Series & Parallel Configurations

4.7   Define Spring Rate

4.8   Define Pitch of the Spring

5. Clutches & Brakes

5.1   Define Clutches

5.2   Explain the Types of Clutches

    5.2.3.   Positive Clutches

    5.2.4.   Friction Clutches

5.3   Explain the Types of Brakes

    5.3.4.   Hydraulic brakes

    5.3.5.   Electric brakes

    5.3.6.   Mechanical brakes

6. Gears

6.1   Define Gears and state its application

6.2   Explain the Advantages and Disadvantages of Gear Drives

6.3   Explain the Terms used in Gear Design

6.4   Explain the Law of Gearing for constant velocity

6.5   Describe the constriction of Spur Gears

    6.5.1.   Definition of Spur Gear.

    6.5.2.   Applications of Spur Gear

6.6   Describe the constriction Bevel Gears

    6.6.1.   Definition of Bevel Gear

    6.6.2.   Applications of Bevel Gear

6.7   Describe the constriction of Helical Gear

    6.7.1.   Definition of Helical Gear

    6.7.2.   Applications of Helical Gear

6.8   Describe the constriction of Worm Gear

    6.8.1.   Definition of Worm Gear

    6.8.2.   Applications of Worm Gear

6.9   Explain the types of Gear trains

    6.9.1.   Explain the Construction of Simple Gear train

    6.9.2.   Explain the Construction of Compound Gear train

    6.9.3.   Explain the Construction of Reverted Gear train

    6.9.4.   Explain the calculation of Velocity ratio of Simple Gear train, Compound Gear train & Reverted Gear train.

7. Cam Follower Mechanism

7.1   Describe the Cam Terminologies

7.2   Explain the Types of Follower Motion

7.3   Describe the Types of Cam

    7.3.1.   Radial/Plate Cam

    7.3.2.   Axial/Cylindrical Cam

7.4   Types of Followers

    7.4.1.   Flat-faced

    7.4.2.   Mushroom (Curved)

    7.4.3.   Roller

LIST OF PRACTICALS

1. To study the characteristics of four bar mechanism by applying Gruebler and Grashof conditions.

2. To plot slider displacement, velocity and acceleration against crank rotation for single slider

3. crank mechanism.

4. Study the transmission calculation of Worm Drive.

5. Study and compare the velocity ratios and direction of rotation of Simple, Compound and

6. Reverted Gear Train.

7. Determine the follower displacement against angular rotation of a cam.

8. Drive the velocity and acceleration diagrams of cam follower mechanism.

9. Study of uniform motion cam with a roller follower.

10. Study the comparison of SHM and constant acceleration cams with a roller follower.

11. Verify the application of the expression for maximum torque in Clutch Plate

12. Measure the slip & creep on measurement apparatus in belt drive

13. Create the various types of linkage mechanism in CAD and simulate for the motion output.

<div align="center">

MTRC-222   Sensors & Actuators

</div>

		T	P	C
Total Contact Hours:	**128**			
Theory (Hours):	**32**	1	3	2
Practical (Hours):	**96**			

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

- To Attain a Practical and Working Knowledge of Different Types of Sensors
- To Attain a Practical and Working Knowledge of Different Types of Actuators Esp. ElectricalActuators
- To Identify and Select Sensors & Actuators as Per the Given Parameters

1. The Process of Measurement   **1 Hours**
     1.1   Define Measurement
     1.2   Fundamental Methods of Measurement
     1.3   The SI System

2. Sensors And Transducers   **2 Hours**
     2.1   Definition of sensors and transducers
     2.2   Performance terminologies
     2.3   Static and Dynamic Characteristics

3. Displacement, Position and Proximity Sensors   **6 Hours**
     3.1   Potentiometer Sensor
     3.2   Strain-gauge Element
     3.3   Capacitive Element
     3.4   Variable Inductance Transducers
     3.5   Differential Transformer
     3.6   Proximity Switches
     3.7   Hall effect Sensors

4. Velocity And Motion Sensors   **5 Hours**
     4.1   Optical Encoder
     4.2   Tacho Generator
     4.3   Pyro electric Sensor
     4.4   Accelerometer
     4.5   Vibro-meters

5. FORCE   **3 Hours**
     5.1   Strain-gauge Load Cells
     5.2   Piezoelectric Load Cells
     5.3   Ballistic weighing

6. Fluid Pressure   **3 Hours**
     6.1   Bourdon Tube Gauges
          6.1.1.   Corrugated Diaphragms
          6.1.2.   Semiconductor Diaphragms

        6.1.3.   Flat metal Diaphragms

   6.2   Additional Transducers

        6.2.1.   Strain Gauges and Flat diaphragms

        6.2.2.   Inductive Transducers

        6.2.3.   Capacitive Transducers

        6.2.4.   Piezoelectric Transducers (PVDF)

7. Liquid Flow   **4 Hours**

   7.1   Flow Measurement Methods

        7.1.1.   Flowmeters

           7.1.1.1.   Orifice Plate

           7.1.1.2.   Venturi Meter

           7.1.1.3.   Turbine Meter

           7.1.1.4.   Variable Area Meter

           7.1.1.5.   Ultrasonic Flowmeter

        7.1.2.   Velocity probes

        7.1.3.   Doppler shift method for velocity measurement

        7.1.4.   Flow visualization Techniques

8. Temperature   **4 Hours**

   8.1   Bimetallic Strips

   8.2   Resistance Temperature Detectors (RTDs)

   8.3   Thermistor

   8.4   Thermocouple

   8.5   Pyrometer

9. Electrical Actuation System   **4 Hours**

   9.1   Pneumatic and Hydraulic Actuator

        9.1.1.   Linear Actuator or Pneumatic/Hydraulic cylinders

        9.1.2.   Rotary Actuator or Air/Hydraulic Motors

        9.1.3.   Limited angle Actuators

   9.2   Electrical Actuators

      9.2.1.   Solenoid

   9.3   Micro Actuators

        9.3.1.   Shape Memory Alloy(SMA) based Actuators

        9.3.2.   Piezoelectric Micro Actuators

        9.3.3.   Micro Endoscopes and Catheters

   9.4   DC Motors

        9.4.1.   Control of Brush-type DC motors

           9.4.2.   Control of Brushless permanent magnet DC motors

      9.5   AC Motors

      9.6   Stepper Motor

        9.6.1.   Construction

        9.6.2.   Types

        9.6.3.   Control of Stepper Motor

INSTRUCTIONAL OBJECTIVES

1. **The Process of Measurement**
   1.1. Define Measurement
   1.2. Understand Fundamental Methods of Measurement
      1.2.1. Direct Comparison
      1.2.2. Indirect Comparison
   1.3. Interpret SI System
      1.3.1. Fundamental Units (base units)
      1.3.2. Derived Units
      1.3.3. Define standards
      1.3.4. Standards of base units
2. **SENSORS AND TRANSDUCERS**
   2.1. Define Sensors and Transducers
   2.2. Explain the terminologies used to define the Performance of transducers
      2.2.1. Range
      2.2.2. Error
      2.2.3. Accuracy
      2.2.4. Sensitivity
      2.2.5. Hysteresis Error
      2.2.6. Linearity and Non-Linearity
      2.2.7. Repeatability
      2.2.8. Dead Band
      2.2.9. Resolution
   2.3. Describe the Static and Dynamic Characteristics of the transducers
      2.3.1. Response time
      2.3.2. Time Constant
      2.3.3. Rise time
      2.3.4. Settling time
3. **DISPLACEMENT, POSITION AND PROXIMITY SENSORS**
   3.1. Explain Sliding contact resistive transducers
      3.1.1. State the governing equationand measurement process
      3.1.2. Construction of Sliding contact resistive transducers
         3.1.2.1. Resistive wire arrangement
         3.1.2.2. Variable resistance element (conductive film)
      3.1.3. Describe the characteristics Potentiometer
         3.1.3.1. Resolution
         3.1.3.2. Linearity
   3.2. Explain the Strain-gauge Element transducer
      3.2.1. Describe the Construction and configuration of Strain gauge element
      3.2.2. Explain the sensitivity characteristic of Strain-gauge element
      3.2.3. Explain the governing equation and measurement process
      3.2.4. Describe the use of strain-gauge bridge circuit
   3.3. Explain the Capacitive Element transducer

3.3.1. Explain the governing equation of capacitive element transducer

3.3.2. Describe the Construction and configuration of capacitive element

    3.3.2.1. The use of changing dielectric constant configuration

    3.3.2.2. The use of changing Area configuration

    3.3.2.3. The use of changing distance configuration

3.4. Explain the Variable Inductance Transducers

    3.4.1. Describe the classification of Variable Inductance Transducers

        3.4.1.1. Variable self-inductance

        3.4.1.2. Variable mutual inductance

    3.4.2. Explain the governing principle and equation

3.5. Describe the Differential Transformer

    3.5.1. Explain the construction of Linear-Variable Differential Transformer

    3.5.2. Explain the linearity characteristic of LVDT using performance curve

    3.5.3. Describe the phase-sensitive circuitry for LVDT

3.6. Explain the use of Proximity Switches

    3.6.1. Define proximity switches

    3.6.2. Explain different types of mechanical switches as Proximity switches (limiting device)

    3.6.3. Describe the construction and working of reed switch as Proximity switches (limiting device)

    3.6.4. Explain the use of photo detectors as Proximity switches (limiting device)

        3.6.4.1. Photo emissive Detectors

        3.6.4.2. Photodiodes

        3.6.4.3. Phototransistors

        3.6.4.4. Light Dependent Resistors (LDRs)

3.7. Explain the Hall effect Sensors

    3.7.1. Explain the Working principle of Hall Effect Sensor

    3.7.2. State the formula for hall-effect voltage

    3.7.3. Explain the characteristics of Hall-Effect Sensor

    3.7.4. Describe different arrangement of hall-effect sensor according to its use

        3.7.4.1. Position

        3.7.4.2. Displacement

        3.7.4.3. Proximity sensor

4. VELOCITY AND MOTION SENSORS

4.1. Explain the types of Optical shaft Encoder

    4.1.1. Explain the construction and working of Incremental encoder

    4.1.2. Explain the construction and working of Absolute encoders

    4.1.3. Characteristics of absolute and incremental encoder

4.2. Explain the construction and working of Tacho-generator

    4.2.1. Explain the loading effect on tacho-generator

4.3. Explain Pyro electric Sensors

    4.3.1. Describe pyro electric effect

    4.3.2. Explain pyro electric materials

    4.3.3. Explain the use of pyro electric sensor in household motion detectors

4.4. Explain Vibrometers and Accelerometers

    4.4.1. Explain the function of Accelerometer

    4.4.2. Explain the operation of The Seismic Instrument

    4.4.3. Explain the function of gyroscope

5. FORCE
    5.1. Explain the working of Strain-gauge Load Cells for force measurement
        5.1.1. Configuration for tension and compression detection
        5.1.2. Temperature compensation procedure
    5.2. Explain the working of Piezoelectric Load Cells for force measurement
        5.2.1. Define Piezoelectric effect
        5.2.2. Explain some characteristics of available Piezoelectric materials

6. FLUID PRESSURE
    6.1. Describe the Bourdon Tube Gauges
        6.1.1. Explain the function of Flat Metal Diaphragms
        6.1.2. Explain the function of Corrugated Diaphragms
        6.1.3. Explain the function of Semiconductor Diaphragms
    6.2. Describe some Additional Transducers
        6.2.1. Explain the configuration of Strain Gauges and Flat diaphragms for pressure measurement
        6.2.2. Explain the function of Inductive Transducers
        6.2.3. Explain the function of Capacitive Transducers

7. FLUID FLOW
    7.1. Describe the flow measurement methods.
        7.1.1. Explain the basic function of different flowmeters
            7.1.1.1. Orifice Plate
            7.1.1.2. Venturi meters
            7.1.1.3. Turbine Meter
            7.1.1.4. Variable Area Meter
            7.1.1.5. Ultrasonic Flowmeter
        7.1.2. Explain the basic function of different velocity probes
        7.1.3. Explain the Doppler shift method for fluid velocity measurement
        7.1.4. Explain the basic function of different Flow Visualization Techniques

8. DESCRIBE THE TEMPARATURE MEASUREMENT TRANSDUCERS
    8.1. Bimetallic Strips
    8.2. Explain the function of Resistance Temperature Detectors (RTDs)
    8.3. Explain the measurement of resistance change in RTDs
    8.4. Explain the function of Thermistors
        8.4.1. Materials of thermistor
        8.4.2. Characteristic of thermistoer
    8.5. Explain the working principle of Thermocouples
        8.5.1. State Seebeck Effect
        8.5.2. Describe the Thermocouple materials and construction
        8.5.3. Explain the measurement of thermocouple emf
    8.6. Explain Pyrometry

9. ELECTRICAL ACTUATION SYSTEM
9.1 Pneumatic and Hydraulic Actuator
9.1.1 Linear Actuator or Pneumatic/Hydraulic cylinders
9.1.2 Rotary Actuator or Air/Hydraulic Motors
9.1.3 Limited angle Actuators
9.2 Electrical Actuators

LIST OF PRACTICALS

1. To perform the function and study the characteristics of photo Conductive Detectors.

2. To perform the function and find temperature by using Thermistor.

3. Verify the Seebeck Effect in thermocouple and its temperature measuring procedure.

4. To perform the on/off function by using different types of manual switches.

5. To perform the function and find the temperature of a fluid by using Resistance Temperature Detector (RTD).

6. Use Magnetic Device Sensor as proximity sensor to detect an obstacle.

7. Use strain gauge in a quarter, half and full bridge circuit to find deformation.

8. To perform the function and study characteristics of LVDT.

9. To perform the function and study characteristics of Photovoltaic Cells.

10. To perform the function and study the characteristic of infrared Transducer.

11. To perform the function to find obstacle using Ultrasonic Transducers.

12. To perform the function to find the gas pressure using Pressure Transducer.

13. To use the potentiometer to detect angular position.

14. Use accelerometer to find acceleration of a wheel

15. Measure the speed, direction and positon of a DC motor using optical encoder.

16. Use Hall Sensor to find speed and position of any thing

17. Use reed switch as a proximity sensor.

18. Use orifice plate and venturi meter to find pressure and flow of fluid.

19. Use dc motor, ac motor and stepper motor as an actuator in any application.

MTRC-233   Motors and Generators

			T	P	C
Total Contact Hours:	160				
Theory (Hours):	64		2	3	3
Practical (Hours):	96				

Aims:

1. Develop a comprehensive understanding of the fundamental working principles behind motors andgenerators, including their respective mechanisms and functions.
2. Acquire knowledge about the various types of motors and generators, exploring their uniquecharacteristics, applications, and operational principles.
3. Gain insights into different repair techniques employed for motors and generators, enabling the abilityto diagnose and troubleshoot common issues, as well as perform maintenance tasks to ensure
optimal performance.

1. Introduction   **6 Hours**

    1.1   Definition of Motor

    1.2   Definition of Generator

    1.3   Types of Motors

    1.4   Types of Generators

    1.5   Aspects of motor and generator selection

        1.5.1. Torque

        1.5.2. Moments of inertia

        1.5.3. Electric Flux

        1.5.4. Magnetic Flux

    1.6   Law of Conservation of Energy

    1.7   Faraday's law of electromagnetic induction and Lenz's law.

2. DC Motors   **16 Hours**

    2.1   Operating Principles

    2.2   Permanent Magnet DC Motor

    2.3   DC Motor with field coils

        2.3.1. Series wound motor

        2.3.2. Shunt wound motor

        2.3.3. Compound motor

    2.4   Brushless Permanent Magnet DC Motor

    2.5   Control of DC Motors

    2.6   Advantages and Drawbacks of DC motors

    2.7   Speed control of DC motor (Electrical and Electronics)

    2.8   Motor starters (3 point and 4 point)

3. AC Motors   **16 Hours**

    3.1   Operating Principles

    3.2   Single Phase Squirrel Cage Induction Motor

3.3   Three Phase Induction Motor

3.4   Synchronous Motors

3.5   Advantages and Drawbacks of AC motors

3.6   Motor starters (DOL and star delta starter)

3.7   Speed Control of AC motors

4. Special Motors   10 Hours

i.   Stepper Motor

4.1   Operating Principles

4.2   Stepper Motor Specifications

4.3   Stepper Motor Control

ii.   SERVO MOTOR

4.4   Operating Principle

4.5   Servo vs Stepper motor

4.6   What is inside a Servo?

4.7   Applications of Servo Motors

4.8   Servo Motor Control

5. Generators   12 Hours

5.1   How does a AC Generator work?

5.2   Components of a Generator:

      5.2.1.   Engine

      5.2.2.   Alternator

      5.2.3.   Fuel System

      5.2.4.   Voltage Regulator

      5.2.5.   Cooling and Exhaust Systems

      5.2.6.   Lubrication System

      5.2.7.   Battery Charger

      5.2.8.   Control Panel

      5.2.9.   Main Assembly/Frame

5.3   Working of DC Generator

5.4   Enlist the types of DC generator

5.5   Explain the method of field excitation, and characteristics of each

5.6   Compare an alternator with dc generator

5.7   Using generator to power industrial applications

6. Motor Control through PLC   04 Hours

6.1   What is a PLC motor control system

6.2   Types of programmable controllers

6.3   Working principle of the programmable controller

6.4   Programming languages for programmable controllers

6.5   Forward and reverse control of three-phase asynchronous motor

<div align="center">**INSTRUCTIONAL OBJECTIVES:**</div>

1. Introduction

    1.1   Define an electric Motor and its working principle.

    1.2   Define Generator and describe its working.

    1.3   Explain different types of Motors.

    1.4   Explain different types of Generators.

    1.5   Describe how the following parameters are necessary consideration for motor and generator selection:

        1.5.1. Torque

        1.5.2. Moments of inertia

        1.5.3. Electric Flux

        1.5.4. Magnetic Flux

    1.6   Define Law of Conservation of Energy.

    1.7   Explain Faraday's law of electromagnetic induction and Lenz's law.

2. DC Motors

    2.1   Describe the operating principle and construction of DC motors.

    2.2   Explain the working of Permanent Magnet DC Motor.

    2.3   Describe the following DC Motors types with respect to field coils:

        2.3.1. Series wound motor

        2.3.2. Shunt wound motor

        2.3.3. Compound motor

    2.4   Describe the working of Brushless Permanent Magnet DC Motor.

    2.5   Describe the position Control methods of DC Motors.

    2.6   Write the Advantages and Drawbacks of DC motors.

    2.7   Explain the following methods of Speed control of DC motors:

        i.   Flux control method

        ii.   Voltage regulation method

        iii.   Armature resistance method

        iv.   PWM

    2.8   Describe three point and four point Motor starters.

3. AC Motors

    3.1   Describe the operating Principle and construction of AC motors.

    3.2   Briefly describe the working of Single Phase Squirrel Cage Induction Motor.

    3.3   Describe the working of Three Phase Induction Motor.

    3.4   What is Synchronous Motor? Explain its working.

    3.5   Write the Advantages and Drawbacks of AC motors.

    3.6   Describe DOL and star delta starter with diagrams.

    3.7   Explain the Speed and position Control method of AC motors.

4. Special Motors

iii. Stepper Motor

4.1 Describe the Operating Principle of unipolar and bipolar stepper motor.

4.2 Describe the following specifications of Stepper Motor:

    i.   Step angle.

    ii.   Steps per revolution.

    iii.   Current rating.

    iv.   Voltage rating.

    v.   Resistance per coil.

4.3 Describe position and speed control of Stepper Motor.

iv. SERVO MOTOR

4.4 Describe the Operating Principle of servo motor.

4.5 Differentiate between Servo and Stepper motor.

4.6 What is inside a Servo?

4.7 Write Applications of Servo Motors.

4.8 Describe position and speed control of Servo Motor.

5. Generators

5.1 How does a AC Generator work?

5.2 Explain the following Components of a Generator:

    5.2.1. Engine

    5.2.2. Alternator

    5.2.3. Fuel System

    5.2.4. Voltage Regulator

    5.2.5. Cooling and Exhaust Systems

    5.2.6. Lubrication System

    5.2.7. Battery Charger

    5.2.8. Control Panel

    5.2.9. Main Assembly/Frame

5.3 Explain the Working of DC Generator.

5.4 Enlist the types of DC generator.

5.5 Explain the method of field excitation, and characteristics of DC generators.

5.6 Compare an alternator with dc generator.

5.7 How generator is used to power industrial applications.

6. Motor Control through PLC

6.1 What is a PLC motor control system

6.2 Describe Types of programmable controllers

6.3 Explain Working principle of the programmable controller

6.4 Enlist Programming languages for programmable controllers

6.5 Explain Forward and reverse control of three-phase asynchronous motor

LIST OF PRACTICALS

1. Identification of the working principle, components of a DC motor and demonstrate it's running in terms of fundamental physical laws and phenomenon.

2. Identification of the working principle, components of an AC motor and demonstrate it's running in terms of fundamental physical laws and phenomenon.

3. Identification of the working principle, components of a generator and demonstrate it's running in terms of fundamental physical laws and phenomenon.

4. Verify the Faraday's Laws of electromagnetic induction by using a simple loop generator.

5. Demonstrate the different types of DC motor.

6. Demonstrate the different types of AC motor.

7. Determine the relationship between different types of DC motor rotational speed and voltage.

8. Determine the relationshipbetweendifferenttypesofACmotorrotationalspeedandvoltage

9. DeterminetherelationshipbetweendifferenttypesofDCmotoroutputtorqueandinputcurrent

10. DeterminetherelationshipbetweendifferenttypesofACmotoroutputtorqueandinputcurrent

11. Practice installation of a DC Motor.

12. Starting a D.C. series and shunt motors through starters.

13. Installation of a stepper and servo motor, study its applications and compare advantages and draw backs of each.

14. Practice installation of a Generator.

15. Testing of motors &generators

16. Connect a 3-phase induction motor to supply line through a direct-on starter.

17. Study the line and connection diagram of a starter-delta starter.

18. Study the speed control of a-c series motor

MTRC- 253   Measuring Instruments

Total Contact Hours: 160   **T   P   C**
Theory (Hours): 64
Practical Hours: 96   **2   3   3**

Aims

❖ To develop knowledge and understanding of a range of instruments used in the industry
❖ To acquire the practical skills for the usage of these instruments
❖ To understand the working principle, types and construction of different
analog anddigital instruments and their accessories
❖ To manipulate skills of proper selection use, handling, maintain and repairing
of variouselectrical and electronics instruments

Course Contents

1. **Measurement, Instrumentation & Calibration   8 Hours**
    1.1   Introduction
    1.2   Measurement
    1.3   Instrument
    1.4   Instrumentation
    1.5   Error in measurement
    1.6   Calibration and standards
2. **Analog Electromechanical Instruments   8 Hours**
    2.1   Classification of instrument
    2.2   Selection of instrument
    2.3   Function of instrument
    2.4   Comparison of analog and digital instrument
    2.5   Electrical instrument
    2.6   Ammeter, voltmeter
3. **Frequency and rotational speed Meter   6 Hours**
    3.1   Introduction
    3.2   Types of frequency meters
    3.3   Mechanical resonance type frequency meter
    3.4   Electrical resonance type frequency meter
    3.5   Rotational speed measurements
4. **Instrument Transformer   6 Hours**
    4.1   Introduction
    4.2   Term relating to instrument transformer
    4.3   Current Transformer
    4.4   Potential Transformer

INSTRUCTIONAL OBJECTIVES

1. Measurement, Instrumentation & Calibration
1.1 Define measurement.
1.2 Define instrumentation.
1.3 Define error.
1.4 Describe types of errors.
1.5 Describe the need of calibration.
1.6 Describe the importance of standards.

2. Analog Electromechanical Instruments
2.1 Define analog instrument.
2.2 Define digital instrument.
2.3 Make a comparison of analog and digital instruments.
2.4 Describe the function of an instrument.
2.5 Describe the selection criteria of a measuring instrument.
2.6 Describe the working of Ammeter.
2.7 Describe the working of the Voltmeter.

3. Frequency and rotational speed meter
3.1 Define frequency meter.
3.2 Explain the types of the frequency meters.
3.3 Describe the working of mechanical resonance type frequency meter.
3.4 Describe the working of electrical resonance type frequency meter.
3.5 Explain rotational speed measurement methods.

4. Instrument Transformer
4.1 Define transformer.
4.2 Define current transformer.
4.3 Define potential transformer.
4.4 Define instrument transformer.
4.5 Explain different terms of instrument transformer.
4.6 Describe the testing method of instrument transformer.

Electronic Instruments

4.7 Define electronic instrument.
4.8 Describe the essentials of electronic instrument.
4.9 Explain the advantages of the electronic instrument.
4.10   Describe the working of the electronic voltmeter.
4.11   Explain the functions of the digital multi meter.
4.12   Describe the working of the clamp meter.

5. Digital Storage Oscilloscope (DSO)

5.1 Define CRO.

5.2 Define DSO.

5.3 Draw the block diagram of DSO.

5.4 Enlist main parts of DSO.

5.5 Describe the terms of DSO.

5.6 Describe the measuring methods using DSO.

5.7 Describe the operating modes of DSO.

5.8 Describe the trigger modes of the DSO.

5.9 Explain the common accessories used with DSO.

6. Sophistication in Instrumentation

6.1 Define thermometry in instrumentation.

6.2 Explain the thermometry and thermography.

6.3 Explain the aspects of Nano Instrumentations

6.4 Explain the condition monitoring.

6.5 Explain the biomedical Instrumentation.

6.6 Explain the Robotic Instrumentation.

LIST OF PRACTICALS

1. Calibrate and make the following measurements with a ruler, measuring tape and Vernier Caliper. Remove zero error if present and discuss which method of measurement gives a more accurate answer. Also discuss which instrument has a better utility that caters to different sorts of measurements. Write your observations. (6 Hours)

    - Thickness of a block -Depth of a bowl

    - Internal diameter of a hole

2. Calibrate and make the following measurements with a Vernier caliper and a micrometer screw gauge. Remove zero error if present and discuss which method of measurement gives a more accurate answer. Discuss which instrument has a better utility. (6 Hours.)

    - Diameter of a rod

    - Diameter of a ball

3. Describe the working of digital Oscilloscope and learn to measure basic electrical quantities using DSO like voltage, current, power, frequency, amplitude, wavelength in a simple electrical circuit. (6 Hours)

4. Describe the working of the digital multimeter and learn to measure basic electrical quantities using DMM like DC voltage, AC voltage, current, power, frequency, amplitude, wavelength in a simple electrical circuit. (6 Hours)

5. Measure the current flowing in a simple circuit using a galvanometer. Determine the value of the resistances. Set the power supply at 12 V. Record the reading and uncertainty in your answer. Determine the internal resistance of the galvanometer. (6 Hours)

6. Measure the current, voltage and power in a series circuit with two different values of resistances. (6 Hours)

7. Measure the current, voltage and power in a parallel circuit with two different values of resistances. (6 Hours)

8. Assemble the following basic electrical circuits and measure the voltage, current and resistance using an ammeter, voltmeter, and ohmmeter. Substitute all the measuring instruments for a multi-meter and take readings. (6 Hours)

    - Electric bulb circuit - Buzzer circuit

    - Electric bulbs in series circuit

    - Electric bulbs in parallel circuit

9. Determine the temperature of the following using a thermometer. Discuss the limitations of a thermometer. Suggest other methods of temperature sensing that cater to a wide variety of measurements. Make a circuit to display the temperature. (6 Hours)
    -Boiling Water

    - Closed Room

    -Computer

    -Circuit Board

10. Observe and record the following in an Instrument Transformer (Current Transformer) Rise and Drop time, Volts per Amps, Single windings versus multiple windings, Common mode noise. (6 Hours)

11. Assemble a wheat-stone bridge and take readings of the output. Measure voltage and current in the circuit (6 Hours)

12. Assemble a Kevin and a Maxwell bridge and take readings at the output. Measure voltage and current in the circuit. (6 Hours)

13. Generate different frequencies (FM, AM, AF, RF) by the signal generator and view on the screen. (6 Hours)

14. Observe a small strand of hair under a simple optical microscope. Change the magnification and resolution. Observe the difference and record. (6 Hours)

15. Calibrate different instruments in lab (electrical and mechanical) (6Hours)

16. Use a measuring cylinder and a burette to measure a colored and transparent liquid quantity. Differentiate between the two methods of measurement stating the pros and cons of each. Also elaborate on the utility of both methods. (6 Hours)

MTRC-263   Electronic Devices and Circuits

Total contact hours: 160

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

Aim: Apply the principles of operation and function of various electronic components and devices topractical circuits.

1. Identify various electronics components/devices used in the field of electronics.
2. Explain the principle of operation of various type of electronic components/devices.
3. Identify the function of each electronic components/devices.
4. Identify the pin configurations of various electronics components/devices.
5. Identify specification of electronic components/devices.
6. Identify the use of electronic components.

Course Contents

1. Semiconductor Diodes and Applications   **16 Hours**
     1.1   Vacuum Tubes (Diode, Triode, Tetrode, Pentode, CRT)
     1.2   Electron Emission
     1.3   Biasing the PN junction.
         1.3.1.   Depletion region, Junction barrier potential
         1.3.2.   Forward and reverse bias.
     1.4   Rectifier Diode.
         1.4.1.   Half wave and full wave (Bridge) rectifier.
         1.4.2.   Ripple factor, surge current.
         1.4.3.   Rectifier filter: L, PI and T filters.
     1.5   Diode limiting, clamping and Multipliers circuits.
         1.5.1.   Single end and double end limiter.
         1.5.2.   Positive and Negative clamper
         1.5.3.   Voltage multiplier circuit. (Doubler, Tripler, Quadrupler)
     1.6   Diode Data Sheet
     1.7   Common faults in rectifier.
     1.8   Diode as a switch.

2. Special Diodes   **12 Hours**
     2.1   Zener Diodes.
     2.2   Zener Diode as voltage Regulator.
         2.2.1.   Zener limiting.
     2.3   Varactor Diodes.
         2.3.1.   Varactor in Tuning Circuits.
     2.4   Optical Diodes

      2.4.1.   Light Emitting Diode (LED)

      2.4.2.   Liquid Crystal Diode (LCD)

      2.4.3.   Photo Diode.

  2.5   Other Diodes.

      2.5.1.   Schottky diode, construction, Characteristics, uses.

      2.5.2.   Tunnel Diode, Negative resistance region.

      2.5.3.   Tunnel Diode Oscillator.

      2.5.4.   PIN Diode

      2.5.5.   Step Recovery Diode

      2.5.6.   LASER Diode

      2.5.7.   IMPATT Diode.

      2.5.8.   Gunn Diode.

3. Bipolar Junction Transistors   10 Hours

  3.1   Transistor types and BJT construction.

  3.2   Basic Transistor operation, Forward, Reverse Bias. Transistor current.

  3.3   Transistor Parameters and Ratings

  3.4   Transistor as a voltage amplifier.

  3.5   Transistor, modes of operation.

  3.6   Transistor as a switch.

  3.7   Transistor and IC packages and terminal Identification.

      3.7.1.   General purpose transistors (TO-I8, TO-39, TO-46, TO-52, TO-72, TO-23 AB)

      3.7.2.   Power Transistor (TO-3, TO-218, T-220, T-225)

      3.7.3.   RF Transistor.

  3.8   BJT Biasing Techniques:

      3.8.1.   The DC operating point.

      3.8.2.   The fixed base bias.

      3.8.3.   The emitter bias.

      3.8.4.   Voltage divider bias.

      3.8.5.   The collector bias.

4. Field Effect Transistors   10 Hours

  4.1   Field Effect Transistor and Its Biasing.

  4.2   Junction Field Effect Transistor (JFET).

  4.3   JFET Characteristics and parameter.

  4.4   JFET Biasing.

  4.5   Metal oxide Semiconductor FET (MOSFET) types.

  4.6   MOSFET Biasing.

5. Thyristor & Special Devices   8 Hours

  5.1   The shockley diode,

  5.2   Silicon Controlled Rectifier (SCR)

5.3   SCR Applications.

5.4   Silicon Controlled Switch (SCS)

5.5   Diac and Triac

5.6   Unijunction Transistor (UJT)

5.7   Photo diode & Phototransistor

5.8   Light Activated SCR (LASCR)

5.9   Opto-coupler.

6.   Integrated Circuits and Operational Amplifier   **8 Hours**

6.1   Introduction to ICs

6.2   Types of ICs

6.3   Types of Integration

6.4   Advantages and Disadvantages of ICs.

6.5   Introduction to operational Amplifier.

6.6   The differential Amplifier.

6.7   OP-AMP Data Sheet Parameters.

6.8   OP-AMP with negative Feedback.

6.9   Inverting and non-inverting amplifiers.

6.10 Voltage follower.

6.11 Summing and difference amplifiers.

6.12 Introduction to 741 OP AMP.

INSTRUCTIONAL OBJECTIVES

1. **Semiconductor Diodes and Applications**
   - 1.1 Describe Vacuum Tubes (Diode, Triode, Tetrode, Pentode, CRT)
   - 1.2 Explain Electron Emission.
   - 1.3 Define the following terms regarding Biasing of PN junction.
     - 1.3.1. Depletion region, Junction barrier potential
     - 1.3.2. Forward and reverse bias.
   - 1.4 Explain the following circuits and terms:
     - 1.4.1. Half wave and full wave (Bridge) rectifier.
     - 1.4.2. Ripple factor, surge current.
     - 1.4.3. Rectifier filter: L, PI and T filters.
   - 1.5 Explain the following Diode limiting, clamping and Multipliers circuits:
     - 1.5.1. Single end and double end limiter.
     - 1.5.2. Positive and Negative clamper
     - 1.5.3. Voltage multiplier circuit. (Doubler, Tripler, Quadrupler)
   - 1.6 Study the data sheet of a Diode.
   - 1.7 Write the Common faults in rectifier.
   - 1.8 Describe the working of Diode as a switch.

2. **Special Diodes**
   - 2.1 Define Zener Diode.
   - 2.2 Describe the working of Zener Diode as voltage Regulator.
     - 2.2.1. Describe Zener limiting circuit.
   - 2.3 Define Varactor Diode and its application in following circuit.
     - 2.3.1. Varactor in Tuning Circuits.
   - 2.4 Explain the following types of Optical Diodes:
     - 2.4.1. Light Emitting Diode (LED)
   Liquid Crystal Diode (LCD)

     - 2.4.2. Photo Diode.
   - 2.5 Explain the following Diode types:
     - 2.5.1. Schottky diode, construction, Characteristics, uses.
     - 2.5.2. Tunnel Diode, Negative resistance region.
     - 2.5.3. Tunnel Diode Oscillator.
     - 2.5.4. PIN Diode
     - 2.5.5. Step Recovery Diode
     - 2.5.6. LASER Diode
     - 2.5.7. IMPATT Diode.
     - 2.5.8. Gunn Diode.

3. **Bipolar Junction Transistors**

3.1 Enlist Transistor types and describe their construction.

3.2 Describe Basic Transistor operation, Forward, Reverse Bias and Transistor currents.

3.3 Describe Transistor Parameters and Ratings.

3.4 Transistor as a voltage amplifier.

3.5 Explain the modes of operation of BJT.

3.6 Describe the working of Transistor as a switch.

3.7 Describe the following IC packages and terminal Identification of BJTs.

    3.7.1. General purpose transistors (TO-I8, TO-39, TO-46, TO-52, TO-72, TO-23 AB)

    3.7.2. Power Transistor (TO-3, TO-218, T-220, T-225)

    3.7.3. RF Transistor.

3.8 Explain the following BJT Biasing Techniques:

    3.8.1. The DC operating point.

    3.8.2. The fixed base bias.

    3.8.3. The emitter bias.

    3.8.4. Voltage divider bias.

    3.8.5. The collector bias.

4. Field Effect Transistors

4.1 Describe Field Effect Transistor and Its Biasing.

4.2 Define Junction Field Effect Transistor (JFET).

4.3 Explain different JFET Characteristics and parameter.

4.4 Describe the biasing of JFET.

4.5 Explain the types of Metal oxide Semiconductor FET (MOSFET).

4.6 Describe the Biasing of MOSFET.

5. Thyristor & Special Devices

5.1 Describe the working and construction of shockley diode.

5.2 Describe the working and construction of Silicon Controlled Rectifier (SCR).

5.3 Write the applications of SCR.

5.4 Describe the working and construction of Silicon Controlled Switch (SCS)

5.5 Describe the working and construction of Diac and Triac.

5.6 Describe the working and construction of Unijunction Transistor (UJT).

5.7 Describe the working and construction of Photo diode & Phototransistor.

5.8 Describe the working and construction of Light Activated SCR (LASCR).

5.9 Describe the working and construction of Opto-coupler.

6. Integrated Circuits and Operational Amplifier

6.1 Define ICs.

6.2 Describe the Types of ICs.

6.3 What are the different Types of Integration?

6.4 Write the Advantages and Disadvantages of ICs.

6.5 Describe the working and construction of operational Amplifier.

6.6 Describe the working of differential Amplifier.

6.7 Study different Data Sheet Parameters OP-AMP.

6.8 Explain the working of OP-AMP with negative Feedback.

6.9 Explain the working of Inverting and non-inverting amplifiers.

6.10 Explain the working of Voltage follower circuit.

6.11 Explain the working of Summing and difference amplifiers.

6.12 Write applications of 741 OP AMP.

LIST OF PRACTICALS

1. Identify the various diodes, transistors & IC package, number system and terminals.
2. Draw the forward & reverse characteristics of a P.N junction diode.
3. Assemble a full wave diode rectifier circuit with a PI filter & calculate the ripple factor of output wave.
4. Demonstrate diode as a switch with LED as a load.
5. Troubleshoot a faulty diode rectifier circuit.
6. Assemble a diode limiter circuit.
7. Familiarize with a voltage quadrupler circuit.
8. Use a Zener diode as a voltage regulator with diode rectifier.
9. Demonstrate the performance of power supply using IC regulator.
10. Assemble transistor circuit as a switch.
11. Assemble a transistor voltage amplifier (Darlington pair).
12. Assemble a Street light Control using LDR.
13. Assemble a mobile charger circuit using mini solar panel.
14. Demonstrate MOSFET as a switch and study the performance.
15. Plot the characteristics curves for SCR & UJT.
16. Assemble a light dimmer using a DIAC & a TRIAC.
17. Demonstrate the working of an opto-coupler using
    a)   Photodiode & LED b)   Phototransistor & LED
18. Demonstrate the working of an operational amplifier, use of op-Amp as an inverting & non-inverting amplifier and a voltage follower.
19. Demonstrate SCR phase control.
20. Demonstrate the use of digital logic probe & logic pulser.
21. Prepare a project using electronics devices assigned by instructor.

MTRC-272   Digital Logic Design

			T	P	C
Total Contact Hours:	160				
Theory (Hours):	64		2	3	3
Practical (Hours):	96				

Aims

1. Develop a solid grasp of the fundamental concepts in digital electronics, including essential principlesand components.
2. Explore the practical applications of digital electronic devices within various industries, gaininginsights into how these devices are utilized to enhance efficiency, automation, and functionality.

1. Introduction   8 Hours
     1.1   Digital & analog quantities
     1.2   BIT, BYTE, NIBBLE
     1.3   Number systems
         1.3.1.   Binary
         1.3.2.   Octal.
         1.3.3.   Decimal
         1.3.4.   Hexadecimal
     1.4   Conversion of numbers from one base to another:
         1.4.1.   Binary <--> Decimal
         1.4.1   Binary <--> Octal
         1.4.2   Binary <--> Hexadecimal
         1.4.3   Octal <--> Decimal
         1.4.4   Octal <--> Hexadecimal
         1.4.5   Hexadecimal <--> Decimal
     1.5   Elements of digital electronics

2. Logic Gates   8 Hours
     2.1   Function of each basic gate
         2.1.1.   AND Gate
         2.1.2.   OR Gate
         2.1.3.   NOT Gate
         2.1.4.   NAND Gate
         2.1.5.   NOR Gate
         2.1.6.   XOR Gates
         2.1.7.   XNOR Gates
     2.2   Introduction to Digital ICs
         2.2.1.   IC numbers for each gate

2.2.2. Data Sheets

2.2.3. Location of pin 1 or index for a given IC.

2.2.4. Different techniques used for mounting each type of IC.

3. Boolean Algebra   6 Hours

3.1 Laws of Boolean algebra

3.2 De Morgans Laws

3.3 Boolean Function Generation from truth tables

4. Arithmetic Logic Circuits   5 Hours

4.1 Arithmetic functions:

4.1.1. Binary addition

4.1.2. Binary subtraction by 1's complement

4.1.3. Binary subtraction by 2's complement

4.1.4. Binary multiplication

4.1.5. Binary division

4.2 Operation of the following circuits

4.3 Half adders

4.4 Full adders

4.5 Adder-subtractor

4.6 Comparators

5. Combinational Logic and Data Processing Circuits   8 Hours

5.1 Multiplexers & logic (IC's such as 74150)

5.2 Demultiplexers (IC's such as 74154)

5.3 Decoders

5.4 BCD-to-Decimal Decoders (such as 7445)

5.5 Seven-Segment Decoders & Displays

5.6 Encoders (IC's such as 74147)

5.7 Types of encoder

6. Flip-Flops   5 Hours

6.1 Definition of the following terms:

6.1.1. Latch

6.1.2. flip flop

6.1.3. Hold time

6.2 Operation of following circuits

6.1.4. RS Flip-Flop

6.1.5. Clocked RS Flip-Flop

6.1.6. D Flip-Flop

6.1.7. Edge-triggered D Flip-Flop

6.1.8. JK Flip-Flop

7. Clocks & Timers   **5 Hours**

     7.1   Definition of the following terms

         7.1.1.   Clock

         7.1.2.   Trigger

         7.1.3.   Pulse

         7.1.4.   Frequency

         7.1.5.   Pulse width

     7.2   TTL clock

     7.3   operation of the followings:

         7.3.1.   Inverter Clock

         7.3.2.   Ring Oscillator

         7.3.3.   NAND/NOR Gate clock

         7.3.4.   555 Timer IC

8. Shift Registers   **5 Hours**

     8.1   Definition of the following terms

         8.1.1.   Register

         8.1.2.   Storage Capacity

         8.1.3.   Shift right

         8.1.4.   Shift left

     8.2   Operation of following

         8.2.1.   Serial in-serial out

         8.2.2.   Serial-in parallel-out

         8.2.3.   Parallel-in serial-out

         8.2.4.   Parallel in parallel out

9. Counters   **4 Hours**

     9.1   9.1 Definition of following

         9.1.1.   Synchronous

         9.1.2.   Asynchronous

     9.2   Types of Counters

         9.2.1.   Ripple counter

         9.2.2.   Synchronous counter

         9.2.3.   Presetable counter

         9.2.4.   Ring Counter

         9.2.5.   Up/Down Counter

     9.3   Working of Digital Clock

10. Application Of Digital Electronics   **2 Hours**

     10.1   Digital clock

     10.2   Frequency & time period counter

     10.3   Moving Message Display

11. Latest Technology Used in Digital Electronics   **8 Hours**

11.1   Description of the following technology:

     11.1.1. SMD

     11.1.2. Hybrid IC's

     11.1.3. DSP

     11.1.4. VLSI

     11.1.5. Optical IC's

     11.1.6. Super-conduction

     11.1.7. Josephson's junction

11.2   How the above technologies are an improvement over current technology

INSTRUCTIONAL OBJECTIVES

1.   KNOW THE BASIC TERMS RELATED TO DIGITAL ELECTRONICS.

1.1   State in a tabulated form the merits & demerits of analog & digital quantities

1.2   Define basic terms related to digital electronics

1.3   Define the following terms

    1.3.1   Binary

    1.3.2   Octal.

    1.3.3   Decimal

    1.3.4   Hexadecimal

1.4   Conversion of numbers from one base to another:

    1.4.1   Binary <--> Decimal

    1.4.6   Binary <--> Octal

    1.4.7   Binary <--> Hexadecimal

    1.4.8   Octal <--> Decimal

    1.4.9   Octal <--> Hexadecimal

    1.4.10   Hexadecimal <--> Decimal

2.   UNDERSTAND THE WORKING OF VARIOUS LOGIC GATES

2.1.1   Describe the working of AND Gate

2.1.2   Describe the working of OR Gate

2.1.3   Describe the working of NOT Gate

2.1.4   Describe the working of NAND Gate

2.1.5   Describe the working of NOR Gate

2.1.6   Describe the working of XOR Gates

2.1.7   Understand the configurations formed by combining gates

    2.3   **2.2**   Introduction to Digital ICs

        2.3.1.   IC numbers for each gate

        2.3.2.   Data Sheets

        2.3.3.   Location of pin 1 or index for a given IC.

        2.2.4.   Different techniques used for mounting each type of IC.

3. INTRODUCTION TO BOOLEAN ALGEBRA & ITS LAWS

3.1 Study the laws of boolean algebra

3.2 Study the De Morgans Laws

3.3 Understand the boolean function generation from truth tables

4. DETAILED DESCRIPTION OF ARITHMETIC LOGIC CIRCUITS

4.3 Arithmetic functions:
  4.3.1. Binary addition
  4.3.2. Binary subtraction by 1's complement
  4.3.3. Binary subtraction by 2's complement
  4.3.4. Binary multiplication
  4.3.5. Binary division

4.2 Describe the working of Half adders

4.3 Describe the working of Full adders

4.4 Describe the working of Adder-subtractor

4.5 Describe the working of comparators

5. UNDERSTAND THE WORKING AND USES OF COMBINATIONAL LOGIC CIRCUITS, INCLUDING DATA PROCESSING CIRCUITS

5.1 Define the terms multiplexer, demultiplexers, decoder, encoders, BDC converters

5.2 Explain multiplexers, using logic circuits & block-diagrams (multiplexers using IC's such as 74150)

5.3 Explain demultiplexers, using block-diagrams (using IC's such as 74154)

5.4 Explain using block-diagram<BDC& its conversion to Decimals, using IC's, such as7445

5.5 Explain seven segments decoders, showing block diagrams, giving examples for letters & digits.

5.6 Describe the operation of combinational logic circuits as applied to data processing circuits

5.7 Explain the working of 7-segment display circuit

6.   **DETAILED DESCRIPTION OF FLIP-FLOPS**

6.3   Definition of the following terms:
     6.3.1. Latch
     6.3.2. flip flop
     6.3.3. Hold time

6.2   Describe the working of RS Flip-Flop

6.3   Describe the working of Clocked RS Flip-Flop

6.4   Describe the working of D Flip-Flop

6.5   Describe the working of Edge-triggered D Flip-Flop

6.6   Describe the working of JK Flip-Flop

7.   **UNDERSTAND THE WORKING OF CLOCKS & TIMERS**

7.3   Definition of the following terms
     7.3.1. Clock
     7.3.2. Trigger
     7.3.3. Pulse
     7.3.4. Frequency
     7.3.5. Pulse width

7.1   Study the function of a TTL clock

7.2   Study the Timer 555 – astable, monostable

7.3   Identify the applications of clock and timers

     7.3.5. Inverter Clock
     7.3.6. Ring Oscillator
     7.3.7. NAND/NOR Gate clock

8.   **KNOW ABOUT SHIFT REGISTERS**

8.1   Definition of the following terms
     8.1.1. Register
     8.1.2. Storage Capacity
     8.1.3. Shift right
     8.1.4. Shift left

8.2   Study the basic concepts of shift-right & shift-left registers

8.3   Understanding the serial in-serial out configuration

8.4   Understand the serial-in parallel-out configuration

8.5   Understand the parallel-in serial-out configuration

8.6   Understand the parallel-in parallel-out configuration

9.   UNDERSTAND THE WORKING OF COUNTERS
    10.2   9.1 Definition of following
            10.2.1. Synchronous
            10.2.2. Asynchronous
9.2   Describe the working of the ripple counter

9.3   Describe the working of synchronous counter

9.4   Describe the working of presentable counter

9.5   Describe the working of ring counter

9.6   Describe the working of up/down counter

9.5   Understand the working of digital clock

10   APPLY THE CONCEPTS OF DIGITAL ELECTRONICS FOR PROJECT(S)

10.1   Explain the use of digital electronic circuits as elements of a chosen system

10.2   Describe the use of digital electronic circuits for the following:-

10.2.1   Moving display

10.2.2   Frequency counters
10.2.3   Digital clock

11.   LATEST TECHNOLOGY USED IN DIGITAL ELECTRONICS
            10.2.4   Description of the following technology:
                10.2.4.1   SMD
                10.2.4.2   Hybrid IC's
                10.2.4.3   DSP
                10.2.4.4   VLSI
                10.2.4.5   Optical IC's
                10.2.4.6   Superconduction
                10.2.4.7   Josephson's junction
            10.2.5   How the above technologies are an improvement over current technology

LIST OF PRACTICALS   **96 Hours**

1. Familiarization with Digital trainer.
2. Identify and verify truth tables for AND, OR, NOT Gates ICs
3. Identify and verify truth tables for NOR, NAND, XOR Gates ICs
4. Construct and verify truth tables of half adder
5. Construct and verify the truth table of full adder
6. To perform and study the function of multiplexer through related IC
7. To perform and study the function of demultiplexer through related IC
8. To perform and study the function of decoder through related IC
9. To perform and study the function of encoder through related IC
10. Identify and verify the functions of RS Flip-Flop
11. Identify and verify the functions of D Flip-Flop
12. Identify and verify the functions of JK Flip-Flop
13. Connect a 555 IC as
    - A-stable multivibrator
    - Monostable multivibrator
    - Bistable multivibrator
14. Connect and observe the working of shift registers (SISO, SIP, PISO, PIPO)
15. Identify, connect and observe working of ripple and synchronous counters
16. Select components, assemble and observe working of a digital clock.
17. Assemble and observe working of frequency counter (Project – 2)
18. Assemble and observe working of moving message display (Project – 3)

YEAR - 3
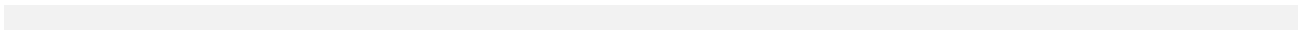
MGMC-311   INTELLIGENT PRODUCTION AND MANAGEMENT

Total Contact (Hours): 32   T   P   C

Theory (Hours): 32   1   0   1
Practical (Hours):   0

Aims
1. To understand the concept and content of production management, master the concept of intelligent production management
2. Able to analyze production operation systems, production operation management activities, and other management activities of the enterprise
3. To master the overall layout of the production system, production plan preparation procedure and production operation plan preparation method
4. To understand the functions of ERP and MES systems
5. To understand the basic idea of JIT production mode, Lean manufacturing (LP), computer integrated manufacturing system (CIMS), optimal production technology (OPT), agile manufacturing (AM), industry 4.0 and Made in China 2025

COURSE CONTENTS
1. INTRODUCTION TO INTELLIGENT PRODUCTION MANAGEMENT   4 HOURS
1.1 Production and Production Management
1.2 Content of production management
1.3 Productive process
1.4 Production type
1.5 Intelligent production management

2. PLANNING AND ORGANIZATION OF PRODUCTION SYSTEMS   4 HOURS
2.1 General layout of production system
2.2 Workshop layout
2.3 Time organization of the production process
2.4 Flow production organization

3. MATERIAL MANAGEMENT   4 HOURS
3.1 Overview of Material Management
3.2 Material consumption quota and reserve quota
3.3 Material Supply Plan and Material requirements planning (MRP)
3.4 Production site material management
3.5 Inventory management

4. PRODUCTION PLAN AND PRODUCTION OPERATION PLAN   4 HOURS
4.1 Comprehensive Production Plan
4.2 Production capacity of industrial enterprises
4.3 Arrangement of production plan
4.4 Production operation plan
4.5 Production operation control

4.6 Production operation statistics and work in progress management

5. EQUIPMENT MANAGEMENT AND LABOR MANAGEMENT   4 HOURS
5.1 Overview of Device Management
5.2 Use and maintenance of equipment
5.3 Equipment updates and renovations
5.4 TPM Management
5.5 Labor Management
5.6 On job training and versatile work
5.7 Skill evaluation method

6. QUALITY MANAGEMENT AND ISO 9000 QUALITY MANAGEMENT SYSTEM CERTIFICATION   4 HOURS
6.1 Overview of Quality Management
6.2 Quality management principles
6.3 Quality management system and methods
6.4 Quality management system audit
6.5 ISO 9000 Quality Standards and Quality Certification

7. ERP AND MES SYSTEMS   4 HOURS
7.1Overview of ERP system
7.2Implementation process of ERP
7.3 Evaluation of ERP implementation effectiveness
7.4Overview of MES system
7.5 MES system functions
7.6 The relationship between MES system and ERP system

8. DEVELOPMENT AND MODE CHANGE OF PRODUCTION MANAGEMENT TECHNOLOGY   4 HOURS
8.1 The evolution process of production methods
8.2 Basic ideas and main methods of JIT production method
8.3 Lean manufacturing (LP)
8.4 Computer Integrated Manufacturing System (CIMS)
8.5 Optimal Production Technology (OPT)
8.6 Agile Manufacturing (AM)
8.7 Industry 4.0 and Made in China 2025

RECOMMENDEDBOOKS
1. Modern production management （3rd Edition）:Cui PingChina Machine Press(2020)
2. Intelligent Manufacturing Production Management and Control （intermediate）: PZheng Limei, Yu Xinyi, Chen Qiang   Higher Education Press (2022)
3. New Manufacturing Intelligent Management Practical Series - Intelligent Production Management Practical Manual:Dang ZhengQi   Chemical Industry Press(2020)

MGMC-311   INTELLIGENT PRODUCTION AND MANAGEMENT

INSTRUCTIONAL OBJECTIVES

1. UNDERSTAND INTELLIGENT PRODUCTION MANAGEMENT
1.1 Production and Production Management
1.2 Content of production management
1.3 Productive process
1.4 Production type
1.5 Intelligent production management

2. APPLY PRODUCTION SYSTEMS
2.1 General layout of production system
2.2 Workshop layout
2.3 Time organization of the production process
2.4 Flow production organization

3. APPLY MATERIAL MANAGEMENT
3.1 Overview of Material Management
3.2 Material consumption quota and reserve quota
3.3 Material Supply Plan and Material requirements planning (MRP)
3.4 Production site material management
3.5 Inventory management

4. APPLY PRODUCTION PLAN AND PRODUCTION OPERATION PLAN
4.1 Comprehensive Production Plan
4.2 Production capacity of industrial enterprises
4.3 Arrangement of production plan
4.4 Production operation plan
4.5 Production operation control
4.6 Production operation statistics and work in progress management

5. UNDERSTAND EQUIPMENT MANAGEMENT AND LABOR MANAGEMENT
5.1 Overview of Device Management
5.2 Use and maintenance of equipment
5.3 Equipment updates and renovations
5.4 TPM Management
5.5 Labor Management
5.6 On job training and versatile work
5.7 Skill evaluation method

6. KNOW THE USE OF QUALITY MANAGEMENT AND ISO 9000 QUALITY MANAGEMENT SYSTEM CERTIFICATION
6.1 Overview of Quality Management
6.2 Quality management principles
6.3 Quality management system and methods
6.4 Quality management system audit
6.5 ISO 9000 Quality Standards and Quality Certification

7. KNOW THE USE OF ERP AND MES SYSTEMS

7.1Overview of ERP system

7.2Implementation process of ERP

7.3 Evaluation of ERP implementation effectiveness

7.4 Overview of MES system

7.5 MES system functions

7.6 The relationship between MES system and ERP system

8. UNDERSTAND DEVELOPMENT AND MODE CHANGE OF PRODUCTION MANAGEMENT TECHNOLOGY

8.1 The evolution process of production methods

8.2 Basic ideas and main methods of JIT production method

8.3 Lean manufacturing (LP)

8.4 Computer Integrated Manufacturing System (CIMS)

8.5 Optimal Production Technology (OPT)

8.6 Agile Manufacturing (AM)

8.7 Industry 4.0 and Made in China 2025

MTRC-313   DIGITAL DESIGN AND SIMULATION OF PRODUCTION LINE

Total Contact (Hours)   160   T   P   C
Theory (Hours):   64   2   3   3
Practical (Hours):   96
Aims
1. To understand the concept and role of digital twin technology
2. To master the programming and simulation methods for robot production lines and PLC controlled production lines
3. To master the architecture and application of digital integrated production lines
COURSE CONTENTS
1. INTRODUCTION   4 HOURS
1.1 Introduction to Industrial Digital Twin Technology
1.2 The Function and Application of Digital Production Line Design Platform
1.3 Application background and functional requirements of intelligent detection production lines

2. COLOR CLASSIFICATION STATION SIMULATION   6 HOURS
2.1 Equipment configuration of color classification station
2.1.1 Process of Color Classification Station
2.1.2 Equipment and Simulation Method of Color Classification Station
2.1.3 Application of relevant software terms and instructions
2.1.4 Task implementation
2.2 Color classification station simulation settings
2.2.1 Understanding Sensors
2.2.2 Application of relevant software terms and instructions
2.2.3 Task implementation

3. SIMULATION OF PROCESSING DETECTION STATION   6 HOURS
3.1 Configuration of processing and testing stations
3.1.1 Process of processing and testing station
3.1.2 Equipment and simulation methods for processing inspection stations
3.1.3 Application of relevant software terms and instructions
3.1.4 Task implementation
3.2 Simulation Settings for Processing Detection Station
3.2.1 Internal signal simulation
3.2.2 Application of relevant software terms and instructions
3.2.3 Task implementation

4 . VIRTUAL DEBUGGING OF THREE-DIMENSIONAL WAREHOUSE 6 HOURS
4.1 Equipment configuration of three-dimensional warehouse
4.1.1 Process of three-dimensional warehouse
4.1.2 The Structure and Simulation Method of a Stereoscopic Warehouse
4.1.3 Application of relevant software terms and instructions
4.1.4 Task implementation
4.2 Virtual debugging settings for three-dimensional warehouses
4.2.1 Virtual debugging
4.2.2 Application of relevant software terms and instructions
4.2.3 Task implementation

5. PRODUCTION LINE SIMULATION DESIGN 6HOURS

5.1 Mission planning

5.2 PROCESS ANALYSIS

5.3 Production line design

6. SIMULATION OF PNEUMATIC TRANSLATION STATION   6 HOURS

6.1 Introduction to pneumatic translation device

6.2 Motion Analysis and Simulation Method of Pneumatic Translation Device

6.3 Application of relevant software terms and instructions

6.4 Task implementation

6.5 Simulation results of pneumatic translation station motion

7. INTELLIGENT WAREHOUSING STATION SIMULATION   6 HOURS

7.1 Knowledge of Intelligent Warehouse Station

7.2 Intelligent warehousing station equipment configuration

7.3 Time series simulation of intelligent warehousing station

8. SIMULATION OF INTELLIGENT ASSEMBLY STATION   8 HOURS

8.1 Cognition of Intelligent Assembly Station

8.2 Intelligent assembly station equipment configuration

8.3 Intelligent Assembly Station CEE Simulation

8.3.1 The workflow of an intelligent assembly station

8.3.2 CEE mode simulation

8.3.3 Application of relevant software terms and instructions

8.3.4 Task implementation

8.3.5 Simulation of the Motion Process of Intelligent Assembly Station

9. VISUAL INSPECTION WORKSTATION SIMULATION   8 HOURS

9.1 Visual inspection station cognition

9.2 Visual inspection station equipment configuration

9.3 Virtual Simulation of Visual Inspection Station

9.3.1 The workflow of visual inspection station

9.3.2 Software in the loop virtual debugging based on virtual PLC

9.3.3 Application of relevant software terms and instructions

9.3.4 Task implementation

9.3.5 Simulation of Visual Inspection Station Motion Process

10 INTELLIGENT DETECTION PRODUCTION LINE VIRTUAL AND REAL JOINT DEBUGGING   8 HOURS

10.1 Real intelligent detection production line settings

10.2 Virtual intelligent detection production line settings

10.3 Intelligent detection production line virtual and real joint debugging

RECOMMENDED BOOKS

1. Digital Design and Simulation of Production Line(NX MCD):Meng Qingbo,China Machine Press,2020

2.   Digital Design and Simulation of Intelligent Production Line—PLC Program Design and MCD Electromechanical Joint Debugging:

3.   The Art of Assembly Language: Randall Hyde, 2010

MTRC-323   **Digital Design and Simulation of Production Line**
INSTRUCTIONAL OBJECTIVES

1.   UNDERSTANDING OF INDUSTRIAL DIGITAL TWIN TECHNOLOGY
1.1   Understanding of Industrial Digital Twin Technology
1.2   Familiar with the functions and applications of digital production line design platforms
1.3   Understand the application background and functional requirements of intelligent detection production lines
1.4 Able to design digital production lines according to requirements

2.   MASTERING THE DIGITAL DESIGN AND SIMULATION OF TYPICAL EQUIPMENT
2.1 Simulation Design of Color Classification Station
2.1.1 Master the process of color classification station
2.1.2 Master the equipment and simulation methods of color classification stations
2.1.3 Learning of Simulation Software SimensNX MCD
2.1.4 Understanding sensors in color classification stations
2.2   Simulation Design of processing detection station
2.2.1 Master the process of processing detection station
2.2.2 Master the equipment and simulation methods of processing detection station
2.2.3 Complete the internal signal simulation of the processing detection station
2.2.4 Learning of Simulation Software SimensNX MCD
2.3   Virtual debugging of three-dimensional warehouses
2.3.1 Master the process of three-dimensional warehouses
2.3.2 Master the equipment and simulation methods of three-dimensional warehouses
2.3.3 Complete the Virtual debugging of three-dimensional warehouses
2.3.4 Learning of Simulation Software SimensNX MCD

3.   DESIGN A DIGITAL PRODUCTION LINE ACCORDING TO REQUIREMENTS
3.1   Ability to analyze task books and planning priorities
3.2   Able to analyze the process and key points of the production line
3.3   Design analysis production line
3.4   Understanding of production line structure
3.5   Learning of Simulation Software Tecnomatix Process Simulate
3.6 Design a digital production line according to requirements

4.   DESIGN AND SIMULATION OF PNEUMATIC TRANSLATION STATION
4.1   Introduction to pneumatic translation device
4.2   Master the motion analysis and simulation methods of pneumatic translation devices
4.3   Learning of Simulation Software Tecnomatix Process Simulate
4.4 Design and motion simulation of pneumatic translation station

5 DIGITAL DESIGN AND SIMULATION OF TYPICAL PRODUCTION LINES
5.1 Digital Design and Simulation of Intelligent Warehouse Station
5.1.1 Understand intelligent warehousing stations
5.1.2 Master the motion analysis and simulation methods of intelligent warehousing stations

5.1.3 Design and simulate intelligent warehousing stations

5.1.4 Master the workflow of intelligent warehousing stations

5.2   Digital Design and Simulation of Intelligent Assembly Station

5.3   Digital Design and Simulation of Visual Inspection Station

6. CAPABLE OF VIRTUAL AND REAL JOINT DEBUGGING OF INTELLIGENT DETECTION PRODUCTION LINES

6.1   Mastering the control principles of real intelligent inspection production lines

6.2   Master the control principle of virtual intelligent inspection production line

6.3   Master the method of combining virtual and real adjustments

MTRC-323   DIGITAL DESIGN AND SIMULATION OF PRODUCTION LINE

LIST OF PRACTICAL

1. Introduction to Digital Twin Technology   (4 Hours.)

2. Digitization setting of basic objects on the production line   (8 Hours.)

3. Digital Design and Simulation of Color Classification Station   (8 Hours.)

4. Digital Design and Simulation of Processing Inspection Station   (8 Hours.)

5. Digital Design and Virtual Debugging of Stereoscopic Warehouse   (8 Hours.)

6. Kinematics and pose creation of production line equipment   (8 Hours.)

7. Digital Design and Simulation of Pneumatic Translation Station   (8 Hours.)

8. Digital Design and Simulation of Intelligent Warehouse Station   (8 Hours.)

9. Digital Design and Simulation of Intelligent Assembly Station   (8 Hours.)

10. Digital Design and Simulation of Visual Inspection Station   (8 Hours.)

11. Motion Simulation of Industrial Robots   (8 Hours.)

12. Virtual and Real Joint Debugging of Intelligent Detection Production Line   (12 Hours.)

MTRC-321   HYDRAULICS & PNEUMATICS

TOTAL CONTACT HOURS: 32   T   P   C
THEORY (HOURS):   32   1   0   1
PRACTICAL (HOURS):   0

AIMS
1.   ・To familiarize the students to basic concepts & working of hydraulics and pneumatics
2.   □To master the types, working principles, graphic symbols, and functions of hydraulic and pneumatic components
3.   □To master the types, composition, working principles, and applications of basic hydraulic and pneumatic transmission circuits
4.   □To familiarize the students to the working principles, system installation, debugging, and fault diagnosis methods of typical hydraulic and pneumatic transmission systems

COURSE CONTENTS
1.HYDRAULIC TRANSMISSION SYSTEM   4 HOUR

1.1Hydraulic transmission
1.2Hydraulic oil

2.HYDRAULIC DIRECTIONAL CONTROL CIRCUIT   4 HOURS

2.1Hydraulic power components
2.2Hydraulic actuator components
2.3Hydraulic auxiliary components
2.4One-way valve and locking circuit
2.5Directional valve and directional circuit

3. HYDRAULIC PRESSURE CONTROL CIRCUIT   4 HOURS

3.1Overflow valve and pressure regulating circuit
3.2Pressure reducing valve and circuit
3.3Sequence valves and sequence action circuits

4. HYDRAULIC SPEED CONTROL CIRCUIT   4 HOURS

4.1Throttle valve and throttle speed control circuit
4.2Speed control valve and typical speed control

5. TYPICAL HYDRAULIC SYSTEMS   6 HOURS

5.1Hydraulic system of the combined machine tool power slide
5.2Hydraulic system of hydraulic press

6. PNEUMATIC TRANSMISSION SYSTEMS   4 HOURS

6.1Pneumatic transmission system
6.2Pneumatic actuators and control components

7. PNEUMATIC CIRCUIT   6 HOURS

7.1Pneumatic basic circuit
7.2Pneumatic control components and circuits
7.3Pneumatic transmission of pneumatic drilling machines

BOOKS RECOMMENDED

1.Hydraulic and Pneumatic Technology: Xinde Li, 2018
2.Hydraulic and Pneumatic Technology: Bo Zhao, 2023

HYDRAULICS & PNEUMATICS

INSTRUCTIONAL OBJECTIVES

1. COGNITION OF HYDRAULIC TRANSMISSION SYSTEM

1.1 Application of hydraulic transmission
1.2 Cognition of hydraulic oil

2. CONSTRUCTION AND DEBUGGING OF HYDRAULIC DIRECTIONAL CONTROL CIRCUIT

2.1 Selection of hydraulic power components
2.2 Selection of hydraulic actuator components
2.3 Selection of hydraulic auxiliary components
2.4 Use one-way valve and locking circuit
2.5 Use directional valve and directional circuit

3. CONSTRUCTION AND DEBUGGING OF HYDRAULIC PRESSURE CONTROL CIRCUIT

3.1 Use overflow valve and pressure regulating circuit
3.2 Use a pressure reducing valve and circuit
3.3 Use sequence valves and sequence action circuits

4. CONSTRUCTION AND DEBUGGING OF HYDRAULIC SPEED CONTROL CIRCUIT

4.1 Use throttle valve and throttle speed control circuit
4.2 Use speed control valve and typical speed control

5. ANALYSIS AND MAINTENANCE OF TYPICAL HYDRAULIC SYSTEMS

5.1 Analysis of the hydraulic system of the combined machine tool power slide
5.2 Analysis of hydraulic system of hydraulic press

6. UNDERSTANDING OF PNEUMATIC TRANSMISSION SYSTEMS

6.1 Composition of pneumatic transmission system
6.2 Selection of pneumatic actuators and control components

7. ESTABLISHMENT AND DEBUGGING OF PNEUMATIC CIRCUIT

7.1 Establishment and debugging of pneumatic basic circuit
7.2 Other typical pneumatic control components and circuits
7.3 Analysis of pneumatic transmission of pneumatic drilling machines

MTRC-333   PROGRAMMABLE LOGIC CONTROLLER

TOTAL CONTACT HOURS   160   **T   P   C**

THEORY HOURS: 64   **2   3   3**

PRACTICAL: 96

AIMS

1.   ・Master the structure, working principle and application of common low-voltage electrical appliances.
2.   ☐Master electrical circuit drawing rules and implement installation and maintenance process technical regulations.
3.   ☐Be able to read and design typical control lines.
4.   ☐Be able to carry out fault detection and maintenance of typical control lines.
5.   ☐Master the characteristics, hardware composition and working principle of the programmable controller.
6.   ☐Master the basic logic instruction, function instruction, step by step control instruction and programming method.
7.   ☐Capable of PLC control programming and debugging of medium complex electrical control system.
8.   ☐Be able to control with touch screen.

COURSE CONTENTS

1. Forward and reverse control of three-phase asynchronous motor   08 Hours
1.1 Commonly used low-voltage electrical graphic symbols, text symbols of the national standard
1.2 The drawing rules of circuit diagram, layout diagram and wiring diagram;
1.3 Commonly used low-voltage electrical appliances: knife
switch, button, fuse, contactor, thermal relay, stroke switch
Structure, working principle, selection and application
1.4 Asynchronous motor one-way point, continuous operation control circuit
1.5 Asynchronous motor positive and negative operation control circuit

2. Step-down start control of three-phase asynchronous motor   08 Hours
2.1 Circuit breaker, time relay structure, working principle, selection principle and use occasions
2.2 Common step-down starting methods: star-triangle step-down starting, autotransformer step-down starting, rotor winding series resistance step-down starting
2.3 Sequence control of the motor
2.4 Control principle diagram, installation wiring diagram and position installation diagram of commonly used buck start control line

3. Brake control of three-phase asynchronous motor   5 Hours
3.1 Structure, working principle, selection and use method of speed relay and intermediate relay.
3.2 Commonly used braking methods for motor control: energy
consumption braking, reverse braking
3.3 Electrical control schematic diagram, position

3.4 installation diagram and electrical wiring diagram of common braking methods

4. Overview of the PLC   **4 Hours**
4.1 Types of programmable controllers
4.2 The structure of the programmable controller
4.3 Working principle of the programmable controller
4.4 External wiring of the programmable controller
4.5 Programming languages for programmable controllers
4.6 Installation and use of Botu software

5. Programming and debugging of bit logic instructions   **06 Hours**
5.1 Set reset instruction
5.2 Edge pulse instruction
5.3 PLC control of point operation of three-phase asynchronous motor
5.4 PLC control of continuous operation of three-phase asynchronous motor
5.5 PLC control of positive and negative transfer line of three-phase asynchronous motor

6. Programming and debugging of timer/counter instruction   **06 Hours**
6.1 Timer instruction
6.2 Counter Instructions
6.3 Apply timer instruction to realize PLC control of star-triangle step-down start of three-phase asynchronous motor
6.4 Apply counter instruction to realize PLC control of single-button start and stop control of three-phase asynchronous motor

7. Application of functional instructions   **10 Hours**
7.1Moving instruction, comparison instruction, arithmetic operation instruction, logic operation instruction, displacement instruction
7.2 Apply moving instruction to realize PLC control of star-triangle step-down start-up
7.3 The PLC control of the intersection traffic light is realized by using the comparison instruction
7.4 The application of arithmetic operation instruction to achieve the heater power selection PLC control
7.5The application of logic operation instruction to achieve the control of the lamp
7.6The application of cycle instruction to achieve neon light cycle lighting PLC control

8. PLC sequence control   **12 Hours**
8.1 The composition of the sequence control function chart
8.2 Single flow, parallel flow, selective flow sequence control function diagram drawing
8.3 Programming method of sequence control
8.4 PLC control of manipulator
8.5 PLC control of large ball sorting
8.6 PLC control of traffic lights at crossroads

9. Use of touch screen   **05 Hours**
9.1 Configuration method of touch screen
9.2 Communication between touch screen and PLC
9.3 The application of touch screen to achieve the control of intersection traffic lights

RECOMMENDEDBOOKS
1. Electrical Control Technology and Application (3rd Edition): Hua Manxiang People's Posts and Telecommunications Press (2022)
2.Siemens S7-1200PLC Application Technology Project Tutorial (2nd edition), Wu Fanhong, Publishing House of Electronics Industry (2022)

INSTRUCTIONAL OBJECTIVES

1.Master the structure, working principle, use occasions and selection principles of common low-voltage electrical appliances

1.1 Understand the commonly used low-voltage electrical graphic symbols, text symbols of the national standard;

1.2 Master the definition and classification of low-voltage electrical appliances

1.3 Master the structure and composition of common low-voltage electrical appliances

1.4 Master the working principle of commonly used low-voltage electrical appliances

1.5 Master the use of low-voltage electrical appliances

1.6 Master the selection principle of low-voltage electrical appliances

2. Master the typical control circuit reading and design

2.1 Master the commonly used electrical control diagram: electrical control schematic diagram, electrical installation position diagram, electrical installation wiring diagram of the reading principle and drawing principle

2.2 Be able to read the commonly used typical electrical control lines: the starting, speed regulation and braking control of three-phase asynchronous motorsCircuitry

2.3 Capable of reading and designing moderately complex electrical control circuit diagrams

2.4 Be able to read the common machine tool electrical control schematic

3. Master the fault detection and maintenance methods of typical control circuits

3.1 Master the use of common electrical tools

3.2 Master the use of common instruments and meters

3.3 Master the method of fault detection of control line

3.4 Be able to use electrical tools for circuit fault detection and maintenance

4. Master the basic knowledge of programmable controller

4.1 Understand the history of programmable controllers

4.2 Understand the classification of programmable controllers

4.3 Master the structure and working principle of the programmable controller

4.4 Master the programming language of the PLC

4.5 Be able to recognize the external terminals of the programmable controller

4.6 Master the installation and use methods of Botu software

5. Master the basic instructions of the programmable controller

5.1 Master the storage format of the input and output

5.2 Master the application of basic instructions such as bit instruction, edge pulse instruction, timer and counter

5.3 Be able to apply basic instructions to PLC programming and simulation of three-phase asynchronous motor operation

6. Master the functional instructions of the programmable controller

6.1 Master the application of moving instruction, comparison instruction, arithmetic operation instruction, logic operation instruction and cyclic displacement instruction

6.2 Master the application of program control instructions

6.3 Able to apply functional instructions for moderately complex control PLC programming and simulation

7. Master the sequential control programming method

7.1Understand the classification of sequence control

7.2 Understand the composition of the sequence control function chart

7.3 Master the programming methods of the sequence control function chart: start-start-start-start-stop structure, set reset instructions, Graph language

7.4 Be able to analyze the control requirements and draw the sequence control function chart according to the production process

7.5 Proficient in the application of sequential control programming

8. Master the use of touch screen

8.1Master the communication method between touch screen and programmable controller

8.2 Master the configuration method of the touch screen

8.3 Be able to control with touch screen

LIST OF PRACTICAL   96 Hrs.

1. Installation and debugging of continuous operation control line of three-phase asynchronous motor   (8 Hours)

2. Installation and debugging of positive and negative rotation control circuit of three-phase asynchronous motor   (8 Hours)

3. Installation and commissioning of Star-Triangle step-down start control circuit of three-phase asynchronous motor   (8 Hours)

4. Installation and debugging of three-phase asynchronous motor self-locking operation PLC control line   (8 Hours)

5. Installation and debugging of PLC control line for positive and negative operation of three-phase asynchronous motor   (8 Hours)

6. Installation and debugging of PLC control line for star-triangle step-down start of three-phase asynchronous motor   (8 Hours)

7. Installation and debugging of PLC control line of intersection traffic lights   (8 Hours)

8. Installation and debugging of PLC control line with neon light cycle lighting   (8 Hours)

9. Installation and debugging of positive and negative rotation control line of three-phase asynchronous motor controlled by touch screen   (8 Hours)

10. PLC control of manipulator (12 Hours)

11. PLC control of two mixed liquids (12 Hours)

12. PLC control of conveyor car (8 Hours)

MTRC-343   MICROCONTROLLER APPLICATION TECHNOLOGY

Total Contact (Hours)   160   T   P   C
Theory (Hours):   64   2   3   3
Practical (Hours):   96
Aims
1.   ☐Cultivate students' basic thinking, programming skills, and logical thinking abilities in microcontroller programming.
2.   ☐Mastering the methods and steps of using C language programming to solve practical problems in job positions, enabling students to master the basic methods and thinking of program design, and form the basic ideas of program design.
3.   ☐Mastering the basic methods of programming, enabling students to have preliminary programming skills.

COURSE CONTENTS
1 UNDERSTAND THE OPERATING ENVIRONMENT AND HARDWARE SYSTEM OF SINGLE-CHIP MICROCONTROLLERS   12 Hours
1.4The Concept of Microcontrollers and Microcontroller Application Systems
1.5Basic system structure and composition of microcontroller
1.6Understanding of KEIL software
1.7Operation of KEIL software
1.8Definition and function of microcontroller pins
1.9Designing a Minimal System for Microcontrollers
1.10Composition of microcontroller storage structure

2 THE APPLICATION OF MICROCONTROLLER I/O PORT AND THE FUNDAMENTALS OF C LANGUAGE   16 Hours
2.1 Flow light display
2.2 Definition and operation methods of I/O ports in microcontrollers
2.3 Definition of Sbit and SFR
2.4 Data types and variable definitions
2.5 Header file reg51. h parsing
2.6 Preprocessing Command # include

3 TECHNICAL APPLICATION OF DISPLAY AND KEYBODRD INTERFACE 20 Hrs
3.1 Display interface circuit and Chinese character font
3.2 Data storage location in 51
3.3 Bitwise operation operator, auto increment, auto decrement operator
3.4 Drive and Display of LED Segment Code Tube
3.5 The Drive Display of Character LCD Liquid Crystal
3.6Master the usage of arrays and pointers
3.751 microcontroller function definition and call
3.8 Analysis and application of Header file instrins.
3.9 Relationships, logic, compound operators, and expressions

4 TIMING AND INTERRUPT SYSTEM   8 Hours
4.1Structure Analysis of Timer in Timing and Interrupt Systems
4.2How the timer works

4.3Application of timers
4.4Interrupt system
4.5Writing interrupt program

5. I2C BUS COMMUNICATION   8 Hours
5.1 Basic Applications of 24C02 Chip
5.2Using I2C bus interface to achieve internal data reading and writing of devices
5.3Write data reading and writing programs

RECOMMENDED BOOKS

1. Microcontroller Application Technology (C Language Version): Wang Jingxia,2019
2.   Design of C Language Application Program for Microcontrollers: Ma Zhongmei, 2017
3.   C language programming: Sun Gaiping, Wang Dezhi, 2016

MICROCONTROLLER APPLICATION TECHNOLOGY
INSTRUCTIONAL OBJECTIVES:-

1. PROFESSIONAL COMPETENCE
1.1   Theoretical objectives
1.1.1 Master the basic knowledge and concepts of microcomputers;
1.1.2 Master the basic structure and working principle of the 51 series microcontroller;
1.1.3 Master the working principles and usage methods of the I/O interface, interrupt, timer/counter of the 51 series microcontroller;
1.1.4 Master the basic process of microcontroller programming;
1.1.5 Master the basic data types and various operators of C language, and be able to achieve simple processing of various data;
1.1.6 Master the characteristics and applications of the three basic structures of C language (sequential structure, branch structure, and loop structure);
1.1.7 Master the principles and programming methods of sequence, branching, and loop structure programming in C language;
1.1.8 Master the use of commonly used library functions in C language and the usage methods of user-defined functions;
1.1.9 Master the usage of arrays, pointers, structures, and files;
1.1.10 Master the development and debugging steps of simple programs, and recognize common Syntax error.
1.2   Practical objectives
1.2.1 Ability to recognize and draw circuit diagrams for microcontroller project products;
1.2.2 Welding, manufacturing, and debugging of microcontroller project products, troubleshooting and maintenance capabilities;
1.2.3 Ability to analyze and design microcontroller projects;
1.2.4 The microcontroller project has the ability to use C language for simple programming.

2. SOCIAL ABILITY
2.1 Standardization: Having standardized operating habits and using tools and instruments correctly;
2.2 Ability to access relevant information through books or the internet;
2.3 Teamwork awareness: possessing a spirit of unity and collaboration - helping each other, learning together, and achieving goals together;
2.4 Communication awareness: possessing language expression and communication, expressing and answering questions;
2.5 Sense of responsibility: Able to strictly follow national standards, regulations, and requirements to complete work projects;
2.6 Safety awareness: Possess awareness of safe electricity use and environmental protection;
2.7 Be able to reduce negative impacts on the environment during the work process by using appropriate materials, responsible handling methods, and complying with environmental protection regulations.

MICROCONTROLLER APPLICATION TECHNOLOGY

LIST OF PRACTICAL

1.Design of Signal Lamp Control System (6 Hours.)

2.Proteus Simulation Design of Signal Lamp Control System   (6 Hours.)

3.Design of 8 signal light control systems   (6 Hours.)

4.Design of Sound Alarm System   (6 Hours.)

5.Design of Left and Right Turn Signal Control System for Automobile (6 Hours.)

6.Design of a Flowing Lamp System Based on Shift Operation   (12 Hours.)

7.Design of Button Controlled Neon Lamp System   (6 Hours.)

8.Design of a Flowing Lamp System Based on Array Implementation   (6 Hours.)

9.Design of Navigation Mark Indicator System   (6 Hours.)

10.Design of a 24 second countdown timer system   (6 Hours.)

11.Design of an electronic stopwatch system   (6 Hours.)

12.Design of Love Display Board System   (6 Hours.)

13.Design of a 24-hour clock system   (6 Hours.)

14.Design of Simulated Traffic Light Control System   (6 Hours.)

15.Design of Remote Control Billboard System for Dual Machine Communication (6 Hours.)

MTRC-353 Fundamentals of Industrial Robotics

Total Contact Hours   160
Theory (Hours): 64
Practical(Hours) : 96

T   P   C
2   3   3

AIMS: After studying this course, the student will be able to:

1. Understand the origin, development, composition, and technical parameters of robots, master the classification and application of robots, and have a comprehensive and systematic understanding of various types of robots;
2. Understand the basic structure of the robot body, including the body and arm structures, wrist and hand structures, transmission and walking mechanisms, etc;
3. Understand the composition of the industrial robot perception system, the basic composition and operation methods of the control system;
4. Master the working principles of commonly used sensors inside and outside industrial robots;
5. Proficient in the use of teaching aids for typical industrial robots and basic manual operation methods for industrial robots;
6. Master the basic program instructions and programming methods of typical industrial robot languages, and on this basis, master trajectory teaching programming, tool center point calibration, and simple robot handling programming methods;
7. Familiar with the composition of typical automatic production lines for industrial robots such as painting, gluing, welding, assembly, and packaging, and master simple programming methods.

COURSE CONTENTS
1. DEVELOPMENT AND CLASSIFICATION OF INDUSTRIAL ROBOTS 6 Hours
1.1.   The Development History and Definition of Industrial Robots
1.2.   Classification of industrial robots
1.3.   Basic composition and main parameters of industrial robots
1.4.   Industry Development Trends of Industrial Robots

2. MECHANICAL STRUCTURE OF INDUSTRIAL ROBOTS 6 Hours
2.1. End effector
2.2. The wrist of industrial robots
2.3. Arms of industrial robots
2.4. The body of an industrial robot
2.5. The walking mechanism and transmission system of industrial robots

3. SENSING SYSTEM FOR INDUSTRIAL ROBOTS   6 Hours

3.1. sensors
3.2. Commonly used industrial robot sensors

4. CONTROL SYSTEM OF INDUSTRIAL ROBOTS   6 Hours
4.1. The functions, characteristics, and structural composition of industrial robot control systems

4.2. Control System of Typical Industrial Robots

5. MAKE THE ROBOT MOVE   6 Hours
5.1. On/off and restart of industrial robots
5.2. Manual operation of industrial robots

6. BASIC SETTINGS FOR INDUSTRIAL ROBOTS   6 Hours
6.1. Industrial robot teaching device
6.2. Establishment of tool and workpiece coordinate system
6.3. I/O communication of industrial robots

7. BASIC INSTRUCTIONS FOR INDUSTRIAL ROBOTS 6 Hours
7.1 Robot motion instructions
7.2 Common instructions for robots

8. BASIC PROGRAMMING OF INDUSTRIAL ROBOTS 10 Hours
8.1. Establish executable routines
8.2. Programming of Basic Motion Trajectories for Industrial Robots

9. INTEGRATED APPLICATION PROGRAMMING FOR INDUSTRIAL ROBOTS 12 Hours
9.1. Basic programming for industrial robot handling and palletizing
9.2. Advanced programming for industrial robot handling and palletizing

RECOMMENDED BOOKS:

1. Fundamentals of Industrial Robotics: Qiang Zhang,2023
2. Industrial Robot Field Programming (ABB):Guifu Tian,2022

INSTRUCTIONAL OBJECTIVES:-

1. INDUSTRIAL ROBOT COGNITION
   1.1 Introduce the Development History and Definition of Industrial Robots
   1.2 Describe the Classification of industrial robots
   1.3 Describe basic composition and main parameters of industrial robots
   1.4 Describe the industry Development Trends of Industrial Robots

2. MASTER THE MECHANICAL STRUCTURE
   2.1 Describe end effector
   2.2 Classification of the wrist of industrial robots
   2.3 Classification of arms of industrial robots
   2.4 Classification of the body of an industrial robot
   2.5 Master the walking mechanism and transmission system of industrial robots

3. SENSING SYSTEM FOR INDUSTRIAL ROBOTS
   3.1 Introduce the sensors used
   3.2 Master the commonly used industrial robot sensors

4. INTRDUCE CONTROL SYSTEM OF INDUSTRIAL ROBOTS
   4.1Understand the functions, characteristics, and structural composition of industrial robot control systems
   4.2 Master Control System of Typical Industrial Robots

5. MAKE THE ROBOT MOVE
   5.1 Master the On/off and restart of industrial robots
   5.2 Master the Manual operation methods of industrial robots

6. INTRODUCE BASIC SETTINGS FOR INDUSTRIAL ROBOTS
   6.1 Establishment of tool and workpiece coordinate system
   6.2 Master I/O communication of industrial robots

7. LEARN THE BASIC INSTRUCTIONS FOR INDUSTRIAL ROBOTS
   7.1 Learn robot motion instructions
   7.2 Learn common instructions for robots

8. MASTER BASIC PROGRAMMING OF INDUSTRIAL ROBOT
   8.1 Learn to establish executable routines
   8.2 Master programming of Basic Motion Trajectories for Industrial Robots

9. INTRODUCE INTEGRATED APPLICATION PROGRAMMING FOR INDUSTRIAL ROBOTS
9.1 Master the basic programming for industrial robot handling and palletizing
 9.2 Master the advanced programming for industrial robot handling and palletizing

Fundamentals of Industrial Robotics

LIST OF PRACTICALS

1. Correctly judge the operating status of industrial robots (1hour)
2. The correct method for switching on and off typical industrial robots (1hour)
3. Reasons and correct methods for restarting industrial robots (1hour)
4. Manual operation of single axis movement (2hours)
5. Manual operation of linear motion (2hours)
6. Manual operation of repositioning motion (2hours)
7. Proficient in using the teaching pendant enable button (1hour)
8. Proficient in the basic structure and common interface functions of teaching aids (2hour)
9. Proficient in mastering the language of setting up teaching aids and methods for robot system time (1hour)
10. Master the methods and steps for establishing tool coordinate systems, and correctly set corresponding parameters (6 hours)
11. Master the verification methods and steps for creating a new tool coordinate system (4hours)
12. Master the methods and steps for establishing the workpiece coordinate system(2hours)
13. Master the verification methods and steps for creating a new workpiece coordinate system(1hour)
14. Understand the types of robot I/O communication and commonly used standard I/O boards(2hours)
15. Understand the configuration of DSQC651 and DSQC652 boards(2hours)
16. Master the method of establishing the correlation between system input motor start and digital input signal(4hours)
17. Master the method of establishing the correlation between system output motor start and digital output signal(4hours)
18. Proficient in mastering the meanings of various parts of joint interpolation motion commands, as well as the methods of command input and parameter settings(4hours)
19. Proficient in mastering the meaning of each part of the linear interpolation motion command, as well as the input and parameter setting methods of the command(4hours)
20. Proficient in mastering the meaning of each part of the arc interpolation motion command, as well as the method of command input and parameter setting(2hours)
21. Master the characteristics and programming methods of different conditional logic judgment instructions(4hours)
22. Master the characteristics and programming methods of different mathematical operation instructions(2hours)
23. Master the characteristics and programming methods of different I/O instructions(2hours)
24. Able to independently complete programming tasks for point motion(4hours)
25. Able to independently complete programming tasks for linear motion(4hours)
26. Able to independently complete programming tasks for circular arc motion(4hours)
27. Master the programming methods and steps of using point by point teaching method to achieve object handling(14 hours)
28. Master the programming methods and steps for implementing object blocks using point by point teaching methods(14 hours)
29. Master the connections and differences between programming methods with parameters, without parameters, and functional programs
30. Master the method of using routine programs with parameters to achieve transportation and stacking

MTRC-361 Overview of Artificial Intelligence

			T	P	C
Total Contact (Hours)	32				
Theory (Hours):	32		1	0	1
Practical (Hours):	0				

Aims

1. ☐Master the concept and development history of artificial intelligence, as well as major turning points in its development process, understand the current development status of artificial intelligence and current popular research directions;
2. ☐Understand the concepts of machine learning and deep learning, Internet of Things technology, Big data and cloud computing technology, virtual simulation and other core technologies;
3. ☐Master the application of artificial intelligence technology in daily life, manufacturing, education, security, healthcare, and urban construction;
4. ☐Understand the impact of intelligent manufacturing on economic structural reform in the context of the new era, as well as the changes in employment situation in this context, and understand what new opportunities we have with the rapid development of artificial intelligence today.

COURSE CONTENTS

1 The Development History of Artificial Intelligence   4 Hours
1.1 Work as a group to review materials and draw a mind map of the development history of artificial intelligence
1.2 Students explain key figures and major historical events

2 Machine learning   4 Hours
2.1 The Alpha Dog only took two years. How did it do it?
2.2 The concepts of machine learning and deep learning, and the concept and application of Knowledge graph

3 The Internet of Things   4 Hours
3.1 Provide examples to illustrate common IoT technologies
3.2 Discuss in groups and design a renovation plan for future life smart homes

4 Big data and Cloud Computing   4 Hours
4.1Changes in life brought by Big data and cloud computing

5 Virtual simulation technology   4 Hours
5.1 How is AR virtualization technology applied?
5.2The Legal Boundary and Ethical Issues of the Application of Virtual Simulation Technology

6 Artificial Intelligence Applications   12 Hours
6.1 Artificial Intelligence Life Applications
6.2 Artificial Intelligence Manufacturing Applications
6.3 Artificial Intelligence Education Applications
6.4 Other Applications and Development Trends of Artificial Intelligence

RECOMMENDED BOOKS:-

1. Introduction to Artificial Intelligence: Zhao Keling, 2021
2. Introduction to Artificial Intelligence: Lian Shiyou, 2022

INSTRUCTIONAL OBJECTIVES

1. The Development History of Artificial Intelligence

1.1 Work as a group to review materials and draw a mind map of the development history of artificial intelligence

1.2 Students explain key figures and major historical events

2. Machine learning

2.1 The Alpha Dog only took two years. How did it do it?

2.2 The concepts of machine learning and deep learning, and the concept and application of Knowledge graph

3. The Internet of Things

3.1 Provide examples to illustrate common IoT technologies

3.2 Discuss in groups and design a renovation plan for future life smart homes

4. Big data and Cloud Computing 4 Hours

4.1 Changes in life brought by Big data and cloud computing

5. Virtual simulation technology

5.1 How is AR virtualization technology applied?

5.2The Legal Boundary and Ethical Issues of the Application of Virtual Simulation Technology

6. Artificial Intelligence Applications

6.1 Artificial Intelligence Life Applications

6.2 Artificial Intelligence Manufacturing Applications

6.3 Artificial Intelligence Education Applications

6.4 Other Applications and Development Trends of Artificial Intelligence

MTRC-372-
PROGRAMMING AND PRACTICAL TRAINING OF CNC MACHINE TOOLS

Total Contact (Hours):   **128**   **T**   **P**   **C**
Theory(Hours):   **32**   **1**   **3**   **2**
Practical(Hours):   **96**
Aims
☐Capable of developing CNC machining processes and programs based on existing production conditions, corresponding technical standards, and technical data, in response to the characteristics and processing technology requirements of medium and advanced complex parts. Capable of optimizing process parameters, machining paths, and other related parameters, and then adjusting CNC machining to achieve CNC machining of parts and obtain products that meet technical requirements.

COURSE CONTENTS

1.ESTABLISHING THE WORKPIECE COORDINATE SYSTEM   **4 Hours**
1.1Application of CNC lathe operation face-plate
1.2 Establish basic concepts for the workpiece coordinate system
1.3CNC lathe tool setting operation
1.4Establishment and transformation application of workpiece coordinate system

2. PROGRAMMING AND MACHINNING OF SIMPLE AXIS PARTS   **8 Hours**
2.1Fundamentals of CNC lathe processing technology
2.2Fundamentals of CNC programming
2.3Quick positioning G00 and linear interpolation G01
2.4Circular interpolation (G02, G03)
2.5 Single fixed loop command
2.6 Automatic compensation function for tool tip arc
2.7 Preparation of part programs
2.8Part processing

3. PROGRAMMING OF STEP AXIS PARTS   **4 Hours**
3.1Drawing analysis;
3.2Clamping and positioning of workpieces;
3.3Determination of processing route;
3.4Selection of cutting tools;
3.5Selection of cutting amount;
3.6 Selection of machine tools and CNC systems
3.7 Outer diameter rough turning cycle command G71
3.8Fine turning cycle command G70
3.9Programming analysis, writing CNC machining programs for parts
3.10Part processing

4.PROGRAMMING AND PROCESSING OF THREADED PARTS   **2 Hours**
4.1Drawing analysis

4.2Clamping and positioning of workpieces
4.3Determination of processing route
4.4Selection of cutting tools
4.5 Selection of cutting amount
4.6Selection of machine tools and CNC systems
4.7Thread cutting instruction (G32)
4.8 Single fixed cycle of thread (G92)
4.9Thread fixation cycle (G76)
4.10Knowledge of thread processing technology
4.11Programming analysis, writing CNC machining programs for parts
4.12Part processing.

5. PROGRAMMING AND PROCESSING OF SHAFT SLEEVE PARTS   2 Hours
5.1Development of CNC machining process for sleeve parts;
5.2Coarse turning cycle command G71 for inner and outer diameters;
5.3Programming analysis, writing CNC machining programs for parts;
5.4Part processing

6.PROGRAMMING AND PROCESSING OF PLANAR CONTOUR PARTS 8 Hours
6.1 Establishment of CNC milling machine coordinate system
6.2Tool change instructions and applications for milling machines
6.3Drawing analysis
6.4Clamping and positioning of workpieces
6.5Determination of processing route
6.6Selection of cutting tools
6.7Selection of cutting amount
6.8Selection of machine tools and CNC systems
6.9Simple commands G01, G02/G03, G00, tool radius compensation commands G41/G42/G40, tool length compensation commands G43/G44/G49
6.10Programming analysis, writing CNC machining programs for parts
6.11Part processing

7.PROGRAMMING AND PROCESSING OF HOLE PARTS   4 Hours
7.1Establishment of the workpiece coordinate system of the machining center
7.2Tool change instructions and applications for machining centers
7.3Tool compensation instructions and applications for machining centers
7.4Cycle instruction G81 for hole processing
7.5Programming analysis, writing CNC machining programs for parts
7.6Part processing

RECOMMENDED BOOKS
1. Programming and implementation of CNC machining: Liu Li (2019)
2.   CNC machining programming and operation: Li He Shui (2022)
3.   CNC programming and machining technology, Zhou Baoniu (2019)

INSTRUCTIONAL OBJECTIVES

1.ESTABLISHING THE WORKPIECE COORDINATE SYSTEM
1.1 Master the functions and purposes of each button on the FANUC system CNC lathe control panel;
1.2 Master the concepts and interrelationships of machine tool coordinate system and workpiece coordinate system;
1.3 Master the common operating steps of CNC lathes;
1.4 Able to use coordinate system programming instructions to establish workpiece coordinate systems with multiple tools.
2.PROGRAMMING AND MACHINNING OF SIMPLE AXIS PARTS
2.1 Understand the structure and format of CNC machining programs;
2.2 Understand the concepts of base points and nodes;
2.3 Master the determination of cutting parameters;
2.4 Master simple commands, tool tip arc radius compensation commands, single fixed cycle programming commands, T, S, F, M programming commands;
2.5 Understand commonly used process specification forms, program sheets, and work orders;
2.6 Master CNC machining programming for outer circles, end faces, and grooves;
2.7 Able to apply simple fixed loop commands to program large margin step axes;
2.8 Able to program parts using basic instructions and process qualified parts.**3.PROGRAMMING OF STEP AXIS PARTS**
3.1 Master the programming of composite loop instructions;
3.2 Be able to flexibly apply composite loop instructions for programming;
3.3 Develop CNC machining process cards for stepped shaft parts;
3.4 Develop a program for stepped shaft parts;
3.5 Simulate and process qualified parts;
3.6 Through simulation, it is possible to modify and optimize processes and programs.
4.PROGRAMMING AND PROCESSING OF THREADED PARTS 2 Hours
4.1 Analysis of part drawings
4.2 Able to correctly calculate the basic parameters of threads;
4.3 Master the development of common thread parts processing plans;
4.4 Understand the machining principle of thread instructions;
4.5 Flexible application of thread instructions for programming.
4.6 Develop CNC machining process cards for threaded parts;
4.7 Develop CNC machining programs for threaded parts;
4.8 Through simulation, it is possible to modify and optimize processes and programs.
5.PROGRAMMING AND PROCESSING OF SHAFT SLEEVE PARTS
5.1 Master the development of CNC machining process for sleeve parts;
5.2 Be able to use the composite cycle instruction G71G70 to program the processing of shaft sleeve parts;
5.3 Through simulation, it is possible to modify and optimize processes and programs;
5.4 Process qualified parts.
6.PROGRAMMING AND PROCESSING OF PLANAR CONTOUR PARTS
6.1 Master the establishment of CNC milling machine coordinate system;
6.2 Master the tool change instructions and applications of milling machines;
6.3 Master the command and application of milling machine tool compensation;
6.4 Master the G54~G59 instructions to establish the workpiece coordinate system;

6.5 Understand the determination of cutting and walking routes;
6.6 Understand the determination of cutting parameters;
6.7 Master G00, G01, G02, G03, G41/G42/G40, G43/G44/G49, instructions and applications.
6.8 Develop CNC machining process cards for planar contour parts;
6.9 Develop CNC machining programs for planar contour parts;
6.10 Through simulation, it is possible to modify and optimize processes and programs;
6.11 Process qualified parts.

7.PROGRAMMING AND PROCESSING OF HOLE PARTS
7.1 Master the establishment of the workpiece coordinate system of the machining center;
7.2 Able to correctly and automatically change tools;
7.3 Able to select appropriate hole processing instructions for programming.

7.4 Develop CNC machining process cards for hole parts;
7.5 Develop CNC machining programs for hole type parts;
7.6 Process qualified parts.

LIST OF PRACTICALS

1. Comprehensive Practice of CNC Turning Programming and Machining   (48 Hours.)
1.1 Compilation of machining process documents for turning and milling mating parts
a) Able to analyze the machining process of turning and milling mating parts based on the task requirements and mechanical processing process cards, and optimize and adjust the machining process of turning and milling mating parts.
b) Able to complete the preparation of CNC machining process cards for turning and milling mating parts based on the machining process specifications and machining process cards for turning and milling mating parts, as well as the CNC machine tools and process equipment provided on site.
c) Be able to complete the preparation of tool cards for turning and milling mating parts based on the mechanical processing process specifications and machining process cards for turning and milling mating parts, as well as the CNC machine tools and process equipment provided on site.
d) Able to fill out CNC machining program cards based on manual programming or CAM programming of turning and milling mating parts, as well as adjustment of CNC machine tools.
1.2 CNC programming
Capable of working according to task requirements and CNC programmingManual, using manual programming or CAD/CAM softwareComplete the simulation verification of turning parts processing.
1.3   Step axis CNC machining
a) Able to dress neatly and properly according to the safety and civilized production system, use safety protective equipment correctly, and meet the requirements of safety and civilized production.
b)Able to select CNC machining tools, measuring tools, and fixtures for step axes according to the requirements of mechanical processing process documents.
c)Able to use CNC lathe universal fixtures to complete the installation and clamping of workpieces according to the requirements of the CNC lathe operation manual and mechanical processing process documents.
d) Be able to follow the safety operation regulations of the CNC lathe according to the CNC lathe operation manual, use tool installation tools, and complete tool installation and adjustment.
e)Be able to follow the operating procedures of the CNC lathe and use the electrical switches of the CNC lathe to start and stop the CNC lathe.
f) Able to use the CNC lathe operation panel according to the CNC lathe operation manual to complete basic operations such as working mode switching, feed rate setting, and spindle speed adjustment.
g)Able to input and edit CNC machining programs using panel input or program transfer methods according to the requirements of the CNC lathe operation manual and mechanical machining process documents.
h)Able to use cutting tools and measuring tools according to the requirements of the CNC lathe operation manual and mechanical processing process documents to complete the tool alignment of the CNC lathe.
i)Able to use machining accuracy control methods according to the requirements of machining process documents, have quality awareness, complete CNC machining of stepped shaft parts, and meet the following requirements:
Dimensional tolerance level: IT8
Geometric tolerance level: IT8
Surface roughness: Ra3.2 μ M
1.4   Part accuracy testing

a) Be able to calibrate Vernier scale, micrometer, dial indicator, dial indicator, universal angle gauge and other measuring tools.

b) Able to use corresponding measuring tools or instruments according to the requirements of part drawings and mechanical processing process documents to complete the inspection of machining accuracy for turning and milling mating parts.

c)Able to follow the inspection specifications for mechanical components, complete the self inspection form for machined parts, and correctly classify, store, and label qualified and unqualified products.

d) Able to use commonly used assembly tools to complete the assembly and adjustment of turning and milling mating parts according to the assembly process requirements of turning and milling mating parts.

2. Comprehensive Practice of Programming and Processing for CNC Milling (Machining Center) (48 Hours.)

2.1 CNC programming

Capable of working according to task requirements and CNC programmingManual, using manual programming or CAD/CAM softwareComplete the simulation verification of turning parts processing.

2.2 CNC machining of planar three-dimensional parts

a)Able to dress neatly and properly according to the safety and civilized production system, use safety protective equipment correctly, and meet the requirements of safety and civilized production.

b)Able to select CNC machining tools, measuring tools, and fixtures for milling workpieces according to the requirements of mechanical processing process documents.

c) Able to use CNC milling machine universal fixtures to complete the installation and clamping of workpieces according to the requirements of the CNC milling machine operation manual and mechanical processing process documents.

d) Be able to follow the CNC milling machine operation manual, follow the safety operating procedures of the CNC milling machine, use tool installation tools, and complete tool installation and adjustment.

e)Be able to follow the operating procedures of CNC milling machines and use the electrical switches of CNC machine tools to start and stop the CNC machine tool.

f)According to the CNC milling machine operation manual, use the CNC milling machine operation panel to complete basic operations such as working mode switching, feed rate setting, and spindle speed adjustment.

g)Able to input and edit CNC machining programs using panel input or program transfer methods according to the requirements of the CNC milling machine operation manual and mechanical machining process documents.

h)Able to use cutting tools and measuring tools according to the requirements of the CNC milling machine operation manual and mechanical processing process documents to complete the tool alignment of the CNC machine tool.

i)Able to use mechanical processing accuracy control methods according to the requirements of mechanical processing process documents, have quality awareness, and complete milling of parts with features such as protrusions, inner grooves, fixed holes, etc

CNC machining and meeting the following requirements:

Dimensional tolerance level: IT8

Geometric tolerance level: IT8

Surface roughness: Ra3.2 μ M

2.3 Part accuracy testing

a) Be able to calibrate Vernier scale, micrometer, dial indicator, dial indicator, universal angle gauge and other measuring tools.

b)Able to follow the requirements of part drawings and machining process documents Request the use of corresponding measuring tools or instruments to complete the inspection of the machining accuracy of turning and milling mating parts.

c) Able to follow the inspection specifications for mechanical components, complete the self inspection form for machined parts, and correctly classify, store, and label qualified and unqualified products.

d)Able to use commonly used assembly tools to complete the assembly and adjustment of turning and milling mating parts according to the assembly process requirements of turning and milling mating parts.

MTRC-383   MECHANICAL AND ELECTRICAL COMPREHENSIVE TRAINING

Total Contact Hours 160   **T**   **P**   **C**
Theory Hours: **64**   **2**   **3**   **3**
Practical: **96**

Aims
1.   ☐Ability to use a variety of common electrical tools proficiently
2.   ☐Master sensing detection and application technology
3.   ☐Master the use of commonly used electrical instruments and meters
4.   ☐Be proficient in wiring and wiring of control circuits
5.   ☐Master the basic analysis methods of all kinds of motor control circuits and the operation and troubleshooting methods of typical machine tool circuits
6.   ☐Master PLC control program design, writing and debugging methods
7.   ☐Master frequency converter installation, parameter setting and modification operation
8.   ☐Master sensing detection and application technology

COURSE CONTENTS

1.Innovative design of mechanical and electrical products   16 Hours

1.1 Research the enterprise engineering project and complete the proposal report.
1.2 According to the selected topic to complete the product design and production. The design is required to be specific and complete, with a complete total assembly effect drawing or physical photos.
1.3 In the part of product structure design, each part is required to have a complete three-part modeling diagram or physical photos, and the electrical control part is required to have a complete electrical control wiring diagram and control program.
1.4 After the design is completed, it is required to sort out the product design specification and print it for submission.

2. Installation and commissioning of gas-liquid control system   16 Hours
2.1 PLC, liquid pressure synchronous operation control experiment;
2.2 PLC, hydraulic/pneumatic interlock operation control experiment;
2.3 PLC, stroke switch cylinder/cylinder speed change circuit experiment;
2.4 PLC, hydraulic/pneumatic multi-cylinder motion control experiment;
2.5 PLC, hydraulic/air pressure safety protection control experiment.

3. Small automated production line (MECLAB) practical training   16 Hours
3.1 Siemens 1200PLC programming;
3.2 Innovative design of different production lines, and installation and commissioning.

4. Industrial robot workstation system integration   16 Hours
4.1 Industrial robot handling workstation system integration;
4.2 Industrial robot welding workstation system integration;
4.3 industrial robot loading and unloading workstation system integration.

INSTRUCTIONAL OBJECTIVES

1.Innovative design of mechanical and electrical products

1.1Understand the current status of mechanical and electrical products

1.2 Have methods for data collection, sorting out, formulation and implementation of work plans

1.3 Master the method of three-dimensional composition of mechanical products

1.4 Master electrical circuit design, wiring, PLC programming methods

1.5 Master the writing method of proposal report and design specification

2. Installation and debugging of gas-liquid control system

2.1 Understand the working mechanism and characteristics of the control object;

2.2 Be able to select control equipment (technical performance index) according to control requirements;

2.3 Master the basic methods of hardware connection, installation and debugging of the system;

2.4 Master the compilation methods of typical control programs to achieve basic control functions.

3. Small automatic production line (MECLAB) training

3.1 Able to apply Siemens S7-1200 PLC programming, wiring and debugging;

3.2 Be able to transmit PLC control system program;

3.3 Be able to use electrical tools and instruments correctly;

3.4 Innovative design of different production lines, and installation and commissioning.

4. Industrial robot workstation system integration

4.1 Be able to select industrial robots and peripherals of workstations;

4.2 Be able to design the interface circuit and control program of industrial robot and peripheral equipment.

LIST OF PRACTICAL

1. Innovative design of mechanical and electrical products   (24 Hours.)

2. Installation and commissioning of gas-liquid control system   (24 Hours.)

3. Small automatic Production line (MECLAB) training   (24 Hours.)

4. Industrial robot workstation system integration   (24 Hours.)

MTRC-392 Project

Total Contact (Hours): 192   **T   P   C**
Theory(Hours):   0   0   6   2
Practical(Hours):   192

Aims
1.   ☐Train students to comprehensively apply the theoretical knowledge and skills they have learned, select the equipment they choose, and cultivate their ability to analyze and solve problems.
2.   ☐Cultivate students' global, production, and economic concepts necessary for equipment selection and design, establish correct design concepts and a serious and serious work style.
3.   ☐Cultivate students' ability to conduct research, access technical literature, materials, manuals, conduct engineering calculations, draw drawings, and write technical documents.
4.   ☐Independently complete the graduation project without plagiarism. If there are any similarities, the graduation project score will be cancelled.

COURSE CONTENTS

1.FAMILIAR WITH THE TOPIC   8 HOURS
After the design task book is issued, students should first investigate and research, determine the name of the project, and clarify the design ideas. Students of the same topic should choose different mines and different raw materials for selection and design.

2.COLLECTING DATA AND CONDUCTING FACTORY INTERNSHIPS 8 HOURS
Collect relevant Chinese and foreign materials around the topic, consult relevant data and technical documents, or go to the site to understand the actual usage situation.

3.DETERMINE THE DESIGN PLAN   16 HOURS
After having a thorough understanding of this topic, propose several solutions (structural or control solutions) to solve the problem, and conduct a detailed analysis of the solutions, proposing advantages, disadvantages, and implementation possibilities.
4. Finally, compare and summarize each plan, and select the best plan based on actual conditions. When quantitative analysis of the plan is required. To conduct initial calculations (or group division of labor), obtain estimates of technical and economic data, and then determine the best plan based on multiple plans.

5.   DESIGN CONTENT (TAKING THE DESIGN OF MINE HOISTING SYSTEM AS AN EXAMPLE) 60 HOURS
Overview of the mining area (improvement status, mining level, geological 60Hours
 characteristics, mine reserves, production capacity, service life, and work system, etc.).
Factors to consider and selection principles
When a mine simultaneously mines multiple types of coal and requires different types of coal to be transported separately, cage should be considered as the lifting container;

☐When there is a high requirement for the lump size of coal, cage should be considered as the main lifting equipment;

☐A mine with horizontal mining often adopts a double container lifting system, while a mine with multiple horizontal mining should adopt a single container and balance weight lifting system;

☐For vertical shaft mining, single rope winding lifting equipment is generally used. For mines with a capacity of over 600000 tons or mines with a depth exceeding 350 meters, multi rope friction lifting equipment is considered;

☐If the mine is divided into two levels for mining, the hoist and mast should be selected based on the final level. The lifting container, wire rope, and motor can be selected based on the first level first, and then replaced later.

Selection and calculation of transportation equipment for main transportation alleys

☐Calculate and select the lifting container;

☐Calculate and select the lifting wire rope;

☐Calculate the diameter of the drum and select the elevator;

☐Calculate the diameter of the crown wheel and select the crown wheel;

☐Calculation of the relative position between the hoist and the wellbore;

☐Verification calculation of motor power;

☐Calculate the electricity consumption and efficiency per ton of coal (for main shaft lifting);

☐Develop a maximum shift operation time balance table (for auxiliary well lifting)

6. DRAW A PATTERN 40 HOURS

Determine the overall layout, draw a sketch of the improvement system, and after being reviewed and approved by the guidance teacher, proceed to draw a formal diagram, annotate the dimensions and technical requirements according to the specified requirements, and then assemble and design the overall diagram.

7. WRITE INSTRUCTIONS 40 HOURS

☐Table of Contents and Preface: The preface mainly provides a brief overview of this design.

☐Design Introduction: The design content and requirements, as well as the principles and methods of design, should be briefly described, and the text should be concise.

☐Scheme determination and design. This includes an explanation of the overall plan and its principles, as well as the physical design of the plan (such as structural diagrams, tables, calculation formulas and data for each part, literature selection, etc.).

☐References: Indicate the name, author, publishing unit, etc. of the materials referenced in the design.

☐Design reflections or design summaries.

8. COPYING DESIGN INSTRUCTIONS 10 HOURS

After the draft of the instruction manual is written, it should be submitted to the guidance teacher for review, and then students should transcribe it according to the prescribed design instruction format. All design instructions are printed using computers, and after being signed by the guidance teacher, they are bound together with the graduation design task book into a volume.

9. PREPARE FOR DEFENSE 10 HOURS

The graduation project defense is an important teaching link that must be completed for the goals of engineering majors, and an important process of cultivating students' independent thinking and scientific work methods.

Suggested Fields
Renewable Energy
Environment
Construction
Transport
Robotics
Industrial Automation& Machinery
Telecommunication
Electric Power
Medicine & Health
Nanotechnology
Chemical & Petro-Chemical
Oil & Gas

RECOMMENDED BOOKS

1. Design Manual for Coal Mine Hoisting published by Coal Industry Press
2. Mechanical Design Manual published by Coal Industry Press
3. Machine element Design Manual, published by Coal Industry Press
4. Coal Mine Safety Regulations published by Coal Industry Press
5. Selection Manual for Complete Equipment of Coal Mine Mechanization published by Coal Industry Press
6. Fixed Machinery and Transportation Equipment published by Coal Industry Press
7. Mine Hoisting and Transportation Equipment published by Coal Industry Press

PROJECT
INSTRUCTIONAL OBJECTIVES

1. KNOWLEDGE OBJECTIVES

1.1 Train students to comprehensively apply the theoretical knowledge and skills they have learned, select the equipment they choose, and cultivate their ability to analyze and solve problems.1.2 Analyze the processing possibilities and key content, select processing methods and equipment, design process, determine cutting parameters, etc;
1.2 Cultivate students' ability to conduct research, access technical literature, materials, manuals, conduct engineering calculations, draw drawings, and write technical documents.

2. CAPABILITY OBJECTIVES

2.1 Cultivate students' historical thinking, dialectical thinking, Systems thinking and innovative thinking;
2.2 Having a sense of responsibility, innovation, and teamwork;
2.3 Having the ability to independently collect and process information is a necessary skill in the information age, which also lays the foundation for students' self-reliance and self-directed learning in the future;
2.3 Develop a study habit of being good at cooperation, diligent in thinking, seeking truth and practicality, actively practicing, and being serious and meticulous.

MINIMUM QUALIFICATIONS OF TEACHER/ INSTRUCTOR

For Technical Subjects

i) B.Sc. /BE degree in Engineering (Mechatronics Mechanical / Electronics/ Electrical/) preferably with minimum of 1 years Industrial/ Teaching experience in the related field

ii) B.Sc/ B.S.Tech. in relevant Technology Mechatronics / Mechanical / Electronics/ Electrical/

iii) MSc. / Ph.D degree in disciplines related to Mechanical/Electronics/Electrical/ Mechatronics & Control/Automation Systems Engineering

iv) DAE in Automation / Mechatronics/Mechanical'/Electronics/ Instrumentation with 3→4-yearsIndustrial/ Teaching experience in the related field

Note:- Purely, Mechatronics related degree qualification will be preferred, being most relevant.

For Subjects pertaining to Humanities / Related Studies /Management

i) MA degree in English/ Islamiat / Pst. with 2 years of teaching experience

ii) M.Sc. degree in IT / Computer Sciences or BE in Computer Engineering with 2-years of teaching experience

iii) M.Sc. degree in Mathematics with 2-years of teaching experience

iv) M.Sc. degree in Physics / Chemistry with 2-years of teaching experience

v) MBA degree with 2-years of teaching experience

PROGRESSION ROUTE FOR EMPLOYMENT / CAREER

The students holding DAE qualifications in Mechatronics can seek employment in firms/companies/industry dealing in any of the following Areas / Sectors:

Mechanical, Electrical, Electronics, Computer & Controls Engineering	Industrial Automation and Controls
Electromechanical systems	Digital and Embedded Systems
Industrial robots / Robotics	Instrumentation
Medical devices	Programming or Control Networks
Aircraft simulators, Aircraft & Space craft manufacturing	Control and Network System / Control System Integration
Automated assembly lines	Innovative Product Development
Building control systems,	Embedded Systems Development
Automated vehicles	Food & Beverage
Construction & Cement sector	PLC based Automated system

Starting with Supervisory position, the vertical mobility for this qualification holders is shown below:

i. *Asstt. Technician*
ii. *Technician*
iii. *Senior Technician*
iv. *Supervisor*
OR
i. *Skilled Mechanic*
ii. *Charge man*
iii. *Foreman*
iv. *Principal Foreman*

- This pass-out graduate may also get job opportunity of teacher / instructor in TVET sector as Junior Instructor with vertical mobility upto Senior Instructor.

- They may be employed for installation, operation, repairing & maintenance jobs pertaining to industrial automation / mechatronic systems. There are always positions available for sales & marketing of parts, devices and systems pertaining to M&IA and Electro-Mechanical product

Curriculum Development Committee

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