GOVERNMENT OF KERALA
DEPARTMENT OF TECHNICAL EDUCATION

CURRICULUM DEVELOPMENT CENTRE
KALAMASSERY

CURRICULUM OF
DIPLOMA COURSE

IN

MECHANICAL ENGINEERING

SEMESTER SYSTEM
(Revision 2006)

Prepared at

CURRICULUM DEVELOPMENT CENTRE, KALAMASSERY

RULES AND REGULATIONSOF THE DIPLOMA COURSES IN ENGINEERING/TECHNOLOGY/COMMERCIAL PRACTICE UNDER THE STATE BOARD OF TECHNICAL EDUCATION, KERALA STATE. (SEMESTER SYSTEM)

01. Duration of the Diploma Course

The duration of the regular Diploma courses will be of three academic years, consisting of Six (6) consecutive semesters. The first 2 Semesters are combined and run on an year pattern, and called "Combined First and Second Semesters".

02. Medium of Instruction

The medium of instruction in all the theory and practical subjects shall be English.

03. Eligibility for Selection to the Diploma Course

Candidates for admission shall be required to have passed X^{th} class examination (S.S.L.C.) conducted by the Board of Public Examinations, Kerala State or any other equivalent examinations already recognized by the Board of Public Examinations, of Kerala State, with the eligibility for Higher Education.

04. Instructional duration in an academic year

a) The academic year shall consist of 2 Semesters, each consisting of a minimum of 16 weeks of instruction, including intervening holidays, but excluding the period of examinations and study holidays.

b) The course will follow Semester pattern, with an End semester examinations, conducted by the Board of Technical Examinations, Kerala State. The examinations for first year (Semester I & II Combined) will be conducted at the end of second semester.

c) There will be 7 Instructional periods of 55 Minutes duration per Day, and there shall be 5 working days in a week from Monday to Friday, and thereby 35 Periods per Week.

05. Minimum attendance required for obtaining eligibility to appear for the Examination.

a) A candidate must secure a minimum of 80% attendance in the combined First and Second Semester and in each subsequent Semester, in order to secure the eligibility to appear for each End Semester examinations.

b) In the case of those students with 65% or more attendance but could not attain 80% attendance due to Medical reasons, the Principal of the Polytechnic, at his/her discretion, may grant the eligibility to appear for the examination, subject to the remittance of "Condonation fee", fixed by the Government from time to time.

c) Students who have secured less than 65% attendance are not eligible to apply for "condonation", and will not be allowed to appear for the examination under any circumstances.

d) Students who have shortage of attendance, but not condoned, in any of the semesters including first year, are not eligible to appear for the end Semester Examinations, and therefore not eligible to be promoted to the higher semesters. They may seek readmission. Application for readmission may be entertained only for genuine cases on medical grounds and in doubtful cases the Principal may seek report from medical board for verification.

e) Condonation of attendance is permitted only once in the entire course of study both in the case of regular and part time courses.

06. Scheme of Evaluation.

a) The scheme of evaluation shall consist of (1) Internal assessment (Sessional) and (2) End Semester examinations in Theory and Practical Subjects. The maximum marks for End Semester Examinations, and Internal Assessment, both for the Theory and Practical papers will be 75 and 25 respectively except for the Combined I & II Semesters. However, for some exceptional subjects, this may vary. Details of break up of marks are given in the Curricula of each discipline.

b) The Total marks (Internal and End Semester Examinations) will be as follows:

Combined I &II Semesters: 1000 Marks

III to VI Semesters: 700 Marks/ Semester

c) All the end examination including the drawing examination will normally be of 180 Minutes duration. In certain specialized disciplines this requirement may not be adhered to strictly and the End Semester Examination of a longer duration may be permitted.

07. Award of internal assessment marks.

a) In respect of theory subjects the award of sessional mark will be on a Continuous Evaluation method, based on tests, assignments and attendance in the proportion of 40% for tests, 40% for assignments and 20% for attendance. There will be a minimum of three tests and Three Assignments, and all the 3 Test papers and 3 Assignments are taken into account for the calculation of Final Internal Assessment Marks.

b) Split up of Internal Assessment Marks :

A. Attendance:

Sl.No.	Percentage of Attendance*	Marks to be awarded (computed for 5 Marks)
1	Below 65	Zero
2	65 to 79	1
3	80 to 84	2
4	85 to 89	3
5	90 to 94	4
6	95 and above	5

B. Practical:

Sl.No.	Criteria component	Marks to be awarded
1	Observation Note/ Rough Record	20%
2	Fair Record (Timely submission, Accuracy and Neatness)	20%
3	Attendance*	20%
4	Test	40%

C. Drawing

Sl.No.	Criteria component	Marks to be awarded
1	Submission of Completed Drawing Sheets (Timely submission, Accuracy and Neatness)	40%
2	Attendance*	20%
3	Test	40%

*Percentage of attendance for that particular subject only is counted here.

D. Seminar

Sl. No.	Criteria component	Marks to be awarded
1	Relevance of Topic	10%
2	Collection of materials	20%
3	Presentation (Presentation slides, Delivery)	40%
4	Question-Answer,/Discussion	20%
5	Seminar Report	10%

E. Project Work

Sl. No.	Criteria component	Marks to be awarded
1	Relevance of Topic & Selection of	10%
2	Knowledge in the Tool	20%
3	Selection of Tool	20%
4	Fabrication & Final product	20%
4	Role of the individual in the Team	20%
5	Project Report	10%

c) The Faculty concerned will maintain a record of all details regarding Attendance and Internal Assessment marks awarded in the prescribed log book. The students can represent their grievances, if any, in respect of marks awarded, to the concerned Head of Section for clarification.

d) The students are required to keep a record of all their laboratory exercises performed by them in the form of a laboratory record. This record has to be authenticated by the teacher-in-charge of the laboratory and certified as the record of the bonafide work done by the student by the Head of Section before he is allowed to take the practical examinations. No student will be permitted to take any practical examinations without the bonafide Record.

08. End Examination

a) In each theory subject and in the drawing subject there will be an end examination in each Semester conducted by the Board of Technical Examination, Kerala State as per the pre-announced notification of examinations. The Timetable for the examination will also be informed to the students ahead of their conduct.

b) Regular/Supplementary examination for all semesters will be held at the end of each semester as the case may be.

c) The question paper for each Theory paper (excluding the Drawing papers) will consist of Two parts:

Part A – is for a maximum of 15 marks consisting of 10 short answer type questions of 1 ½ (One and a half) marks each (to be answered in one or two sentences) covering the whole subjects area. There will be no choice in Part A.

Part B – consists of 10 structured essay type questions of 12 marks each with two question from each of the five units in a subject. Students will have to attempt one question from each unit to score the prescribed maximum of 60 marks.

The part A and Part B will be given together in one question paper.

d) For drawing subjects, the design of question paper will be according to the needs of that particular drawing. There will not be any short answer type question in drawing.

e) For practical end examinations, the Board of Technical Examination, Kerala State will appoint examiners who will set a question paper consisting of practical exercises. This will be used for that practical subject.

09. Minimum marks for a pass

a) A candidate must secure a minimum of 40% marks in the End Semester examination in Theory and Practical for a Pass in each subject. There will be no separate minimum for a pass in the internal assessment but the total marks of End Semester examination and Internal assessment should not be less than 40% for a pass each subject.

10. Rules for promotion to the Higher Semesters.

a) A candidate will be allowed to go to the next higher Semester, if he/she attended the Combined I & II Semester/ Previous Semester, and has fulfilled the conditions of attendance requirement. However,

b) A candidate will be permitted to register for the Fifth Semester Examination if and only if he/she has passed all the subjects of the Combined I & II Semester, and

c) A candidate will be permitted to register for the Sixth Semester Examination only if he/she has passed all the subjects of Combined I & II, and III Semesters.

11. Classification of successful candidates

a) Candidates shall be declared to have passed the diploma course only if he/she has secured a Pass in all the theory and practical subjects in all the Six Semesters of study.

b) There will be 3 classifications of passed candidates namely.

First class with distinction

First class and

Second class

c) The total marks of the Semesters from 3 to 6 shall be considered to classify the successful candidates. That is all these marks will be added and the percentage of marks out of 2800 worked out.

First Class with Distinction

A candidate will be declared to have passed the Diploma Course in First Class with Distinction if he/she secures not less than 75% of the aggregate marks in all Semesters put together except First Year (Combined I & II Semesters) and passes all the above semesters including the Combined I & II Semesters in the first appearance itself, within the stipulated period of normal study, i.e., Three Years of Six Consecutive Semesters, without any break.

First Class

A candidate will be declared to have passed the Diploma Course in First Class if he/she secures not less than 60% of the aggregate marks in all Semesters put together except First Year (Combined I & II Semesters) and passes all the above semesters including the Combined I & II Semesters, within three consecutive chances including his regular chance offered by the Board of Technical Examination.

Second Class

All other successful candidates will be declared to have passed in the Second Class

12. Provision for Improvement/Betterment:

a). A candidate, if he desires, may improve his/her marks in any subject, in the immediate chance that follow his regular chance/attempt, in the 3rd, 4th and 5th Semesters. A "regular attempt/chance" is defined as the examination chance of the current semester of his/her study.

b) A candidate, if he/she desires, will be permitted to better his/her marks of the 6th Semester Subjects by reappearing for the entire subjects of that semester together, by taking the next available chance only. (Betterment can be done only for the 6th Semester)

c) Improvement/betterment will not be reckoned as another chance/attempt. Candidates appearing for betterment will not be considered for the purpose of ranking.

13. **Award of Rank**: Rank Holder in each Discipline will be selected from among the successful candidates who have passed the Diploma course in "FIRST CLASS WITH DISTINCTION" only. "Grace mark" awarded for the performance in arts/sports/similar extra or co- curricular

activities will not be considered for determining the rank holders subject to rules 11 and 12 above.

14. Maximum duration of the Diploma Course:

Normal duration of the diploma course is 6 consecutive Semesters, spanned in 3 Academic Years, as stated in para 01. However, in the case of those who have not acquired Diploma within the stipulated minimum duration of 3 Years, he/she may acquire the Diploma taking a maximum duration of another 3 Years. However, the maximum number of chances to appear for the End Semester examination is limited to 4, including his/her regular chance.

15. Cancellation of Candidature in the Diploma Examination:

If a candidate desires to cancel his candidature for end semester Examination he/she should forward the duly filled in Application Form, recommended by the Principal of the Polytechnics so as to reach the office of the Controller of Technical Examinations within 10 days after the completion of the last theory Examination of that particular Semester examination. For those who have applied for the examination and absent without canceling their candidature, it will be treated as an attempt/ chance. Cancellation of candidature in any Semester Examination is allowed only once. Candidates reported for malpractice will not be eligible for cancellation of examination.

16. Defaulters of fee:

Defaulters of fee will not be permitted to register for the End Semester examination

17. General Information:

Norms for transfer of students:

a) Application for transfer from one institution to another will be entertained only at the second year (3rd Semester) of the Diploma course. Candidates who desire to get transfer to another institution in the second year (3rd Semester) should submit the application in the prescribed "format for transfer" to the Principal of the Institution to which transfer is requested, through the Principal of the institution where the candidate is studying within 10 days from the date of re-opening of the institution after midsummer vacation.

b) All applications received with in the stipulated time will be processed and the list of candidates selected for transfer on the basis of the index marks secured by the candidates for admission to Polytechnics to the first year (Combined I and II semester)will be published by the concerned principals of the polytechnics to which transfer is requested for, and the selected candidates will be informed accordingly.

c) Principals of Polytechnics should intimate the names of candidates transferred with branch of study to other institution to the Joint Controller of Technical examinations with details such as name of institutions to which transferred, date of transfer, and Diploma Examinations Register Number within ten days from the last date of admission.

SUBJECTS OF STUDY AND SCHEME OF EVALUATION

Branch: Mechanical

First Year (Semesters I & II Combined)

CODE	SUBJECT	Periods Per Week			Evaluation (Marks)			
		Theory	Practical	Total	Theory	Practical	Internal	Total
	THEORY:							
GE 101	English	4	-----	4	100	----	25	125
GE 102	Technical Mathematics	6	-----	6	100	----	25	125
GE 103	Applied Science							
A	Physics	3	----	3	50	----	12.5	62.5
B	Chemistry	3	-----	3	50	----	12.5	62.5
GE 104	Engineering Graphics	1	3	4	100	-----	50	150
GE 105	Computer Fundamentals & Programming in C	2	1	3	100	----	25	125
ME 101	Material Science & Processes	4	-----	4	100	----	25	125
	PRACTICAL:							
GE 106	Applied Science Lab							
A B	Physics Chemistry		2	2		50	25	75
ME 102	W/S Practice	----	6	6		100	50	150
TOTAL		**23**	**12**	**35**	**600**	**150**	**250**	**1000**

SUBJECT TITLE	**:**	**ENGLISH**
SUBJECT CODE	**:**	**GE 101**
PERIODS PER WEEK	**:**	**4**
PERIODS PER YEAR	**:**	**128**
TOTAL MARKS	**:**	**100 (YEARLY EXAMINATION FOR I AND II SEMESTERS)**

TIME SCHEDULE

UNIT	TOPICS		PERIODS
I	a)	Lessons – From Ignited minds	
		The dream and the message	10
		Give us a role model	10
II	a)	Lessons – From Ignited minds	
		Visionary teachers and scientists	15
III	a)	Phonetics and Grammar Introducing speech sounds Consonants, Vowels, Syllables, Stress etc. Tense, Nouns, Verbs, Articles, Active voice and Passive voice Prepositions, Adverbs, Auxiliaries, Direct and Indirect Speech Formation of Questions & Question tags	29
IV	a)	Lessons – from Ignited minds	
		Learning from Saints & Seers	15
		Patriotism Beyond Politics and Religion	15
		To My Country Men	5
		Epilogue	5
V	a)	Composition Essay writing Comprehension Precise writing Note making Application for Jobs Preparation of bio – data	24
		Total Periods	**128**

AIM :

The special needs of the technical students in English language require a curriculum that enables them to handle the language as an effective tool for communication. An integration of the four – fold language abilities namely listening, speaking, reading and writing aims at developing the ability to correctly and effectively use the language for specific technical requirements. Thus the teaching of English language to Technical students will definitely help them for their performance in their professional needs.

OBJECTIVES :

1. Comprehension

1.1 Discriminate words and derive ideas in a speech/writing

1.2 Express the main ideas in a summary

1.3 Organise logically the piece of information provided.

1.4 Comprehend written English available in the prescribed text.

2. Vocabulary

2.1 Identify the key words

2.2 Relate the correct meaning to the terms used

2.3 Extend the vocabulary

2.4 Use a thesaurus

2.5 Study the arrangement of words in sentences

2.6 Identify the structural functions of words in sentences.

3. Grammar

3.1 Use of tense forms

3.2 Nouns, Verbs, Articles

3.3 Identify sentence types

3.4 Analyse the different types of sentences

3.5 Study the ways of negation

3.6 Convert direct speech into Indirect speech

3.7 Realise active and Passive Voice constructions.

4. Composition

4.1 Practice writing essays, précis, note making

4.2 Preparation of Application for Jobs and Bio – data

5. Spoken Communication

5.1 Distinguish between formal and informal speech situations

5.2 Simulate model conversations

5.3 Converse within the peer group

5.4 Conduct seminars on topics learned in the text.

5.5 Conduct model Interviews

5.6 Arrange group discussions on General topics

6. Pronunciation

6.1 Introduce speech sounds

6.2 Consonants, Vowels, Syllables, Stress etc.

6.3 Find out pronunciation of words from dictionary

6.4 Transcribe words and short passages in broad phonemic script

STUDY MATERIALS

1. Ignited Minds by A.P.J. Abdul Kalam Published by Penguin Books
   Chapters : The Dream and the message, Give us a role model, Visionary teachers and scientists. Learning from Saints and seers, Patriotism beyond politics and religion, To my country men, Epilogue.
2. Essential English Grammar by Raymond Murphy Published by Cambridge University Press.
3. Intermediate English Grammar by Raymond Murphy published by Cambridge University Press.
4. Phonetics – A Text Book of English Phonetics for Indian Students by T. Balasubramaniam Published by Macmillan India (P) Ltd.
5. Composition – A Text Book of Two way Communication Techniques by Prof. P.P. John Published by Publication Division, University of Calicut.
6. English Pronouncing dictionary by Daniel Jones Published by Cambridge University Press.

SCHEME FOR SETTING QUESTION PAPERS

TOTAL MARKS : 100
DURATION 3 HOURS

I	Short answer questions	7 Numbers	Answer any 5	(5X2)	10 marks
II	Paragraph questions	7 Numbers	Answer any 4	(4X5)	20 marks
III	Essay questions	3 Numbers	Answer any 1	(1X10)	10 marks
IV	Grammar				30 marks
V	Phonetics				10 marks
VI	Composition				20 marks
				Total	100 marks

SUBJECT TITLE : TECHNICAL MATHEMATICS
SUBJECT CODE : GE 102
PERIODS/WEEK : 6
TOTAL PERIODS : 6 x 32 = 192

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I	1.1 Matrices	8
	1.2 Determinants	6
	1.3 Binomial Series	6
	1.4 Trigonometric Functions	8
	Tutorials	4
	Test on Topics 1.1 to 1.4	3
II	2.1 Properties of Trigonometric functions	7
	2.2 Properties of triangles	6
	2.3 Solutions of a triangle	7
	2.4 Co-ordinate Geometry	8
	Tutorials	4
	Test on Topics 2.1 to 2.4	3
III	3.1 Functions and Limits	8
	3.2 Methods of Differentiation – I	10
	3.3 Methods of Differentiation – II	10
	Tutorials	4
	Test on Topics 3.1 to 3.3	3
IV	4.1 Application of differentiation	10
	4.2 Maxima and minima	8
	4.3 Indefinite Integral	10
	Tutorials	4
	Test on Topics 4.1 to 4.3	3
V	5.1 Integration by parts	6
	5.2 Definite Integral	6
	5.3 Application of integration	8
	5.4 Differential Equations	8
	Tutorials	4
	Test on Topics 5.1 to 5.4	3
	Revision	10
	Model test and feed back	7

		192

OBJECTIVES

On completion of the units, the student will be able to

UNIT – I

1.1 Matrices

1.1.0 Understand operations on matrices such as addition, subtraction, transpose, adjoint, inverse and multiplication

1.1.1 Define a matrix

1.1.2 Identify the type of a given matrix (Square, Unit, Singular etc)

1.1.3 Perform operations of addition and multiplication of a given matrix

1.1.4 Define – transpose, adjoint and inverse of a matrix

1.1.5 Find the inverse of 2 x 2 and 3 x 3 matrices

1.1.6 Solve linear equations by using the inverse of the coefficient matrix

1.2 Determinants

1.2.0 Solve simultaneous linear equations using determinants

1.2.1 Evaluate determinants of second and third order

1.2.3 Find the minors and cofactors of the elements in a determinant

1.2.4 Solve simultaneous linear equations in 3 unknowns using Cramer's rule.

1.2.5 Elimination of three linear equations in to unkowns.

1.3 Binomial series

1.3.0 Understand the binomial theorem for positive integers

1.3.1 State the meaning of nC_r

1.3.2 Derive formula for nCr and the proof of $nC_r = nC_{n-r}$

1.3.3 State the Binomial theorem for positive integers

1.3.4 Find a given term in a binomial expansion

1.4 Trigonometric functions

1.4.0 Understand the concept of trigonometric functions of any angle

1.4.1 Define trigonometric functions

1.4.2 Describe signs of trigonometric functions in each quadrant

1.4.3 Find other functions, given a trigonometric function and its quadrant

1.4.4 Find the trigonometric values of the angle between 0˚ and 360˚.

1.4.5 Find the value of trigonometric functions by using tables.

UNIT – II

2.1 Properties of Trigonometric Functions

2.1.0 Apply properties of trigonometric functions of compound angles, multiple and submultiple, sum and product formulae

2.1.1 State the identities for sin (A± B), cos (A± B), tan (A ±B).

2.1.2 Solve the problems of the types

(1) Prove that $\frac{\text{Cos A - Sin A}}{\text{Cos A + Sin A}} = \tan(45^\circ - A)$

2.1.3 Prove the formulas for Sin 2A, Cos 2A, tan 2A, Sin 3A and Cos 3A

2.1.4 State the identities for SinA, CosA, tanA in terms of A/2.

2.1.5 Solve the problems of the type: if Sin A = 0.6 and A is acute, find sin 2A and cos A/2

2.1.6 Express sum or difference of two sines or two cosines as a product and vice versa.

2.1.7 Apply sum and product formulae to do the problems of the type

(1) $\frac{\text{Sin A + Sin 3A+ Sin 5A}}{\text{Cos A+Cos 3A+ Cos 5A}} = \tan 3A$

(2) $\text{Sin } 10^\circ \text{ Sin } 50^\circ \text{ Sin } 70^\circ = 1/8$

2.2 Properties of Triangles

2.2.0 Understand the properties of triangles

2.2.1 State and prove the following identities

1) $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = 2R$

2) $a^2 = b^2+c^2-2bc \cos A$

3) $a = b \cos C + c \cos B$

2.2.2 State and prove

1) Napier's formula

$$\tan\left(\frac{B-C}{2}\right) = \frac{b-c}{b+c} \cot(A/2)$$

2) $(b-c)\cos(A/2) = a \sin\left(\frac{B-C}{2}\right)$

2.3 Solution of triangles

2.3.0 Solve a triangle given necessary data

2.3.1 Solve a triangle, given

1) Three sides

2) Two sides and the included angle by using Napier's formula.

2.4 Co-ordinate Geometry

2.4.0 Understand various forms of the equation of a straight line

2.4.1 Define slope of a straight line

2.4.2 Find the slope of a line joining two points (x_1,y_1) and (x_2,y_2)

2.4.3 Derive the equation of a straight line of the form

1) $y = mx + c$

2) $y-y_1 = m(x-x_1)$

3) $\frac{y-y_1}{y_1-y_2} = \frac{x-x_1}{x_1-x_2}$

4) $\frac{x}{a} + \frac{y}{b} = 1$

2.4.4 Find the equation of a line given suitable data using any of the above form.

2.4.5 Find the slope and intercepts on the axes, given a linear equation in 'x' and 'y'.

2.4.6 Find the point of intersection of two lines whose equations are given

2.4.7 Find the angle between two lines

2.4.8 Find the condition for two lines are

1) Parallel

2) Perpendicular

2.4.9 Find the equation of the line

1) Parallel and

2) Perpendicular to a given line and passing through a given point.

UNIT – III

3.1 Functions and Limits

3.1.0 Understand the concepts of functions and limits

3.1.1 Give example for functions

3.1.2 Explain the meaning of limit of the following type

1) $f(x) = l$ as $x \to a$

2) $\lim_{x \to \alpha} 1/x = 0$

3.1.3 Find the limit of the following type

1) $\lim_{x \to 1} \frac{2x + 1}{3x - 2}$

2) $\lim_{x \to \alpha} \frac{2x^2 + 3x}{5x^2 + 4x + 1}$

3) limit $\frac{x^2 - 3x}{x^2 - 9}$ as $x \to 3$

3.1.4 verify the following results

1) limit $\frac{x^n - a^n}{x - a} = n a^{n-1}$, when n is rational as $x \to a$

2) limit $\frac{\text{Sin } ø}{ø} = 1$, is in radian as $ø \to 0$

3.1.5 Solve problems of the type

1) Limit $\frac{\sqrt{x} - \sqrt{a}}{x - a}$ as $x \to a$

2) limit $\frac{\text{Sin } mø}{ø}$ as $ø \to 0$

3.1.6 Describe the general definition of continuous functions

3.2 Methods of Differentiation – I

3.2.0 Apply the methods of differentiation

3.2.1 Define the derivative of a function $y = f(x)$ as $\lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x}$

3.2.2 Show the geometrical concept of derivatives

3.2.3 Find the derivatives of x^n, Sinx, and Cosx from first principles

3.2.4 State the rules of differentiation

1) Sum or difference

2) Product

3) Quotient

3.2.5 Find derivatives of e^x and log n. State all the fundamental formulae

3.2.6 Apply the rules and differentiate simple functions of the type

1) $x^2 \sec x$

2) $\frac{\tan x}{x^2 + 1}$

3) $\frac{x \text{ Cosec } x}{3x - 2}$

3.3 Methods of Differentiation – II

3.3.0 Apply different methods of differentiation

3.3.1 Find the derivatives if the functions of the form $[f(x)]^n$, Sin f(x), Cos f(x), with respect to x.

3.3.2 Find the derivatives of

$e^{\text{Sin}x}$, log sinx, $(x^2+1)^{10}$ Sec5x, $\frac{\text{Sin } 2x}{1+\cos 2x}$, $\text{Cot}^5 (x^3)$, log (sec x + tan x)

3.3.3 Find the derivative of the implicit functions of the form $ax^2 + 2hxy + by^2 = 0$

3.3.4 Differentiate parametric functions of the type $x = f(x)$, $y = g(t)$

3.3.5 Find the second derivative of the functions $y = \frac{x}{x-2}$, $y = x^2 \sin x$

3.3.6 Solve the problem of the type

If $y = x^2 \cos x$, show that

$x^2 \frac{d^2y}{dx^2} - 4x \frac{dy}{dx} + (x^2+6) y = 0$

UNIT – IV

4.1 Applications of Differentiation

4.1.0 Apply the theories of differentiation in different problems

4.1.1 State geometrical meaning of derivatives

4.1.2 Find the slope of the curve
$y = x^2 - 3x + 2$ at (3,2)
$y = \tan x$ at $x = \pi/3$

4.1.3 Find the equation of the tangent and normal to the semi circle
$y = \sqrt{25-x^2}$ at (4,3) on it

4.1.4 Solve problems of the type: The radius of a circular plate is increasing in length at 0.1 cm per second. What is the rate at which the area is increasing when the radius is 12 cm.

4.1.5 Solve problems of the type: A spherical balloon is inflated with air such that its volume increases at the rate 5.c.c per second. Find the rate at which its curved surface is increasing when its radius is 7 cm.

4.1.6 Solve problems of the type: The displacement 'S' in time 't' is given by $S = 2/3t+$ Cost at $t = \pi/4$; find the velocity and acceleration

4.2 Maxima and Minima

4.2.0 Apply the concept of derivative to find maxima and minima

4.2.1 State the conditions for a function
$y = f(x)$ to be (1) increasing (2) decreasing

4.2.2 State the conditions for maximum and minimum values of a function

4.2.3 Solve the problem of the type:

1) Find the maximum and minimum values of $y = x^3 - 18x^2 + 96x$

2) Prove that a rectangular of fixed perimeter has its maximum area when it becomes a square.

4.3 Indefinite integral

4.3.0 Apply various methods of integration

4.3.1 Explain that $\int f(x)dx = f(x) + c$ means $\frac{d}{dx}[f(x)+c) = f(x)$, c being an arbitrary constant

4.3.2 State the standard formulas of integral x^n, sinx, cos x, e^x, etc

4.3.3 Find the integrals using the rules

1) $\int (u \pm v)\, dx = \int udu \pm vdx$

2) $\int kudx = k\int udx$

4.3.4 Evaluate the integrals of the form

1) $\int f(ax+b)\, dx$

2) $\int \sin^2 x\, dx$

4.3.5 Evaluate the integrals of the form

1) $\int x \sin(x^2)\, dx$

2) $\int \frac{2x^4}{1+x^{10}} dx$

3) $\int \cos^3 x \sin x\, dx$

4) $\int ex^2\, x\, dx$

UNIT – V

5.1 Integration by parts

5.1.0 Solve the problems of the type

1) $\int x \cos x \, dx$

2) $\int x^2 e^{-x} \, dx$

3) $\int x \log x \, dx$

4) $\int \log x \, dx$

5.2 Definite Integrals

5.2.0 Understand the concept of definite integral

5.2.1 Define the definite integral

$$\int_a^b f(x)\,dx = f(b) - f(a) \text{ where } F^1(x) = f(x)$$

5.2.2 Evaluate the definite integral

1) $\int_0^1 x(1-x)^2 \, dx$

2) $\int_0^{\pi} \sin^2 x \, dx$

3) $\int_0^1 x\sqrt{1+x^2} \, dx$

4) $\int_0^{\pi} \frac{1-\sin x}{x+\cos x} dx$

5) $\int_0^{\pi/2} x \cos x \, dx$

5.3 Application of Integration

5.3.0 Apply the concept of definite integral to solve problems of the following

5.3.1 Find the area bounded by a curve, two ordinates (abscissa) and x – axis (y axis)

5.3.2 Find Volume of a solid of revolution about x or y axis

5.4 Differential equations

5.4.0 Solve simple differential equations of first order

5.4.1 Solve the differential equation of the variable separable type

5.4.2 Solve the differential equation of the form $dy/dx + Py = Q$ where P and Q are simple functions of x

CONTENT DETAILS

UNIT – I

1.1 Matrices

Matrix notation, order of a matrix, and type of matrices: - Square matrix, unit matrix, Zero matrix, and Singular matrix. Transpose of a matrix, symmetric and skew-symmetric matrices, sum and product of matrices, Adjoint of a matrix, inverse of a matrix (definition only) and problems.

1.2 Determinants

Determinants of second and third order matrices, minors and cofactors, Cramer's rule, solution of simultaneous linear equations in three unknowns by Cramer's rule. Elimination of three linear equations in two unknowns.

1.3 **Binomial series**

Idea of nC_r, Value of nC_r (no derivation). Binomial theorem for positive integers (no proof), finding a given term in a Binomial Expansion.

1.4 Trigonometric functions

Definition of trigonometric functions of an angle in any quadrant, Signs of trigonometric functions of related angles, Given a trigonometric functions of an angle and its quadrant find others. Find the values of the trigonometric functions between 0° and 360°.

UNIT – II

2.1 Properties of trigonometric functions

Addition formulae, Multiple and Sub-multiple formulae, Sum and Product formulae, simple problems.

2.2 Properties of triangles

State and prove Sine rule, Cosine rule and projection formula. State and prove Napier's formula and simple problems relating to this.

2.3 Solution of triangle

Solve the triangle given

1. Three sides
2. Two sides and the included angle (use Napier's formula)

2.4 Co-ordinate geometry

Straight line-Slope, Equations of a straight line in the forms

1) $Y = mx + C$,
2) $y-y_1 = m(x-x_1)$,
3) $\frac{y-y_1}{y_1-y_2} = \frac{x-x_1}{x_1-x_2}$
4) $\frac{x}{a} + \frac{y}{b} = 1$

Points of Intersection of two lines, Angle between two lines, Conditions for two lines, Conditions for two lines to be parallel and predicator.

UNIT – III

3.1 Function and Limits

Definition, some problems for finding limits, Properties

Limit $\lim_{x \to a} \frac{x^n-a^n}{x-a} = na^{n-1}$ and limit $\lim_{\phi \to 0} \frac{\sin\phi}{\phi} = 1$ (statements only),

General definition of continuous functions.

3.2 Methods of Differentiation I

Definition of derivative of x^n, Sin x, Cos x etc by using first principle, find derivatives of e^x and log x, Fundamental formulas, product and Quotient rules (statement only). Derivatives of other trigonometric functions, Simple problems.

3.3 Methods of Differentiation II

Function of a function rule, Differentiation of implicit and parametric equations, problems on differentiation of functions involving these forms, second order derivatives, Simple problems.

UNIT – IV

4.1 Application of Differentiation

Geometrical meaning of derivatives, Slope, Tangent, Normal and Equation of a straight line, Rate of change.

Problems connecting Area and Volume, Velocity and Accelerations.

4.2 Maxima and Minima

Increasing and Decreasing functions, Turning points, Finding Maximum and Minimum values of a function by using derivatives, Conditions for Maximum and Minimum, Simple problems.

4.3 Indefinite Integral

Definition of integration, Fundamental formulas, Problems, Integration by substitution, function of the form $\int f(g(x)\, g^1(x)\, dx$, $\int f(ax+b)^n\, dx$

UNIT – V

5.1 Integrates by parts

Integral of the product of two functions, formula (without proof) and simple problems.

5.2 Definite Integral

Definitions, simple problems, $\int_0^{\pi/2} \text{Sin}^2x\, dx$, $\int_0^{\pi/2} \frac{\text{Sin}x}{\sqrt{1-\cos x}}\, dx$

5.3 Application of integration

Finding areas between the curve y = f(x) and the axes, Volume of the solid, Problems

5.4 Differential equations:

Solutions of equations of the form Variable separable, Linear equations.

REFERENCE BOOKS

1. Washington A.J. : Basic Technical Mathematics, Addison Wesley
2. Green John. R : Calculus with Analytic Geometry, McGraw Hill Book Co.,
3. Karuppannan. T.C. : Mathematics for Technical Students, Macmillan and Co.,
4. T.T.T.I. Madras : Mathematics for Technicians Vol. I and II, Sehgal Educational Consultants (P) Ltd, Faridabad
5. Shanti Narayanan : Algebra

SUBJECT TITLE : APPLIED SCIENCE – A - PHYSICS
SUBJECT CODE : GE 103 A
PERIOD/WEEK : 3
PERIODS/YEAR : 96

TIME SHEDULE

UNIT	TOPIC	PERIODS
I	1.1 Units And Dimensions	5
	1.2 Dynamics	14
	1.3 Work, Power and Energy	5
	1.4 Rotational Dynamics	6
	Test – I	2
II	2.1 Statics	10
	2.2 Elasticity	4
	2.3 Fluid Flow	5
	2.4 Viscosity	3
	2.5 Surface Tension	3
	2.6 Simple Harmonic Motion	5
	Test – 2	2
III	3.1 Optics	7
	3.2 Electricity	12
	3.3 Semiconductors	6
	3.4 Laser	2
	3.5 Photoelectric Effect	3
	Test – 3	2
	Total	96

OBJECTIVES

On Completion of the unit, the student will be able to

UNIT – I

1.1 Units And Dimensions

1.1.0 Understand the concept of units and measurements with a basic knowledge about dimensions
1.1.1 Define Unit of a physical quantity.
1.1.2 Explain the principle of measurement.
1.1.3 Identify fundamental and derived units.
1.1.4 Define dimension of a physical quantity.
1.1.5 Derive dimensional formula for physical quantities.

1.2 Dynamics

1.2.0 Apply the dynamics of a particle in practical situations.
1.2.1 Identify vector and scalar quantities.
1.2.2 Derive the expression $Sn = u+a (n – ½)$
1.2.3 Solve Problems related to gravity with equations of motion.
1.2.4 Derive the expressions for time of flight, horizontal range and maximum height for a projectile.
1.2.5 Solve the problems based on the above expression
1.2.6 State the Newton's laws of motion
1.2.7 Define the terms:
1. Force 2. Inertia 3. Momentum
1.2.8 Derive the relation F = ma
1.2.9 State Law of conservation of momentum and prove it in the case of two bodies making a collision.
1.2.10 Explain the principle behind recoil of gun and derive an expression for recoil velocity.
1.2.11 Solve Problems related to Laws of motion.
1.2.12 Define angular displacement, angular velocity and angular acceleration.
1.2.13 Derive relation between linear velocity and angular velocity.
1.2.14 Derive expression for centripetal acceleration.
1.2.15 Apply the principle of centripetal force in the case of banking of roads and rails.
1.2.16 Solve problems related to centripetal force.

1.3 Work, Power and Energy

1.3.0 Understand the concepts of work, power and energy and their applications
1.3.1 Define 1. Work 2. Power 3. Energy
1.3.2 Distinguish between Potential Energy and Kinetic Energy and mention the expressions for them.
1.3.3 Solve problems using the above expressions.

1.4 Rotational Dynamics

1.4.0 Understand the dynamics of a rotating body.
1.4.1 Define Moment of Inertia of a rigid body
1.4.2 Define Radius of gyration
1.4.3 Scale theorems of parallel and perpendicular axes.
1.4.4 Define Torque
1.4.5 Mention relation between torque and angular momentum.
1.4.6 Mention the expression for kinetic energy of rotation.
1.4.7 Derive an expression for moment of inertia of a uniform circular disc about an axis passing through its center and perpendicular to its plane.
1.4.8 Derive expression for kinetic energy of a disc rotting on a horizontal plane.
1.4.9 Solve problems using the above expressions.

UNIT – II

2.1 Statics

2.1.0 Understand the principles of statics and its applications

2.1.1 Add Vectors using triangle method.
2.1.2 Define Resultant and Equilibrant of vectors.
2.1.3 State Parallelogram law of forces.
2.1.4 Derive expression for resultant using Parallelogram law.
2.1.5 State the law of triangle of forces.
2.1.6 State Lami's theorem.
2.1.7 Explain moment of a force.
2.1.8 State the conditions of equilibrium of a rigid body acted upon by a large number of coplanar parallel forces.
2.1.9 Derive expression for work done by a couple.

2.2 Elasticity

2.2.0	Comprehend the concept of elasticity
2.2.1	Define Stress, Strain and Elastic limit.
2.2.2	State Hooke's law.
2.2.3	Derive expression for Young's modulus, rigidity modulus and bulk modulus.
2.2.4	Solve Problems related to modulus of elasticity.

2.3 Fluid Flow

2.3.0	Understand the principle of fluid flow
2.3.1	Distinguish between Streamline and Turbulent flow.
2.3.2	Explain Pressure energy, Kinetic energy and Potential energy of a liquid.
2.3.3	Mention equation of continuity.
2.3.4	State Bernouille's theorem.
2.3.5	Explain the working of airfoil and atomizer.

2.4 Viscosity

2.4.0	Apply the principle of viscosity in solving problems.
2.4.1	Define coefficient of viscosity.
2.4.2	Give the Poiseusilles formula.
2.4.3	Explain terminal velocity.
2.4.4	Mention Stoke's formula.
2.4.5	Explain the effect of temperature on viscosity
2.4.6	Solve problems using Poiseuille's formula.

2.5 Surface Tension

2.5.0	Comprehend the phenomenon of surface tension and its applications.
2.5.1	Define surface tension.
2.5.2	Define surface energy.
2.5.3	Derive the relation between surface tension and surface energy.
2.5.4	Mention the expression for the excess of pressure issued a spherical drop and bubble.
2.5.5	Solve problems related to surface tension.

2.6 Simple Harmonic Motion

2.6.0	Comprehend the concept of wave motion
2.6.1	Define Simple Harmonic motion.
2.6.2	Derive equation for S.H. motion.
2.6.3	Explain period, frequency, amplitude and phase.
2.6.4	Distinguish between transverse and longitudinal waves.
2.6.5	Define wavelength.
2.6.6	Derive the relation $V= n\lambda$
2.6.7	Explain resonance.
2.6.8	Explain ultrasonic frequency.
2.6.9	Mention applications of ultrasonic.

UNIT – III

3.1 Optics

3.1	Understand the concept of optical phenomena
3.1.1	State Snell's law of refraction.
3.1.2	Explain critical angle and total internal reflection.
3.1.3	Explain the propagation of light through optic fiber.
3.1.4	Convex and concave mirror- focus, image formation.
3.1.5	Mention the formula $1/u + 1/v = 1/f$ (No derivation)
3.1.6	Convex and concave lens - focus, image formation.
3.1.7	Mention the formuls $1/f= (n-1)(1/R1 - 1/R2)$, No derivation
3.1.8	Simple microscope, Magnifying power $m=1+D/f$, No derivation.

3.2 Electricity

3.2	Understand the fundamentals of electricity and its magnetic effect
3.2.1	State Kirchoff's law.
3.2.2	Derive expression for balancing condition of wheat Stone's Bridge.
3.2.3	State Biots and Savarts law.
3.2.4	Mention the expression for magnetic field due to current through a circular cuf.
3.2.5	State Fleming's left hand rule.
3.2.6	Describe the principle and construction of a moving coil galvanometer.
3.2.7	Explain the conversion of galvanometer into ammeter and voltmeter
3.2.8	Solves problems based on the above laws.

3.3 Semiconductors

3.3	Comprehend the working of semiconductor devices
3.3.1	Explain P.N. Junction.
3.3.2	Describe a junction transistor PNP and NPN.
3.3.3	Explain transistor configuration.
3.3.4	Describe a common emitter amplifier.
3.3.5	Represent Logic gates symbolically.
3.3.6	Explain with the help of truth table.

3.4 Laser

3.4	Understand laser action and its application
3.4.1	Explain population inversion, spontaneous emission, stimulated emission and optical pumping.
3.4.2	Write down the characteristics of LASER.
3.4.3	Describe various applications of Laser.

3.5 Photoelectric Effect

3.5.0	Comprehend the theories of photoelectric effect
3.5.1	Describe Max planks quantum theory.
3.5.2	Explain Photoelectric effect and its application.
3.5.3	State Laws of Photoelectric emission.
3.5.4	Device Einstein's photoelectric equation.
3.5.5	Solve problems using the above equation.

CONTENT DETAILS

UNIT – I

1.1 Units and dimensions

Units – fundamental and derived units. Systems of units – S.I. Dimensions – Application – Derivation of expression of period of a simple pendulum using dimension.

1.2 Dynamics

Equation of motion (re-capitulation only) - Derivation of $S_n = U + a (n – ½)$ - Acceleration due to gravity – equation of motion under gravity. Numerical problems.

Projectile motion – Derivation of expressions for Time of flight, Horizontal range, Maximum height Problems.

Linear Momentum, Newton's laws of motion – Definition of force and inertia – Derivation of F = ma – Unit of force. Law of conservation of momentum – Derivation – Recoil of gun. Numerical Problems.

Circular motion – definitions for angular displacement angular velocity and angular acceleration – relation between linear velocity and angular velocity (deviation). Centripetal acceleration and centripetal force-derivation-examples Banking of roads and rails (qualitative) centrifugal force – Numerical problems.

1.3 Work, power and energy

Definitions for Work, Power, Energy – Units of work – Power and energy, Potential energy and Kinetic energy – Expression for P.E and K.E. (no derivation). Numerical problems.

1.4 Rotational Dynamics

Moment of inertia of a rigid body – Radius of gyration. Theorems of Parallel and Perpendicular axis (only statement) – Angular momentum Torque – Relation between Torque and angular momentum

(no derivation) expression for K.E. of rotation (no derivation). Moment of Inertia of a uniform circular disc about an axis passing through its center and Perpendicular to its Plane (derivation) – K.E. of disc rolling on a horizontal Plane. Numerical problems.

UNIT – II

2.1 Statics

Vectors and Scalars – Triangle Method of vector addition – Concurrent forces – Resultant and equilibrant – Parallelogram law – Derivation of the resultant in Magnitude and direction – Law of triangle of forces – Lami's theorem – Resolution of forces – Parallel forces – Like and unlike Parallel forces – moment of force- Conditions of equilibrium of body under the action of a number of coplanar parallel forces couples – Moment of a couple – work done by a couple – Numerical problems.

2.2 Elasticity

Elastic and plastic bodies – Stress – Strain – units - Hooke's law – Young's Modulus Rigidity modulus, Bulk modulus – Numerical problems.

2.3 Fluid flow

Stream line and turbulent flow – Pressure enemy, Potential energy and kinetic energy of a liquid – Equation of continuity – Bernoulli's theorem – Applications – Air foil and Atomizer.

2.4 Viscosity

Viscous force – Coefficient of viscosity – Unit dimension - Poiseuille's formula (no derivation). Stokes formula - Variation of viscosity with temperature - Numerical problems.

2.5 Surface tension

Surface tension - Surface energy – Relation between S.T and Surface energy (Proof) – Expression for excess of Pressure inside a spherical drop and bubble (no derivation) – Problems.

2.6 Simple Harmonic Motion

Definition of Simple Harmonic Motion – Examples – SHM as projection of uniform circular motion on any diameter of a circle – Equation of SHM – Period, frequency, amplitude, phase motion – Transverse and longitudinal waves. Definition of wavelength and frequency – Derivation of relation $V + f\lambda$ - free vibration – forced vibration – Resonance – Ultrasonic Applications.

UNIT – III

3.1 Optics

Smells law of refraction – Critical angle – Total internal reflection – Optical fiber Convex and concave mirror – Focus, image formed by mirror (Qualitaive idea only), Mention the formula $1/u + 1/v = 1/f$, (no derivation) – Convex and concave lens, focus image formed by lenses(qualitative idea only), mention the formula $1/f = 9n-1)[1/R1 - 1/R2]$, no derivation. Simple microscope – magnifying power $m=1+d/f$, No derivation.

3.2 Electricity

Kirchoff's Laws – WheatStone's bridge - Condition for balancing – Magnetic effect of Electricity – Biot and Savart Law – Right hand palm rule – Magnetic field due to current through circular coil at a point on the axial line and at the center (no derivation) – Fleming's Left hand rule – Force on a current carrying Conductor placed in a magnetic field – moving coil galvanometer – theory and construction – Conversion of a galvanometer into ammeter and voltmeter – Numerical problems.

3.3 Semiconductors

PN Junction – Junction transistor – Transistor configuration, α and β – Common emitter amplifier.

Logic gates (symbolic representation and truth task only) – AND, OR, NOT gates – universal gates NAND, NOR, XOR gates.

3.4 Laser

Population inversion, Spontaneous emission, stimulated emission, optical pumping – characteristics – applications.

3.5 Photoelectric Effect

Quantum theory – Photoelectric effect – Laws of photoelectric effect – Einstein's photoelectric equation – Numerical problems.

REFERENCE BOOKS

1. Physics - Halliday and Resnick
2. Mechanics - D.S. Mathur
3. Optics - Jenkins and White
4. Digital and Computer Principles - Malvino

SUBJECT TITLE : APPLIED SCIENCE – B. CHEMISTRY
SUBJECT CODE : GE 103 B
PERIODS/WEEK : 3
PERIODS/YEAR : 96

TIME SHEDULE

UNIT	TOPIC	PERIODS
I	**INORGANIC AND THEORECTICAL CHEMISTRY**	
	1.1 Introduction	9
	1.2 Acid Base & Redox Reactions	9
	1.3 Water	8
	Test – I	1
II	**PHYSICAL CHEMISTRY**	
	2.1 Electrochemistry	10
	2.2 Corrosion	7
	2.3 Energetics	10
	2.4 Colloids	5
	Test – II	1
III	**ORGANIC CHEMISTRY**	
	3.1 Introduction	4
	3.2 Polymers	9
	3.3 Paints, Varnishes & Adhesives	6
	3.4 Fuels	9
	3.5 Environmental Pollution	5
	3.6 Chemistry In Action	2
	Test – III	1
	Total	96

OBJECTIVES

UNIT - I INORGANIC AND THEORETICAL CHEMISTRY

Formulae and Equations

1.1.1 Review the fundamental ideas in chemistry
1.1.2 Explain the terms atom, molecule, valency, radical, molecular formula
1.1.3 Compute molecular weight from molecular formula
1.1.4 Do the calculations based on simple stoichiometric equations – weight(s)/volume(s) of product(s)/reactant(s)

Structure of Atom

1.1.5 Understand the basic ideas related to modern approach to the structure of atom
1.1.6 State the fundamental particles – proton, electron, neutron – their charge & mass
1.1.7 Differentiate atomic number & mass number
1.1.8 Explain the concept of isotopes
1.1.9 Describe the dual nature of matter
1.1.10 Outline de-Broglie equation
1.1.11 State Heisenberg's uncertainty principle
1.1.12 Explain the concept of uncertainty
1.1.13 Distinguish between orbit & Orbital
1.1.14 Illustrate the Hund's rule & Aufbau principle
1.1.15 Illustrate the electronic configuration of first 20 elements
1.1.16 State modern periodic law
1.1.17 Classify elements based on electronic configuration

Chemical Bonding

1.1.18 Understand the different types of chemical bonds – how & why they are formed
1.1.19 Explain the reason for inactivity of zero group elements
1.1.20 Illustrate ionic, covalent & co-ordinate bond
1.1.21 Define electro-negativity
1.1.22 Explain the polar character of covalent bond & significance of Hydrogen Bonding
1.1.23 Illustrate the application of hydrogen bonding – high boiling point of water, density of ice, silky nature of proteins (elementary idea only)

Acid-base & Redox reactions

1.4.0 Appreciate the reactions of acids & bases
1.4.1 Illustrate Arrhenius' & Lewis concept of acids and bases
1.4.2 Distinguish between strong and weak acids and bases
1.4.3 Explain neutralization
1.4.4 Illustrate the calculation of equivalent weights of acids and bases based on equations
1.4.5 Explain the electronic concept of oxidation & reduction
1.4.6 State oxidation number
1.4.7 Define the O.N concept of oxidisation & reduction
1.4.8 Illustrate redox reactions taking the reactions in Daniel Cell as example

P^H & Its Applications

1.5.0 Understand the ionic product of water
1.5.1 State pH – understand its expression
1.5.2 Describe what is pH scale
1.5.3 Solve simple problems
1.5.4 Define buffer solutions
1.5.5 Describe what is acid buffer & basic buffer – one example each

Volumetric Analysis

1.6.0 Understand the theory behind volumetric analysis
1.6.1 Describe what is meant by the terms titration, end point & indicator
1.6.2 Identify the indicators phenolphthalein/methyl orange to be used in a given acid-base titration, know the respective pH ranges
1.6.3 Solve problems based on the relation $V_1N_1=V_2N_2$ & $V_1M_1 = V_2M_2$

Water

1.7.0 Understand hard & soft water- definition, types of hardness, its causes & certain methods of removal

1.7.1 Distinguish between hard water & soft water

1.7.2 Mention the types of hardness

1.7.3 Explain methods of removal of hardness – one each (temp. – boiling, permanent – ion exchange)

1.7.4 Define degree of hardness

1.7.5 Explain the method of determination of degree of hardness using EDTA – principle, procedure & calculation

1.7.6 Explain disadvantages of using hard water – wastage of soap in laundry, formation of boiler scales

UNIT - II PHYSICAL CHEMISTRY

Electrochemistry

2.1.0 Review the outline of electrolysis, distinguish between electrolytic cells & galvanic cells, identify corrosion as an electrochemical process

2.1.1 Distinguish between a) conductors & insulators b) metallic & electrolytic conduction c) strong & weak electrolytes

2.1.2 Explain electrolysis taking molten NaCI as example anode reaction & cathode reaction as oxidisation & reduction.

2.1.3 Explain the applications of electrolysis, electroplating & anodizing

2.1.4 Distinguish between electrolytic cell & galvanic cell, the difference in the sign of the electrodes in the above cells

2.1.5 Outline the schematic representation of galvanic cell

2.1.6 Explain the classification of galvanic cells as primary & secondary

2.1.7 Illustrate primary cell with Daniel cell as examples

2.1.8 Illustrate secondary cell with lead storage cell as examples

2.1.9 Explain the electrode reactions while recharging

2.1.10 Explain the term electrode potential

2.1.11 Define electrochemical series

2.1.12 Illustrate the construction of a galvanic cell – minimum 3 examples

2.1.13 Explain the concept of fuel cells (elementary idea only)

2.1.14 Explain hydrogen-oxygen fuel cell & methanol-oxygen fuel cell

2.1.15 Describe the chemical reactions in the cell

2.1.16 Mention the advantages of fuel cells

Corrosion

2.2.0 Understand the concept of corrosion & identify it as an electrochemical process

2.2.1 Define corrosion

2.2.2 Explain the rusting of iron-mention the conditions for rusting

2.2.3 Explain the electrochemical theory of corrosion

2.2.4 Describe the methods of prevention of corrosion, barrier protection and sacrificial protection

2.2.5 Explain the theory behind each method learned

Chemical Energetics

2.3.0 Appreciate the basic concepts of 'Thermodynamics' & 'Chemical Thermodynamics'

2.3.1 Explain the scope and limitations of thermodynamics

2.3.2 Distinguish between a) reversible & irreversible reactions b) exothermic & endothermic reactions

2.3.4 Explain 'system & surroundings'

2.3.5 Distinguish between open, closed & isolated systems

2.3.6 Define macroscopic properties

2.3.7 Distinguish between extensive & intensive properties

2.3.8 Describe the different thermodynamic processes like isothermal, adiabatic, isobaric & isochoric process
2.3.9 State the first law of thermodynamics
2.3.10 Explain internal energy E & ^E
2.3.11 Explain the concept of work & heat
2.3.12 State the mathematical expression for the first law of thermodynamics
2.3.13 State Hess's Law – only statement & examples (solving problems not expected)
2.3.14 Describe the limitations of the 1st law
2.3.15 Explain the terms a) 'enthalpy' H & ^H b) entropy S & ^S
2.3.16 Describe spontaneous & non-spontaneous processes with suitable examples.
2.3.17 State 2nd law of thermodynamics
2.3.18 Explain Gibb's free energy G & ^G
2.3.19 Derive the mathematical expression (only) for Gibb's – Helmholtz equation
2.3.20 State 3rd law of thermodynamics

Colloids

2.4.0 Comprehend the methods of preparation, the properties & some industrial applications of colloid
2.4.1 Define 'colloids'
2.4.2 Illustrate the different types of colloids with examples.
2.4.3 Describe the method for the preparation of Fe(OH)3 sol
2.4.4 Describe Bredic's Arc method
2.4.5 Describe the purification of colloids by Dialysis
2.4.6 Describe the properties 1) Tyndall effect 2) Brownian movement 3) electrophoresis 4) coagulation
2.4.7 State Hardy-Schultze rule & explain with examples.
2.4.8 Define Gold-No
2.4.9 Describe the industrial applications – 1) smoke precipitation 2) sewage treatment 3) purification of drinking water

UNIT – III ORGANIC CHEMISTRY

Introduction to organic chemistry

3.1.0 Understand the fundamental ideas of organic chemistry
3.1.1 List the differences between organic & inorganic compounds
3.1.2 Describe the uniqueness of carbon atom
3.1.3 Define 'catenation'
3.1.4 Distinguish between saturated & unsaturated compounds
3.1.5 Illustrate general classification & that based on functional groups
3.1.6 Define isomerism – explain with simple examples only

Polymers

3.2.0 Understand the nature of some industrially important polymers
3.2.1 Define polymerization
3.2.2 Distinguish between addition & unsaturated compounds
3.2.3 Differentiate between thermoplastics & thermosetting plastics
3.2.4 Outline the merits & demerits of plastics
3.2.5 Distinguish natural rubber from synthetic rubber with suitable examples
3.2.6 Explain vulcanization & its merits
3.2.7 Define "fiber"
3.2.8 Describe different types of fibers with suitable examples

Paints, varnishes, adhesives & lubricants

3.3.0 Appreciate the requisites of good paints
3.3.1 Name the constituents of paints – vehicle, pigment & other additive
3.3.2 Identify the role of various additives – acrylics, polymethanes, fillers, plastizisers, driers, antiskinning agents (one examples each)
3.3.3 List the two types of varnishes & their constituents
3.3.4 State the common uses of varnishes

3.3.5 List the various constituents of varnish
3.3.6 Explain the principle of lubrication
3.3.7 List the types of lubricants – with one example each
3.3.8 Define 'adhesives'
3.3.9 List the two types of adhesives
3.3.10 State the applications of 1) paper adhesive 2) wood adhesive 3) metal bonding adhesive 4) break & clutch bonding adhesive 5) printed circuits

Fuels

3.4.0 Comprehend the classification and use of various types of fuel.
3.4.1 Define "fuel"
3.4.2 Explain their classification into solid, liquid & gaseous
3.4.3 Give brief explanation of solid fuels wood, charcoal, lignite, bituminous coal, anthracite coal – list their applications
3.4.4 Explain briefly the liquid fuels petrol, diesel, kerosene & list their applications
3.4.5 Explain gaseous fuels natural gas (CNG), producer gas, water gas, LPG & Gobar gas
3.4.6 Describe nuclear fuels with examples
3.4.7 Define 1) calorific value 2) octane number 3) Cetane no.
3.4.8 Explain 1) knocking 2) cracking

Environmental pollution

3.5.0 Investigate the impact of pollution on the environment
3.5.1 Describe the categorization and sources
3.5.2 List the different methods of controlling pollution
1) Effluent treatment 2) removal of toxic gases and particulate materials
3.5.3 Distinguish between BOD & COD

Chemistry in action

3.6.0 Understand some commonly used medicines & propellants
3.6.1 Explain what is 1) dyes 2) antipyretics & analgesics 3) antiseptics & disinfectants 4) tranquilizers 5) antibiotics - mention 2 examples each
3.6.2 Define propellants
3.6.3 Classify propellants with one example each.

CONTENT DETAILS

UNIT – I INORGANIC AND THEORECTICAL CHEMISTRY

1.1 Introduction

Atoms and Molecules, Valency, Molecular formula, Atomic weight, Molecular weight, Chemical equation, Problems based on Chemical equation.

Structure of atom, Modern approach De-broghi & Heisenberg's uncertainty Principle (Elementary idea only) – Concept of Orbit, orbital, Aufban, Hundi, Paul's Principle – Electric configuration – Modern Periods Law - classification of elements based on electronic configuration.

Chemical Bonding - theory of valency – Inertness of Zero group elements - Ionic bond, Co-ordinate bond, Co-valent bond, Polar character of covalent bond – Hydrogen bond – Applications High B.P of Water, density of ice, silky nature of protein (Idea only).

1.2 Acids-bases and Redox reactions

Acids-Bases – (Arrherius, & Lewis Concepts) – Concepts of strong and weak acids & bases – Neutralization - Equivalent weight of acid & bases (Calculate based on Equation) -Oxidation, Reduction (electronic concept and oxidation No concept) - Redox reaction (Eg: - Daniel Cell reaction).

Ironic product of water, PH & POH (Definition and expression) PH Scale – Calculation of PH & POH – Buffer solution (examples) – Application of PH a) Boiler feed water b) Potable water c) Effluent treatment.

Volumetric analysis: Quantitative & Qualitative analysis – Units of measurement of Concentration (Normality, Morality & PPM) – Titration, Endpoint Acid – Base Indicators (Phenolphthalein & Methyl orange) – Choice of Indicators.

1.3 Water

Hard & soft water, Types of Hardness – degree of hardness. One method to remove Temporary hardness (Boiling) – Renormal of permanent hardness (Ion-exchange method) – disadvantages of using hard water a) Wastage of Soap in laundry) Boil Scales – Determination of Degree of hardness using EDTA (Principle & Procedure only).
(Problems not expected from the chapter)

UNIT – II PHYSICAL CHEMISTRY

2.1 Electrochemistry & corrosion

Conductors & Insulators, Metallic & electrolyte conductors, strong & weak electrolytes – Mechanism of electrolysis – Molten Nail – Application of electrolysis – Electroplating & Anodizing.

Galvanic cell – Difference in the sign of electrodes – Primary cell (eg: - Daniel cell construction details, Anode reaction, cathode reaction & Net cell reaction)

Secondary cells – Lead storage balling, (Constructional details – charging & discharging) Electrochemical senis – Application in the construction of a cell.

Fuel cells – Introduction, Hydrogen – Oxygen fuel cell, Methanol – Oxygen fuel (elementary idea only) – Advantages.

2.2 Corrosion

Definition – Rusting of Fe condition for Rusting of Fe, Electrochemical theory of corrosion, Preventing of corrosion

i) Barrur protection
ii) Sacrificial protection
iii) Cathodic protection
iv) Antirust solution.

2.3 Chemical Energetics

Understand the term chemical energetic & thermodynamics _ Scope & Limitations of Thermodynamics. Basic concepts – Reversible & Irreversible reaction, Exothermic & endothermic reactions, systems & surroundings – Types of systems Open, closed, Isolated – process – Macroscopic properties – Extensive & Intensive properties.

Thermodynamic process - Isothermal, Adrabalie, Isobaric, Isochoric Process.

First Law of Thermodynamics – (statement)

Internal energy (E) and Internal energy change (E)

Concept of Work & heat

Mathematical expression for the 1^{st} Law of thermodynamics

Application of 1^{st} Law (Hess's Law)

(Statement and eg), Limitation of 1^{st} Law.

Enthalpy (H) and Enthalpy Change (H), Entropy (S) and Entropy Change (S)

Second Law of Thermo dynamics (statement & Mathematical Expression)

Gibbs Free energy (G) and Gibbs free energy change (AG)

Gibbs-Helzmotz equation (expression only)

Third Law of Thermodynamics (statement only)

2.4 Colloids

Definition, Types of colloids, preparation 1) Condensation-e.g. Ferric hydroxide sol 2) Dispersion- e.g. Bredic's arc method, purification – dialysis, Properties. 1. Tyndall effect 2. Brownian movement 3. Electrophoresis 4. Coagulation Hardy – Schulze rule, Gold number Industrial application 1) Smoke precipitation 2) Treatment of sewage 3) Purification of drinking water.

UNIT – III ORGANIC CHEMISTRY

3.1 Introduction

Differences between organic and inorganic compounds – uniqueness of carbon – catenation, saturated and unsaturated – general classification of organic compound – classification based on functional groups isomerism (definition wish an example).

3.2 Polymers

Polymerization – illustrate with examples – Addition and condensation polymerization with one example each.

3.3 Plastics - Thermoplastics, Thermosetting plastic, with one example each – advantages.

3.4 Rubber – Natural and synthetic rubber (example), vulcanization.

3.5 Fiber – Natural fibers, synthetic fibers, semi synthetic fibers, examples.

3.3 Paints and Varnishes and adhesives, lubricants

Requisites of a good paint – Constituents – acrylics, polyurethane, filler, plasticizers, pigments, driers and antiskinning agents.

VARNISHES - Type, Constituents

LUBRICANTS - Principle of lubrication – Types of lubricants

ADHESIVES - Types and Applications.

3.4 Fuels

Types of fuels - solid, liquid, gaseous and nuclear - Calorific value of fuels. Knocking, Cracking - Octane number and octave number.

3.5 Environmental pollution

Categorization, Sources and Controlling.

3.6 Chemistry ice action:

Dyes – antipyretics and analgesics – antiseptic – disinfectant – tranquilizers – antibiotics (Concept and two examples each). Propellants – definition classification (solid – liquid – hybrid) one example each.

REFERENCE BOOKS

1.	Soni P.L.	A Text Book of Inorganic Chemistry	S.Chand & Co., New Delhi
2.	Puri B.L. & Sharma L.R	A Text Book of Inorganic Chemistry	Shoban Lal Nagin Chand&Co
3.	B.S.Bahl	Text book of Organic Chemistry	S.Chand & Co., New Delhi
4.	I.L. Finar Arun Bahl	Organic Chemistry – Vol I	ELBS & Longman, Group Ltd.,
5.	Sono. P.L.	Textbook of physical Chemistry	Sultan Chand & Sons, New
6.	A.J. Mee	Physical Chemistry	William Heinemann Ltd.,
7.	Glasstone & Lewis	Element of Physical Chemistry	Macmillan Press

SUBJECT TITLE : ENGINEERING GRAPHICS
SUBJECT CODE : GE 104
PERIOD/WEEK : 4
PERIOD/YEAR : 128

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I	1.1 Importance of Engineering Graphics	2
	1.2 Drawing Instruments	2
	1.3 Drawing standards	2
	1.4 Free hand Lettering and Numbering	3
	1.5 Dimensioning	3
	1.6 Geometric construction	16
	Test 1	3
		31
II	2.1 Projection of Points, Lines and planes	18
	Test 2	3
		21
III	3.1 Orthographic Projection of Objects	27
	Test 3	3
		30
IV	4.1 Sectional views of objects	11
	4.2 Auxiliary views	3
	Test 4	3
		17
V	5.1 Pictorial Drawing	8
	5.2 Visualization	4
	5.3 Perspective Drawing	3
	5.4 Development of surfaces	11
	Test 5	3
		29
	Total	128 Periods

Note : A minimum number of 10 sheets should be done.

OBJECTIVES

UNIT - I

On completion of this study the student should be able to –

1.1 Importance of Engineering Graphics

1.1.0 Understand the importance of engineering graphics
- 1.1.1 Explain the importance of engineering communication medium
- 1.1.2 Describe the development of engineering graphics and computer aided drafting CAD
- 1.1.3 Indicate the link between engineering graphics and other subjects of study in diploma courses

1.2 Drawing Instruments

1.2.0 Use engineering drawing instruments
- 1.2.1 Select the proper instrument to draw horizontal, vertical and inclined lines
- 1.2.2 Select the proper instrument to draw large and small circles and arcs to its specifications
- 1.2.3 Select the proper pencil to draw different types of line according to its specifications
- 1.2.4 Identify the steps to keep the drawing clean and tiny

1.3 Drawing standards

1.3.0 Appreciate the standards of engineering drawing
- 1.3.1 Select the drawing sheet
- 1.3.2 Draw different types of lines
- 1.3.3 Prepare of title block as per BIS
- 1.3.4 Fold of drawing sheets as per standards

1.4 Free hand Lettering & Numbering

1.4.0 Apply free hand lettering and numbering
- 1.4.1 Write drawing tile using sloping and vertical lettering including numerals as per BIS
- 1.4.2 Select suitable size of letters of different layout and applications
- 1.4.3 Write engineering drawings notes using lettering stencils

1.5 Dimensioning

1.5.0 Apply dimensioning as per standards
- 1.5.1 State the need of dimensioning as per BIS specification
- 1.5.2 Identify the notations used in a drawing as per BIS
- 1.5.3 Identify the system of placement of the dimensions as per BIS
- 1.5.4 Dimension of a given drawing according to BIS including features
- 1.5.5 Apply the rules for dimensioning of standard features, given a drawing comprising of standard features
- 1.5.6 Identify principles of dimensioning, given a dimensioned drawing
- 1.5.7 Identity the correctness or otherwise of an engineering drawing dimensioned as per SP 46 and dimension the same correctly

1.6 Geometric construction

1.6.0 Apply principles of geometrical construction
- 1.6.1 Construct polygon, given the length of the side
- 1.6.2 Insert a regular polygon in a circle.
- 1.6.3 Define Ellipse, involutes, helix, Parabola, Hyperbola and Cycloid,
- 1.6.4 Construct Ellipse by different methods (concentric, eccentricity, parallelogram
- 1.6.5 Construct an involute, helix, parabola from given data
- 1.6.6 Identify the application of these constructions in engineering practice.

UNIT – II

2.1 Projection of Points, Lines and Planes

2.1.0 Understand the projection of points, lines and planes
- 2.1.1 Project points in different quadrants
- 2.1.2 Project lines parallel to both planes
- 2.1.3 Project lines perpendicular to HP and || to VP

2.1.4 Project lines perpendicular to VP and || to HP
2.1.5 Project lines inclined to HP and || to VP
2.1.6 Project lines inclined to VP and || to HP
2.1.7 Project lines inclined to both planes-simple direct questions and answers
2.1.8 Find true length of lines
2.1.9 Project of planes parallel to VP and perpendicular to HP
2.1.10 Project planes parallel to HP and perpendicular to VP

UNIT - III

3.1 Orthographic Projection of Objects

3.1.0 Apply principles of orthographic projection
- 3.1.1 Explain the principle of orthographic projection with simple sketches
- 3.1.2 Prepare an engineering drawing of a given simple engineering path in first angle and third angle projection
- 3.1.3 Draw the orthographic views of an object, given its pictorial drawing
- 3.1.4 Sketch (free hand) the orthographic views of 3.2 and 3.3
- 3.1.5 Select the minimum number of views needed to represent a given object fully
- 3.1.6 Identify the engineering path correctly from a number of orthographic drawings

UNIT - IV

4.1 Sectional views of objects

4.1.0 Recognize the need of sectional views
- 4.1.1 Explain the need to draw sectional views
- 4.1.2 Select the section place for a given component to reveal maximum information
- 4.1.3 Draw the sectional views for 4.2
- 4.1.4 Sketch simple sections (Full and half) for a range of simple engineering objects
- 4.1.5 Select the component from a given sectional view

4.2 Auxiliary views

4.2.0 Recognize the need of auxiliary views
- 4.2.1 State whether the auxiliary view is needed, given an engineering drawing
- 4.2.2 Draw the auxiliary views of a given engineering drawing

UNIT - V

5.1 Pictorial Drawing

5.1.0 Prepare pictorial drawing
- 5.1.1 Explain the need for and types of commonly used pictorial drawings
- 5.1.2 Prepare isometric drawing of simple objects using appropriate construction procedures given their appropriate drawings
- 5.1.3 Sketch the isometric views of simple engineering objects given either orthographic drawing or actual components
- 5.1.4 Prepare oblique drawing – cavalier and cabinet-of simple engineering objects given either orthographic drawings or actual components
- 5.1.5 Sketch 5.4 by free hand
- 5.1.6 Identify the correct pictorial view from orthographic drawings

5.2 Visualization

5.2.0 Visualize and object in 3D, given its orthographic drawings
- 5.2.1 Compare an engineering part with its drawings
- 5.2.2 Identify surfaces with reference to orthographic drawing
- 5.2.3 Prepare a model of the part, given its orthographic drawing

5.3 Perspective Drawing

5.3.0 Prepare perspectives
- 5.3.1 State the principle of perspective projection
- 5.3.2 Prepare two-point perspective of a rectangular block
- 5.3.3 Sketch perspective of combination of rectangular block

5.4 Development of surfaces

5.4.0 Prepare development of surfaces

5.4.1 State the need for preparing the development drawings

5.4.2 Prepare development of surfaces of simple engineering component like tray, funnel, ducts (rectangular and square hopper)

5.4.3 Prepare development of surfaces of 90-degree elbow pipe

CONTENT DETAILS

UNIT - I

1.1 The Importance of Engineering Graphics

Explanation of the scope and objective of this subject – its importance as a graphic communication, Computer Aided Drafting (CAD) need for preparing drawing as per standards – BIS, SP 46.

1.2 Drawing Instruments.

Basic drawing instruments – T square – Set square – compass dividers – drawing boards – Pencils – Drawing papers – Mini drafter – French curves – Stencils – Selection and mode of using them.

1.3 Drawing Standards

Size of drawing sheets – Layouts of drawing sheet – Title Blocks – Types of lines – Folding of drawing sheets.

1.4 Free hand Lettering and Numbering

Need for legible lettering and numbering on drawings – selection of suitable size of lettering for different drawing writing of Engineering drawing titles and notes using both vertical and sloping styles.

1.5 Dimensioning

Function of dimensioning need for dimensioning engineering drawing according to BIS – rotation used in dimensions – dimension line – extension line – arrow heads and leader – system of dimensions - method I and method II

1.6 Geometric construction

Construction of regular polygon given the length of its side - methods of inserting a regular Polygon in a given circle – construction of ellipse by different methods (eccentrically, concentric circle, parallelogram). Definition of involute, helix, parabola & hyperbola – Construction of cycloid helix, involute and parabola.

UNIT – II

2.1 Projection of points, lines and planes

Projection of points in different quadrants, projection of straight lines parallel to one or both planes, parallel to one plane –perpendicular to other – inclined to one plane and parallel to other line inclined to both planes (In first quadrant only)

Methods of finding true length and its inclination with the reference planes. Projection of planes – parallel to one plane and perpendicular to other plane (in first quadrant only)

UNIT - III

3.1 Orthographic projection of objects

Explanation of the meaning of orthographic projection using a viewing box and a model- number views obtained need of only three views for displaying the object. Concept front view, top view and side view-sketching these views for a number of engineering objects- explanation of the meaning of first angle and third angle projection – symbol of projection

UNIT - IV

4.1 **Sectional views of objects**

Need for sectional drawing of an engineering object- selection of the section plane to reveal the maximum information – sectional views (full and half section) of simple engineering objects.

4.2 **Auxiliary views**

Need of auxiliary views – auxiliary views given engineering drawings

UNIT - V

5.1 **Pictorial drawings**

Isometric projection, construction of isometric scales- isometric projection of simple Engineering objects

Oblique projection cavalier and cabinet of simple Engineering objects

5.2 **Visualization**

Preparation of pictorial views from a group of orthographic drawings

5.3 Perspective drawing

Principle of perspective projection – type of perspective projection – two-point perspective of a rectangular block and combination of two rectangular blocks of different sizes

5.4 **Development of surfaces**

Development of surfaces of simple engineering components trace-funnel, ducts-rectangular and square –hopper-90 degree Elbow

REFERENCE BOOKS

1. Engineering Drawing - N. D Bhutt
2. Engineering Graphics - K. C. John
3. Engineering Graphics - P. I. Varghese

SUBJECT TITLE : COMPUTER FUNDAMENTALS & PROGRAMMING IN C
SUBJECT CODE : GE 105
PERIODS/WEEK : 3
PERIODS/YEAR : 96

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I	1.1 Introduction to Computers	12
	1.2 Windows & Word Processing	6
	Test 1	2
II	2.1 Data Processing	5
	2.2 Problem solving methodology	11
	Test 2	2
III	3.1 Introduction to C Programming	12
	3.2 Programming practice	6
	Test 3	2
IV	4.1 Arrays, strings & functions	12
	4.2 Programming practice	6
	Test 4	2
V	5.1 Graphics in C	7
	5.2 Computer Networks	3
	5.3 Programming practice	6
	Test 5	2
	TOTAL	**96**

OBJECTIVES

UNIT – I

1.1.0 Know the application, classification and working of computers

1.1.1 Define a Computer
1.1.2 Discuss the various applications of computers
1.1.3 List the different classifications of computers based on processing methods
1.1.4 Describe the working of analog, digital and hybrid computers

1.2.0 **Appreciate the functions of hardware and software components**

1.2.1 Define hardware and software
1.2.2 Discuss about Instruction and program
1.2.3 Describe the hardware functional components of a digital computer with the help of a block diagram
1.2.4 List the functions of ALU, Memory, Input, Output Units and Control Unit
1.2.5 Define CPU and Microprocessor
1.2.6 List the classifications of computers based on capability
1.2.7 Describe micro, mini, mainframe and supercomputers in brief
1.2.8 Discuss machine language, Assembly language and high level language

1.2.9 List the different software components
1.2.10 Define system software and application software
1.2.11 Give examples for system software and application software
1.2.12 State the need for translators – assembler, compiler
1.2.13 Define operating system
1.2.14 List the functions of operating system
1.2.15 List the names of various operating system

1.3.0 **Appreciate the working of memory and input – output devices**
1.3.1 Define memory
1.3.2 Discuss the units' bit, byte, kilobyte, megabyte, gigabyte etc.
1.3.3 Discuss the characteristics of primary memory and secondary memory
1.3.4 Distinguish between sequential access memory and Random Access Memory
1.3.5 Differentiate between Read Only Memory and Read/Write memory
1.3.6 Discuss RAM & ROM
1.3.7 List the different types of ROM
1.3.8 List the different secondary memory devices
1.3.9 Discuss the working of floppy disk, magnetic tape, Hard disk, Compact disk (block diagrams and detailed description not necessary)
1.3.10 Discuss working of CDROM, CD-R, CD-RW & DVD (block diagrams and detailed description not necessary)
1.3.11 List the names of various I/O devices
1.3.12 Discuss input devices – Keyboard, mouse, scanner, Optical Character reader, Optical Mark reader, bar code reader, digitizer, light pen, joystick in brief (block diagrams and detailed description not necessary)
1.3.13 Discuss output devices – monitor, Printer, plotter (block diagrams and detailed description not necessary)
1.3.14 Describe the printers – Dot matrix printer, Inkjet printer, Laser printer in brief (block diagrams and detailed description not necessary)

1.4.0 Use the provisions of windows o s and word processing
1.4.0 Define Booting
1.4.1 Define Booting
1.4.2 Demonstrate the features of Windows Operating System
1.4.3 Operate various facilities in windows- 95 or higher version such as Desktop, icon, menu, folder, programs, screen saver, media player, shut down procedure
1.4.4 Discuss word processing
1.4.5 Prepare documents using WORD - create, format, save, print and open documents
1.4.6 Prepare presentations using power point – creation and use of slide show presentations

UNIT – II

2.1.0 Use data processing techniques and DBMS (not for theory exam)
2.1.1 Define Data, Database, and Database management system
2.1.2 Define Data, Database, and Database management system
2.1.3 State the need of spreadsheet
2.1.4 List the name of electronics spreadsheet and DBMS software packages
2.1.5 Use Excel for the creation, formatting, formula, save, print, open close and exit worksheets
2.1.6 Use Access for the creation, editing and querying of tables

2.2.0 Understand problem solving methodology
2.2.1 List the various steps involved in problem solving
2.2.2 Define what is an Algorithm
2.2.3 Write Algorithm for solving general and computer related problems
2.2.4 Define what is a Flow chart
2.2.5 Discuss the different flow-charting symbols

2.2.6 Draw flow chart for solving general and computer related problems
2.2.7 Define syntax and semantic of programming languages
2.2.8 List the name of two programming methods
2.2.9 Discuss the characteristics of procedural and object oriented programming languages
2.2.10 Give examples for procedural and object oriented language

UNIT – III

3.1.0 Use 'C' language in programming

3.1.1 Discuss the characteristic of C language
3.1.2 Describe the structure of a C program
3.1.3 State the need for header files, main ()
3.1.4 Discuss the basic data types in C –int., float, and double char
3.1.5 Discuss about identifiers, keywords and declaration of identifiers
3.1.6 Discuss about statements and compound statements
3.1.7 Describe briefly assignment, arithmetic operators, increment-decrement operators and arithmetic expressions
3.1.8 Discuss operator precedence and rules for evaluation of an expression
3.1.9 State the need of stdio.h
3.1.10 Discuss various input and output statements-printf(), scanf(), getchar(), Putchar (), getchar ()
3.1.11 Discuss the need of various control sequences and escape sequences
3.1.12 Write simple programs using input/output assignment and arithmetic statements
3.1.13 Describe the relational operators and relational expressions with their precedence in brief
3.1.14 Describe logical operators with their precedence in brief
3.1.15 Write programs with relational operators and logical operators

3.2.0 Prepare programs involving branching and looping statements

3.2.1 State the need for branching statements
3.2.2 Describe IF, IF ELSE statement, nested IF and IF Ladder
3.2.3 Describe the Switch Statement
3.2.4 Write Programs using IF Else and Switch statement
3.2.5 State the need for looping statements
3.2.6 Discuss the method of looping using While, Do and for loops
3.2.7 Write programs using While, Do and For loops

UNIT – IV

4.1.0 Create arrays and strings

4.1.1 State the need of arrays
4.1.2 Discuss the method declaring arrays and subscripting in arrays
4.1.3 Discuss the method of inputting, processing, and outputting values of array element
4.1.4 Write program for array processing
4.1.5 Write program for linear search and bubble sort
4.1.6 Discuss about multidimensional arrays
4.1.7 Write programs on multidimensional arrays, matrices manipulation
4.1.8 Discuss the declaration of character string
4.1.9 Discuss various string input and output functions – gets() and puts()

4.2.0 Understand functions in 'C' language

4.2.1 State the need for function
4.2.2 Compare user defined and library functions
4.2.3 Discuss the structure of a user defined function and its calling with or without parameters
4.2.4 Define void function
4.2.5 Describe various library functions – sin (), cos.(),tan(),exp(), abs(), log(),log10(), POW(), sqrt(), - strlen (), strcpy (), strcmp (), strcat ().
4.2.6 Write simple programs on functions and strings

UNIT – V

5.1.0 Use computer graphics in 'C' language to prepare programs

- 5.1.1 State the use of graphics.h
- 5.1.2 Define resolution
- 5.1.3 Discuss the functions initgraph(), setcolor(), setbkcolor(), putpixel(), line(), circle(), rectangle(), outtexty()
- 5.1.4 Write programs based on graphics

5.2.0 Understand new trends in information technology

- 5.2.1 Define the work 'multimedia'
- 5.2.2 Define the word 'multimedia'
- 5.2.3 Discuss the components required for a multimedia personal computer
- 5.2.4 Define computer network
- 5.2.5 Define LAN, WAN
- 5.2.6 Discuss the concept if Server and nodes
- 5.2.7 Discuss Internet, World Wide Web, and e-mail
- 5.2.8 Discuss Computer virus and anti-virus programs
- 5.2.9 Define artificial Intelligence and discuss its application fields

CONTENT DETAILS

UNIT – I Introduction to Computers & Word Processing

Introduction, application of computers, generations of computers, classification of computers – analog, digital, hybrid Computers, Structure of a computer - Hardware and Software components – Input unit, Output unit, ALU, Memory unit, Control unit, CPU, Microprocessor, micro, mini, supercomputers – machine languages, assembly languages, high level languages – system soft ware, application software – assembler, compiler, operating system – Types of memory – primary memory, secondary memory, sequential access , random access memory, RAM, ROM – magnetic tape, floppy, hard disc, compact disc – input devices, out put devices.

Practical sessions on Windows O/S, Word, Power point

UNIT – II Data Processing and Programming Methodology

Practical session on Electronic spread sheet and DBMS – EXCEL, ACCESS

Steps in problem solving – Algorithm, Flowchart- Flow chart symbols- examples syntax, semantics-types of high level languages – characteristics of high level languages - Types of high level languages – Examples – Procedural and object oriented programming languages

UNIT – III Introduction to C Programming

Characteristics of C-language – structure of a program header files, main (), Statements, compound statements, Data types – Keyword and variables, assignment operators, arithmetic operators, expressions, precedence of operators, order of evaluation – relational and logical operators - Input /out put statements -– control sequences – escape sequences – branching statements, if, if-else, switch – looping statements while, do, for statements.

Writing Sample programs – Practical session on programming

UNIT – IV Arrays and Functions

Arrays – declaration, processing, searching, sorting – linear search, bubble sort – multi dimensional arrays- matrix manipulations, character strings, string declaration, input/out put functions gets (), puts ()

User defined functions – library functions – structure of functions, calling functions, argument passing, void functions – mathematical and string library functions – math.h, stdio.h, string.h

Writing programs – Practical session on programming

UNIT – V Graphics and Networking

C-Graphics – resolution – graphics functions – initgraph (), setcolor (), setbkcolor (), putpixel (), Line (), circle (), rectangle (), out text (), outtextxy ()
Multimedia – Computer networking
LAN, WAN- Internet, modem, www-E-mail, computer virus, artificial intelligence.

REFERENCE BOOKS

1. Brian w. Kernigham and Dennys M. Ripchie The 'C' programming Language PHI
2. Hughes J. K. and Michton J. I. A structured approach to Programming PHI
3. Gottfried.B Theory and problems Programming with C TMH
4. E. Balaguruswamy Programming ANSI C TMH
5. Robert A. Radcliffe Encyclopedia C BPB

SUBJECT TITLE : MATERIAL SCIENCE AND PROCESSES
SUBJECT CODE : ME 101
PERIODS/WEEK : 4
PERIODS/YEAR : 128

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I	Engineering Materials & Properties	22
	Test – 1	1
II	Metals and alloys	24
	Test – 2	1
III	Metallurgy and heat treatment	22
	Test – 3	1
IV	Preparation of moulding and casting	25
	Test – 4	1
V	Mechanical working of metals	30
	Test – 5	1
	Total	128

OBJECTIVES

UNIT - I

1.1 **Understand the properties & testing of engineering materials**

- 1.1.1 Classify the different engineering materials
- 1.1.2 Explain different properties of materials
- 1.1.3 Explain material testing and its objectives
- 1.1.4 Explain destructive testing method
- 1.1.5 Explain with the aid of a neat sketch of tension and compression test
- 1.1.6 Draw and explain the stress strain diagram of ductile material
- 1.1.7 Explain the different hardness testing methods
- 1.1.8 Explain fatigue test
- 1.1.9 Explain creep test
- 1.1.10 Explain non-destruction testing method
- 1.1.11 Explain radiographic testing methods (x-ray, r-ray)
- 1.1.12 Explain ultrasonic inspection of metals
- 1.1.13 Classify organic and ceramic materials
- 1.1.14 State the application of natural & synthetic rubbers
- 1.1.15 List various thermoplastic and thermosetting plastics
- 1.1.16 Explain the merits and demerits of thermoplastics and thermosetting plastics
- 1.1.17 List various ceramic materials
- 1.1.18 Explain the properties and uses of ceramic materials

UNIT – II

2.1 **Understand the manufacturing of metals and alloys**

- 2.1.1 Classify the various metals
- 2.1.2 Classify the types of various cast iron
- 2.1.3 Explain white, malleable, grey and nodular cast iron
- 2.1.4 State the properties of the above cast irons
- 2.1.5 State the application with reason of above cast iron types
- 2.1.6 Draw the cupola furnace
- 2.1.7 Explain the preparation of cupola for changing
- 2.1.8 Explain the method of changing cupola
- 2.1.9 Explain different zones of cupola
- 2.1.10 Explain the operation of cupola
- 2.1.11 Classify the different types of steel
- 2.1.12 State the chemical composition of low carbon, medium carbon, high carbon, stainless steel, magnetic steel
- 2.1.13 State the specification for the above types of steel
- 2.1.14 Name the furnaces used for the steel production
- 2.1.15 Explain with sketches, the production of steel by Bessemer process, LD process, open health & electric furnace
- 2.1.16 Explain the BIS specification of steel
- 2.1.17 Explain the effect of alloying element in steel
- 2.1.18 Explain the properties of nickel, chromium, molybdenum, tungsten and nickel chromium, nickel chromium manganese (stainless steel)
- 2.1.19 List the industrial uses of above said steels
- 2.1.20 State the specification of above steels
- 2.1.21 List the need for the use of non ferrous metals and alloys in engineering operations
- 2.1.22 State the commercial specification of copper, tin, aluminum, zinc, lead, nickel and magnesium
- 2.1.23 State BIS specification of aluminum, copper etc mentioned above
- 2.1.24 Explain the use of bearing metals and nuclear engineering materials
- 2.1.25 List the composite materials
- 2.1.26 Explain the application and uses of composite materials
- 2.1.27 Explain briefly coal fired and oil fired accessible furnace

UNIT – III

3.1 Understand the different heat treatment processes

- 3.1.1 Explain the crystal growth and grain formation
- 3.1.2 Explain the effects on rate of cooling
- 3.1.3 Explain the effects of grain size on properties
- 3.1.4 Explain the method of controlling grain size
- 3.1.5 Explain the causes of plastic deformation & metals
- 3.1.6 Draw the cooling curve for pure iron and explain the characteristics
- 3.1.7 Draw the iron-carbon equilibrium diagram
- 3.1.8 Identify the various phases of iron-carbon equilibrium diagram
- 3.1.9 Explain the above equilibrium diagram
- 3.1.10 Identify the constituents of steel from the iron-carbon equilibrium diagram
- 3.1.11 Explain the effect of slow cooling for various composition
- 3.1.12 Explain the TTT diagram
- 3.1.13 Identify the need for the heat treatment process
- 3.1.14 List the various heat treatment process
- 3.1.15 Explain the process – annealing, hardening, tempering, normalizing, case hardening (cyaniding, nitriding and carbonizing)
- 3.1.16 Explain the residual stress due to heat treatment
- 3.1.17 Explain the method to relieve residual stresses due to heat treatment

UNIT – IV

4.1 Understand the properties of moulds and casting

4.1.1 Classify the different types of pattern
4.1.2 Sketch the different types of pattern
4.1.3 Explain the necessity of making different types of pattern
4.1.4 List the various pattern material and state the advantages and disadvantages
4.1.5 List and explain various pattern allowances
4.1.6 Explain the use of contraction seals
4.1.7 List and explain properties of moulding sand
4.1.8 List the types of moulding sand
4.1.9 List the ingredient of sand
4.1.10 State the use of cases and explain the case making operation
4.1.11 Mention the uses of chaplets
4.1.12 List the method of moulding
4.1.13 Explain different method of moulding
4.1.14 Identify different moulding operation
4.1.15 Explain the moulding operation using Jolt and Squeezer machine
4.1.16 Explain the pouring techniques of molten metal
4.1.17 Mention the function of risers
4.1.18 Indicate the location of risers in a mould
4.1.19 Identify the importance of chill
4.1.20 List the characteristic of sand pasting
4.1.21 State the importance of permanent mould casting and mention its limitation
4.1.22 Name the types of mould used for aluminum casting
4.1.23 State the various in gradients for a variety of alloy such as brass and gun metal, bell metal, and bronze
4.1.24 List the cleaning methods of casting and explain it
4.1.25 List the special types of casting
4.1.26 List the steps of die casting processes
4.1.27 State the processes of gravity die casting and pressure die casting
4.1.28 Draw and explain goose neck type, direct injection and cold chamber machine
4.1.29 Explain the process of slush casting, vacuum casting, steal moulding, plaster moulding and centrifugal casting.
4.1.30 State the advantages and limitation of above castings

UNIT – V

5.1 Understand the mechanical working of metal

5.1.1 Classify mechanical working of metals
5.1.2 Identify the purpose of mechanical working of metal
5.1.3 Define the cold working and hot working
5.1.4 Identify the advantages and disadvantages of cold working
5.1.5 State the effects due to cold working on metals
5.1.6 Explain briefly with line sketches the working of bench, inclined, gap, and arch presses for cold working
5.1.7 List the cold working operations
5.1.8 Explain the cold working operations
5.1.9 List the hot working operations
5.1.10 State the effects on metals due to hot working
5.1.11 Explain the hot working operations
5.1.12 List the advantages and limitations of hot and cold working
5.1.13 Name the types of forging
5.1.14 Explain the difference between Hand forging and Machine forging
5.1.15 List the forging operations
5.1.16 Explain the forging operations
5.1.17 List the defects in forging and explain its causes
5.1.18 Identify the defects due to improper heating and cooling

CONTENT DETAILS

UNIT – I:

ENGINEERING MATERIALS AND PROPERTIES

Classification of Materials and Properties

Metallic and non-metallic properties such as: - Mechanical, strength, hardness, toughness, brittleness, creep, fatigue, stiffness, ductility, malleability, elasticity and plasticity.

Electrical Properties: - Resistance and Resistivity, conductance and conductivity, capacitance.

Magnetic properties: - Magnomotive force, rellectance, permeance, hysterisis

Thermal properties: - Specific heat, thermal conductivity, thermal resistance, and thermal diffusivity.

Chemical properties: - Corrossion resistance, acidity and alkalinity.

Physical properties: - density, viscosity, colour, finish, porosity.

Testing of Engineering Materials

Destructive testing: - tension and compression test

Hardness test: - Brinell, rock well, Vickers – impact test, fatigue test and creep test

Nondestructive testing: - Radio graphic, ultrasonic inspection,

Organic and ceramic materials.

Introduction, classification of rubber: - natural and synthetic rubber,

Plastic: - thermosetting and thermoplastic with examples – requirements of plastic and elastimers and their uses.

Classification of ceramics – properties and uses – glass building stone, refractory materials, abrasive – materials, concrete.

UNIT – II:

METALS AND ALLOYS

Introduction - Classification of cast iron: - White, malleable, gray and nodular cast iron – properties – application with reasons – brief explanation with sketch of cupola furnace.

Alloy Steel: - Classification: - Low carbon, medium carbon, high carbon, high speed steel, stainless steel, magnetic steel.

Chemical Composition – BIS specification – effect of alloying element in steel.

Manufacturing of steel: - Bessemer process, LD process, open hearth process and electric furnace. (Brief explanation with line diagram)

Non ferrous metals and alloys: - Need of non ferrous metals and alloys in engineering application – commercial and BIS specification of copper, aluminium, tin, zinc, lead, nickel and magnesium – brief explanation of bearing metals and nuclear engg: materials.

Composite Materials – Application and uses – brief explanation of crucible furnace. (Coal fired and oil fired).

UNIT – III:

METALLURGY AND HEAT TREATMENT

Crystallization – crystal growth – grain formation – grain growth – elastic and plastic deformation – influence on rate of cooling – effect of grain size on properties – grain size – cooling curve for pure iron – study of iron carbon equilibrium diagram – TTT diagram.

Heat treatment of metals: - Annealing, normalizing, tempering, hardening, case hardening such as: - cyaniding, nitriding, carbonizing – defect in steel due to faulty heat treatment

Residual stresses: - Causes of residual stresses from heat treatment, methods of relieving stresses.

UNIT – IV:

PREPARATION OF MOULDS, AND CASTINGS

Pattern making: - Classification of patterns such as: - Single piece patterns, split patterns, gate patterns, sweep patterns, loose piece patterns.

Materials for patterns: - Qualities, advantages and disadvantages.

Pattern allowances: - Shrinkage allowances, draft allowance, distortion allowance, raping allowance

Use of contraction scale in pattern making shop foundry: - Properties of moulding sand such as: - permeability, plasticity, adhesiveness, cohesiveness, porosity, refractoriness.
Types of moulding sand: - Green sand, dry sand, parting sand, loom sand, facing sand and core sand – their ingredient and use.
Core making – use of core – use of chaplets
Methods of moulding: - Bench moulding, pit moulding, floor moulding and sweep moulding
Machine moulding: - Jolt machine, squeezer machine.
Casting: - Furnaces casting – pouring and feeding – proper pouring techniques – functions of risers and placement – importance of chiller.
Types of Castings: - Sand casting, permanent mould casting
Non ferrous casting: - Aluminium foundry practice – melting methods – allaying principles – casting alloys – special casting alloys such as: - brass, gunmetal, bell metal, bronze.
Cleaning of casting: - Cut off, trimming shot and sand blasting – safety precaution in casting
Special casting: - Die casting, gravity die casting, pressure casting – description and functions of goose neck type, direct injection and cold chamber machine – advantages and disadvantages of slush casting – vacuum casting – steel moulding – plaster moulding – centrifugal moulding.

UNIT – V:
MECHANICAL WORKING OF METALS

Hot working and cold working

Cold working: - effect of cold working, advantages and limitations, processes for cold working: - bench, inclined, gap and arc press (brief explanation)
Cold working operation: - (1) drawing: - deep drawing, wire and tube drawing, metal spinning, stretch forming
Squeezing: - rolling, upsetting
Bending
Shearing: - cutting off, blanking
Extruding: - cold, impact
Hot working operations: - (1) Rolling (2) piercing (3) drawing (4) spinning (5) extruding.
Compare between hot and cold working operation – machine forging: - working principle with diagram
Type of forging: - Hand forging, machine forging
Forging operations: - upsetting, drawing down, setting down, punching, bending, cutting & forge welding.
Defects in forged joints: - Mismatch, scale pits, unfilled section, defects due to improper heating and cooling.

SUBJECT TITLE : APPLIED SCIENCE LAB - PHYSICS
SUBJECT CODE : GE 106 A
PERIODS/WEEK : 2
PERIODS/YEAR : 64

LIST OF PRACTICAL EXPERIMENTS – PHYSICS

1. Vernier Calipers
2. Screw Gauge
3. Common balance
4. Simple Pendulum
5. Hooke's law
6. Moment bar
7. Inclined Plane
8. Concurrent forces (Mass of the body)
9. Hare's apparatus
10. U-tube
11. Quill tube
12. Resonance column
13. Diode Characteristics
14. Convex lens
15. Ohm's law

SUBJECT TITLE : APPLIED SCIENCE LAB – CHEMISTRY
SUBJECT CODE : GE 106 B
PERIODS/WEEK : 2
PERIODS/YEAR : 64

OBJECTIVES

I. **VOLUMETRIC ANALYSIS**

1.1 Acidimetry Alkalimetry

1.1.a Determine the strength of the given hydrochloric and solution using a standard solution of sodium hydroxide and calculate the amount of HCI in a given volume

1.1.b Determine the strength of given sulphuric acid solution using a standard solution of sodium carbonate. Calculate the amount of sulphuric acid and in a given volume

1.1.c Determine the strength of given sodium hydroxide solution given a standard solution of sodium carbonate using a link solution sulphuric acid/hydrochloric acid. Calculate the amount of sodium hydroxide in a given volume

1.1.d Determine the strength of given nitric acid solution given a standard solution of oxalic acid using link solution sodium hydroxide/potassium hydroxide. Calculate the amount of nitric acid in a given volume.

1.2 Permanganometry

1.2.a Determine the strength of given potassium permanganate solution using a standard solution of ferrous ammonium sulphate

1.2.b Determine the strength and calculate the amount of crystalline ferrous solution

1.3 Hardness estimation

1.3.a Determine the degree of hardness of a given sample of hard water using a standard solution of EDTA.

II. pH DETERMINATION

2.1.1 Determine the pH of three different solutions using pH meter

2.1.2 Determine the pH value of three different solutions using universal indicator

2.1.3 Determine the pH value of three different solutions using pH test paper

III. PREPARATION OF STANDARD SOLUTIONS

3.1.1 Weigh accurately a crystalline substance using a chemical balance

3.1.2 Prepare a standard solution of sodium carbonate by weighting out accurately solid sodium carbonate and making it into a definite volume

3.1.3 Prepare a standard solution of oxalic acid when oxalic acid crystals are given.

CONTENT DETAILS

I. **VOLUMETRIC ANALYSIS**

1.1 Acidimetry Alkalimetry
   a) Estimation of Hydrochloric acid
   b) Estimation of Sulphuric acid
   c) Estimation of Sodium hydroxide given standard sodium carbonate solution
   d) Estimation of Nitric acid given standard sulphuric acid solution

1.2 Permanganometry

1.3 Estimation of potassium permanganate

1.4 Estimation of crystalline ferrous sulphate

1.5 Estimation of sodium hydroxide, given standard ferrous salt solution

1.3 Hardness estimation
Estimation of total hardness of water – using standard EDTA solution

II. pH DETERMINATION

2.1 Determination of pH using pH meter

2.2 Determination of pH using universal indicator, pH test paper.

2.3 Determination of pH using pH test paper.

III. PREPARATION OF STANDARD SOLUTION

3.1 Preparation of a standard solution of sodium carbonates

3.2 Preparation of a standard solution of oxalic acid

REFERENCE BOOKS

A.O. Thomas & Mani Practical Chemistry for B.Sc. main

SUBJECT TITLE : WORKSHOP PRACTICE – I
SUBJECT CODE : ME 102 / EE 102/TT102
PERIODS/WEEK : 6
PERIODS/YEAR : 192

TIME SCHEDULE

UNIT	TOPIC		PERIODS
I	Carpentry and pattern making		45
		Test – I	3
II	Fitting		45
		Test – II	3
III	Smithy		45
		Test – III	3
IV	Foundry		45
		Test – IV	3
		Total	**192**

Note: A Workshop Practice Record should be prepared and certified by the authority.

OBJECTIVES

Upon completion of the course of study, the student should be able to:

Perform various exercises as per the given drawing and specifications
- Identify the required tools from a given number of tools
- Select particular tool for a specified operation
- Locate the functional part of equipments and tools
- Explain the use of tools and equipment
- Prepare the edges/work piece as per drawing standard
- Set up the job as per the procedures of operation
- Perform various steps as per the procedure
- Inspect the job for achievement of accuracy and finish
- Clean the tools, instruments and work place
- Return the tools, instrument as per regulations
- Exhibit safety precautions

CONTENT DETAILS

UNIT – I: CARPENTRY AND PATTERN MAKING

Introduction, objectives, safety in the Carpentry shop

Familiarization of tools

Marking and measuring tools such as straight edge, meter square, tri square, bevel square, combination square, marking knife, marking gauge, mortise gauge, cutting gauge, wing compares, trammel divides, outside and inside calipers, spirit level and plumb bob.

Cutting tools such as Rip saw, Cross cut saw, panel saw, tenon saw, bow saw, compass saw, key hole saw, firmer chisel, bevel edge firmer chisel, parting chisel, mortise chisel, jack plane, wooden and metal, trying plane, smoothening plane, rebate plane, plough plane, router plate, spoke shave.

Boring tools such as Bradawl ratchet brace, wheel brace, shell bit fostries bit, counter sunk bit.

Striking tools such as mallet etc

Holding devices – Bench vice, bench stop, sash clamp, G-clamp, hard screw.

Miscellaneous tools – Rasp and file, scraper, glass paper, pincers, ratchet and cabinet type screw drivers.

Timber – Structure of wood

Classification of timber – soft wood and hard wood

Seasoning of wood – air, water, electrical and kiln method

Defects in timber – natural, fungi insects, seasoning, manufacturing

Carpentry Practice

Marking, sawing, planning, chiseling, grooving, rebating exercises

Preparation of carpentry joints

Making utility models (group activity)

Repair of furniture

Pattern Making

Study of various pattern making tools such as contraction scale divides, Trammels, Calipers, Pinch dogs, Bradawl, Fillet, Iron, Gauge Practice work – Prepare Pattern from blue prints.

UNIT – II: FITTINGS

Introduction, objectives

Familiarization of tools

Hard tools, Marking tools – scribes, compass, dividers, out side and inside caliper, jenny caliper, ordinary scribes block, universal scribing block, angle plate, V-block, center pinch, prick pinch, try square, bevel square, surface plate, straight edge.

Cutting tools – chisels – flat, crosscut, half round, diamond point, side chisel.

Files – single cut and double cut files rough, bustard, second cut, smooth

Dead smooth files – flat, square, pillar, round triangular, half round, knife and needle files.

Scribers – Neck saw – solid and adjustable frames – blades – cutting with point rack saw

Drill – flat, straight, fluted, twist dull, taper and straight drills

Reamers – hovel, expansion and machine reamers

Taps -rough, intermediate and finishing taps tap wrenches. Dies–solid split and adjustable dies, stocks

Striking tools: ball peen, straight peen, cross peen and double-faced hammers

Holding devices-vice-bench, leg, pipe, hand pin and tool makers vice

Marking tools – scriber – ordinary and universal scribing block, center and prick pinch. Angle plate, v-block, Tri Square, surface plate

Miscellaneous tools – screwdrivers, plane spanner, double adjustable and box spanners – ring spanner

Fitting Practice

Cutting, Chipping, filling, scribing, drilling, reaming, tapping, and dieing exercises

Making of utility models (group activity), Making, measuring and checking instruments are to be used during working

UNIT – III: SMITHY

Familiarization of Smithy tools

Hand tools – anvil swage block, hammers such as ball pein, straight peen, cross peen and sledge hammers. Tongs such as flat, hallow, cold and hot chisels, swages, fullers, flatters, set hammers, pinch and drift.

Equipment: Open and closed hearth, heating furnaces, hand and power driven blowers, open and stock fire fuels such as charcoal, coal, oil and gas

Workshop Practice

Building fire in the furnace, Upsetting, bending, drawing, setting down, pinching, cutting and welding exercises, Preparation of utility article like bolts, tongs, spanners

UNIT – IV: FOUNDRY AND CASTING

Familiarization of tools

Hand tools – shovel, riddle, hammers, trowels, relic, lifters, strike off bar spruce, balloons, swab, gate cutter, mallet, vent rod, draw spike, lifting plate, pouring weight, gaggers, clamps.

Practice

Preparation of moulding sand, Prepare moulds of different types using different patterns, Non-ferrous metal casting using simple patterns

SUBJECTS OF STUDY AND SCHEME OF EVALUATION

SEMESTER III

Branch : Mechanical Engineering

Code	Subject	Periods Per Week			Evaluation (Marks)			
		Theory	Practical	Total	Theory	Practical	Internal	Total
ME 301 / TD 301 /WT 301	Applied Mechanics & Strength of materials	6		6	75		25	100
ME 302 / TD 302 / AU302	Fluid Mechanics & Pneumatics	5		5	75		25	100
ME 303/ TD 303 / AU 303	Electrical & Electronics Engineering	5		5	75		25	100
ME 304/AU 304 /WT304	Machine Drawing	1	3	4	75		25	100
ME 305	Electrical Technology Laboratory		3	3		75	25	100
ME 306	Material Testing Laboratory		3	3		75	25	100
ME 307	Workshop Practice -II		6	6		75	25	100
	ISAP* Skills Development		3	3				
	TOTAL	**17**	**18**	**35**	**300**	**225**	**175**	**700**
	***Information Search Analysis and Presentation**							

SUBJECT TITLE : APPLIED MECHANICS & STRENGTH OF MATERIALS
SUBJECT CODE : ME 301/TD 301 /WT 301
PERIODS/WEEK : 6
PERIODS/SEMESTER : 96

TIME SCHEDULE

UNIT	TOPIC		PERIODS
I	1.1 Direct Stresses		11
	1.2 Thermal Stresses		8
II	2.1 Friction		9
	2.2 Geometrical Properties of Sections		10
		Test – I	1
III	3.1 Riveted joints		5
	3.2 Welded joints		4
	3.3 Thin Cylinders		4
	3.4 Torsion and Springs		6
		Test – II	1
IV	4.1 Shear Force and Bending Moment		18
V	5.1 Deflection of beams		9
	5.2 Columns		9
		Test – III	1
			96

OBJECTIVES

UNIT – I

1.1.0 Apply the theory of direct stresses on members of machines and structures

1.1.1 Define the terms tensile and compressive loads, stresses and strains – longitudinal strain lateral strain – Poisson's ratio
1.1.2 Define elastic limit
1.1.3 State Hook's law
1.1.4 Explain Young's modulus
1.1.5 Compute shear stress and shear strain – modulus of rigidity
1.1.6 Compute volumetric strain – Bulk modulus – state relation between E.C.K (No proof)
1.1.7 Solve simple problems of longitudinal strain – lateral strain – Poisson's ratio, Young's modulus of materials for bars of solid, composite and varying sections
1.1.8 Draw stress strain curve for mild steel under tension and identify the significant points
1.1.9 Draw stress strain curve for a brittle material and compare with stress strain curve of mild steel
1.1.10 Calculate ultimate stress, working stress, factor of safety, elastic limit
1.1.11 State typical values of ultimate stress, young's modulus and Poisson's ratio for material like mild steel, cast iron and concrete

1.1.12 State the main factors, which affect the factor of safety and typical values of factor of safety for different materials and conditions

1.2.0 Apply the effect of stress due to change in temperature of materials

1.2.1 Define temperature stress

1.2.2 Define linear coefficient of expansion and state its typical values for material like mild steel, copper, brass

1.2.3 Find the magnitude and nature of stresses in a bar of uniform section when it is prevented from expansion or contraction partially or totally by end grips

1.2.4 Calculate the load on the end grips

1.2.5 Calculate the magnitude and nature of temperature stress induced in a composite bar made of two materials only

UNIT – II

2.1.0 Interpret the laws of friction

2.1.1 State the laws of friction

2.1.2 Explain limiting friction

2.1.3 Explain coefficient of friction, angle of friction and cone of friction

2.1.4 Explain sliding friction, rolling friction, and pivot friction

2.1.5 Analyse the equilibrium of a body on an inclined plane-moving up and down the plane

2.1.6 Solve simple problems based on the laws of friction

2.1.0 Understand the geometrical properties of section of machine parts and structural members

2.2.1 Define centroid, center of gravity, moment of inertia and radius of gyration

2.2.2 Locate the centroid of rectangle, triangle, circle and semi circle and their combinations, cut outs

2.2.3 Derive the expression for the moment of inertia about horizontal centroidal axis for rectangle and triangle

2.2.4 Derive the expression for polar moment of inertia of the section of solid or hollow cylindrical shafts

2.2.5 Derive the moment of inertia of a circle about axes

2.2.6 Prove parallel axis theorem and perpendicular axis theorem and apply them in problems

2.2.7 Calculate the moment of inertial and radius of gyration of standard section like triangle, T and channel about centroidal axis

UNIT – III

3.1.0 Compute the strength and efficiency of riveted joints

3.1.1 Sketch the different types of riveted joints and state their empirical proportions

3.1.2 State types of failure of rivets and plate

3.1.3 Define plate value, rivet value, strength and efficiency of riveted joints

3.1.4 Calculate strength and efficiency of single and double riveted lap joint and but joint

3.1.5 Design riveted joints – single, double, lap and butt

3.1.6 Explain with the aid of sketches the purpose and procedure of caulking and fullering

3.2.0 Compute the strength and efficiency of welded joints

3.2.1 Sketch different types of welded joints between flats plates

3.2.2 State the advantages and disadvantages of welded joints over riveted joint

3.2.3 Calculate the strength of single and double transverse fillet weld, parallel fillet weld, plug

3.2.4 weld, combination of transverse and parallel weld and butt welds

3.3.0 Compute the thickness of thin cylinders for various stress conditions

3.3.1 State failure of thin cylindrical shell due to an internal pressure

3.3.2 Define stresses in a thin cylinder subjected to an internal pressure

3.3.3 Calculate thickness of cylinder

3.4.0 **Apply the theory of torsion on shafts, springs**

3.4.1 Derive the torsion equation and state the assumptions

3.4.2 Define polar moment of inertia – Simple problems on Solid shaft and hollow shaft

3.5.0 Understand the effect of forces on springs

3.5.1 Mention the desirable properties of spring materials

3.5.2 Distinguish between closely coiled and open coiled helical spring

3.5.3 Define the terms spring index and stiffness. Calculate the stress induced, length, diameter, number of turns deflection and stiffness of closely coiled helical spring

UNIT – IV

4.1.0 Compute the shear force and bending moment at any section of a horizontal beam carrying vertical loads

4.1.1 bending moment, shear force, neutral layer neutral axis, bending stress, point of contra flexure, point load and U.D. load

4.1.2 Draw bending moment and shear force diagram for S.S.B and cantilever carrying UD load and point load and mark the salient points and values

4.1.3 Draw SF and BM diagram for overhanging beams and locate the point of contra flexure

4.1.4 State the assumptions made in simple bending theory

4.1.5 Derive the bending equation and apply it to calculate maximum bending stress, maximum permissible load and dimension of the beam

4.1.6 Calculate the Shear force and Bending moment at any section of a Horizontal Beam carrying vertical loads

4.1.7 Mention the purpose of reinforcement in R.C.C

UNIT – V

5.1.0 Compute deflection and slope of beams

5.1.1 Define the slope and deflection

5.1.2 Calculate the maximum deflection at the center and slope at the supports of S.S.B carrying UD load through out the length and/or point load at the center using formulae

5.1.3 Calculate the maximum deflection, its position and deflection under the load for SSB carrying one eccentric load

5.1.4 Calculate, using the formula, the slop and deflection at the free end of a cantilever carrying concentrated loads and partial or complete UD loads

5.1.5 State the advantages of fixed beams and continuous beams

5.2.0 Apply the theory of axial loads

5.2.1 Distinguish between long and short columns

5.2.2 State Euler's formulae and Rankine's formula

5.2.3 Define the terms effective length slenderness ratio buckling

5.2.4 State the limitation and advantages of Euler's formulae and Rankine's formulae

5.2.5 Calculate the load on columns using the two formulae under different end conditions.

CONTENT DETAILS

UNIT – I

Direct Stresses

Types of loading – axial loads – tensile and compressive – stresses and strains, longitudinal and lateral strain, Poisson's ratio – Elastic limit – Hooks law and Young's modulus. Shear stress and shear strain – rigidity modulus – volumetric strain, bulk modulus. Principle of super position – stresses in varying section – stresses in composite section. Problems of effect of axial load on lateral and linear dimension – solid hollow and composite sections of uniform area and varying sections – behaviour of mild steel under tension – stress strain curve – limit of proportionality – elastic limit – yield point – ultimate stress – working stress – factor of safety – factors affecting factor of safety – comparison of stress strain curve of a mild steel and a brittle material – problems of Young's modulus, factor of safety, ultimate stress, yield point stress, working stress.

Thermal Stress

Nature and magnitude of stresses due to change in temperature. - Total or partial prevention of expansion and contraction – temperature stress on composite bar.

UNIT – II

Friction: - Introduction

Explanation of the type of friction – static friction, dynamic friction, limiting friction, angle of friction, coefficient of friction, cone of friction, sliding friction, rolling friction, laws of friction. Equilibrium of a body on a horizontal plane on a inclined plane – force acting along the inclined plane (no proof). Force acting horizontally (no proof), force acting at some angle with the inclined plane. (No proof)

Geometric Properties of Sections

Centroids of plane figures – methods for center of gravity – simple sections – combinations – remainder (cut out sections). Moment of inertia of a plane figure and radius of gyration about a given axis – modulus of section – methods to find MI – Routh's rule, method of integration. Moment of inertia of rectangle, square, triangle, circle and semi circle about horizontal centroidal axis, composite sections, parallel axis theorem and perpendicular axis theorem.

UNIT – III

Riveted joints

Types – lap, butt, single cover, double cover, single, double, multiple, chain, zigzag, diamond – empirical proportions – diameter of rivet, plate thickness, margin, pitch – rivet materials. Types of failure – rivets – by crushing and shearing – failure of plate by tearing – strength and efficiency of joints – design of joints – lap and butt, single and double riveted, single and double cover joint – caulking and filtering operations

Welded joints

Advantages and disadvantages – types fillet and butt welds – strength of welded joints – fillet and butt, transverse single and double rows – parallel welds – combination of transverse and parallel welds – butt welds (flat plates only)

Thin Cylinders

Types of failures two troughs, two cylinders, hoop stress – longitudinal stress – calculation of thickness and pressure

Torsion and springs

Torsional shear stress – torsional stress and strains – polar moment of inertia (with derivations)

Springs

Introduction – stiffness of a spring – types of spring – leaf spring – helical springs – closely coiled and open coiled helical spring with round wire – properties of spring materials – closely – coiled helical springs – subjected to an axial load, an axial twist – stress induced – length – number of turns pitch deflection – stiffness – diameter (No derivations)

UNIT – IV

Shear force and bending moment

Types of beams – cantilever – S.S.B – over hanging beams, fixed beams and continuous beams – types of loads – concentrated, uniformly distributed, uniformly varying – shear force and bending moment diagrams – cantilever beams – point load, UD load, combination of point load and UD load. Simply supported beam – point load, UD load, combination of point load and UD load – maximum bending moment – over hanging beams – point load, UD load, combination of point and UD load, point of contraflexure – theory of simple bending – assumptions and derivation – bending stress. Position of neutral axis – moment of resistance – bending stress distribution across the section in symmetrical sections – section modulus – rectangular and circular sections – applications – simple problems.

UNIT – V

Deflection of beams

Relation between slope, deflection and radius of curvature – simply supported beam with central point load (no proof) – simple problems – SSB with an eccentric point load (no proof) – SSB with UD load (no proof) – simple problems – cantilever with a point load at the free end (no proof) – cantilever with point load not at the free end – cantilever with a UD load partially or complete (no proof) – problems – advantages of fixed beams and continuous beams.

Columns

Introduction – effect of axial load on columns – definitions – column, strut, slenderness ratio, buckling factor, buckling load or crippling load, safe load – types of columns – short column, medium size column, long column – Euler's equations and its assumption for crippling load for different End conditions (no proof) – both end hinged – one end is fixed and other is free, one end is fixed and other is hinged, both ends fixed – limitation of Euler's equation – equivalent length – Rankin's formulae – application – advantages.

REFERENCE BOOKS

1. Strength of Materials – R.K. Rajput
2. Strength of Materials – Dr. R.K.Bansal
3. Strength of Materials – R.S. Khurmi
4. Applied Mechanics – R.S. Khurmi

SUBJECT TITLE : FLUID MECHANICS AND PNEUMATICS
SUBJECT CODE : ME 302 / TD 302 / AU 302
PERIODS/WEEK : 5
PERIODS/SEMESTER : 80

TIME SCHEDULE

UNIT		TOPIC	PERIODS
I	1.1	Introduction	1
	1.2	Properties of Fluids	4
	1.3	Fluid pressure and its measurements	8
	1.4	Buoyancy and Floatation	3
II	2.1	Kinematics and Dynamics of Fluid flow	7
	2.2	Flow through Orifices, Notches, Pipes and Nozzles	8
		Test – I	1
III	3.1	Fluid Power	3
	3.2	Hydraulic system	5
	3.3	Hydraulic Control elements and components	5
	3.4	Hydraulic Circuits	3
		Test – II	1
IV	4.1	Pneumatic System	4
	4.2	Pneumatic Control elements and Components	6
	4.3	Pneumatic Circuits	5
V	5.1	Hydro Pneumatic system	5
	5.2	Electrical Control of Fluid Power	5
	5.3	Micro-electronic control of fluid power	5
		Test – III	1
		Total	80

OBJECTIVES

Upon completion of the study of this subject, the student should be able to:

UNIT – I

1.1.0 Know the areas of application of Hydraulics and the Associated Machines in Engineering

1.1.1 Explain the areas of application of Hydraulics

1.1.2 Explain various Hydraulic and Pneumatic Machines in the areas of transfer of motion, force multipliers and conversion of energy from one form to other like hydraulic press, machine tools, turbines and pumps

1.2.0 Appreciate the properties of Hydraulic Fluids

1.2.1 Explain the various properties of commonly used hydraulic fluids

1.2.2 Solve the problems to calculate various property values

1.3.0 Understand Fluid Pressure and the methods to Measure it

1.3.1 Explain the terms pressure and pressure head and solve problems on these

1.3.2 State and explain Pascal's law

1.3.3 Explain Absolute, Gauge, Atmospheric and Vacuum pressure and Solve simple problems on those
1.3.4 State the fundamental principles of pressure measuring devices balancing by liquid columns and balancing by spring or dead weight
1.3.5 Explain and illustrate the principle of working of piezometer, simple U-tube manometer, differential manometer, inverted differential manometer bourdon's tube pressure gauge
1.3.6 Calculate pressure and difference of pressure using manometer readings and other data
1.3.7 Explain the term total pressure
1.3.8 Derive equations for total pressure on an immersed surface in positions of horizontal, vertical and inclined
1.3.9 Solve problems to compute the total pressure of 1.3.8

1.4.0 Understand Buoyancy and Metacenter and Equilibrium of Floating Body

1.4.1 State Buoyancy and Centre of Buoyancy
1.4.2 Explain Equilibrium of floating bodies and its types- Stable, unstable, Neutral Equilibrium
1.4.3 Explain Metacentre and metacentric Height

UNIT – II

2.1.0 Understand the Principles Kinematics and Dynamics of Fluid Flow

2.1.1 Explain the term Kinematics
2.1.2 Explain the types of fluid flow – steady and unsteady flow, uniform and non-uniform flow, Laminar and Turbulent flow, compressible and incompressible flow – rotational and Irrotational flow, one dimensional flow, two dimensional flow, and three dimensional flow
2.1.3 Explain Discharge
2.1.4 Explain the equation for continuity of flow
2.1.5 Solve simple problems on 2.1.3 and 2.1.4
2.1.6 Explain the term Hydro Dynamics
2.1.7 Explain the energies possessed by a liquid particle that is potential, kinetic and pressure
2.1.8 Define total energy and total head
2.1.9 State Euler's equation of motion
2.1.10 State and prove Bernoulli's equation from Euler's equation
2.1.11 State the limitations of the Bernoulli's theorem
2.1.12 Solve problems using Bernoulli's equation
2.1.13 Explain practical applications of Bernoulli's equation venturi meter and solve problems using it
2.1.14 Sketch a pitot tube and explain how it is used to measure the velocity of a flowing liquid

2.2.0 Appreciate the Flow of Liquids through Orifices, Notches and Pipes

2.2.1 Explain Orifices, types of Orifices, point of venacontracta and Hydraulic coefficients Cc, Cv and Cd
2.2.2 Solve simple problems of hydraulic coefficients
2.2.3 Explain Notches, types of Notches
2.2.4 Derive the equation for discharge over rectangular Notch, Triangular Notch and Trapezoidal Notch
2.2.5 Mention the advantages of Triangular Notch over a Rectangular Notch
2.2.6 Define coefficient of discharge of a Notch
2.2.7 Solve simple problems on 2.2.3 and 2.2.5
2.2.8 Explain losses of head in pipes and identify Major losses and Minor losses
2.2.9 Explain the significance of losses of head due to friction in pipe flow
2.2.10 Derive Darcy's formulae and Chezy's formulae for loss of head in pipes and explain the terms hydraulic mean depth and hydraulic gradient

2.2.11 Solve the problems on 2.2.10
2.2.12 Explain Hydraulic gradient line and total energy line
2.2.13 Derive the equation of loss of head due to sudden enlargement and loss of head due to sudden contraction loss head at the entrance in a pipe and loss of head at the exit of a pipe
2.2.14 Solve the problems on 2.2.13
2.2.15 Explain transmission of power though pipes and derive the equation for power transmitted through a pipe
2.2.16 Solve simple problems on 2.2.15
2.2.17 Explain water hammer

UNIT – III

3.1.0 Understand the Fluid Power Technology

3.1.1 Understand the basic law
3.1.2 Identify the applications of fluid power
3.1.3 Understand the types of hydraulic fluids used in Industrial applications
3.1.4 Know the essential properties of the fluids

3.2.0 Identify the elements of Hydraulic System

3.2.1 Classify the pumps
3.2.2 Identify Positive displacement pumps
3.2.3 Explain the working principle of Positive displacement pumps
3.2.4 Describe gear pumps, vane pumps, piston pumps
3.2.5 Explain the Type of Hydraulic Actuators – Rotary (Hydraulic motor) – Semi-rotary-linear motion type (Hydraulic cylinders)

3.3.0 **Understand the various control elements of various hydraulic control System**

3.3.1 Describe the working principle of different control valves – pressure control valves, direction control valves and flow control valves
3.3.2 Know the applications of valves
3.3.3 Classify various types seals, materials for seals ,
3.3.4 Types of filters, necessity of filtration of fluids
3.3.5 Describe the types of accumulator
3.3.5 Identify the purpose of accumulators

3.4.0 **Know the hydraulic circuits**

3.4.1 Describe deceleration circuit – intensifier circuit – regenerative circuit – synchronizing circuit
3.4.2 Describe the multiple circuitry used for lifting fork lift
3.4.3 Describe Automatic cylinder reciprocating circuit – double sequencing circuit Safety circuit
3.4.3 Describe hydraulic circuit for robotic arm

UNIT – IV

4.1.0 Understand the basic concept of pneumatic system

4.1.1 Compare Pneumatic system with hydraulic system
4.1.2 Identify standard pneumatic symbols
4.1.3 Know the basic component of pneumatic system – air filters, pressure regulator – lubricator – mufflers

4.2.0 Understand pneumatic control elements and components

4.2.1 Explain with sketches pneumatic valves – direction control valves- pressure control valve and flow control valves
4.2.2 Describe the pneumatic actuators – pneumatic cylinders, air motors – types applications

4.3.0 Understand the simple pneumatic circuit

4.3.1 Describe the principle of power operated holding devices, chuck, mandrel, collet clamping circuits

4.3.2 Describe pneumatic safety circuits for protection against pressure drop – overloads – interlock for machine protection, emergency reversal

4.3.3 Explain with sketches of material handling circuits – both semi-automatic and automatic

UNIT – V

5.1.0 Understand the working of Hydro pneumatic system

5.1.1 Compare hydraulic, pneumatic and hydro pneumatic systems

5.1.2 State the advantage and application system of air and Oil

5.1.3 Explain the principle of working of air controlled valves and oil controlled valves

5.1.4 Sketch the arrangements for the control of hydraulic circuits by air

5.1.5 Explain the use air that acts as cushion in hydraulic system

5.1.6 Explain the principle of working of various instruments used for hydro pneumatic instruments

5.2.0 Identify the basic electrical devices used in the control of fluid power

5.2.1 Understand the electro-hydraulic pneumatic circuits

5.2.2 Mention the circuit for reciprocation of cylinder using pressure switch, Single limit switch

5.3.0 Introduction to Micro-electronic devices

5.3.1 Understand use of micro-electronic devices viz, PLC, Microprocessor and microcontroller in fluid power circuits

CONTENT DETAILS

UNIT – I

Introduction

Importance of Hydraulics – Board details of Hydraulic Machines, devices and systems

Properties of Fluids

Density – specific weight – specific volume – specific gravity – problems – viscosity – kinematics viscosity – Newton's law of viscosity – types of fluids – simple problems – compressibility – surface tension – capillarity – problems

Fluid pressure and its measurement

Fluid pressure at a point – pressure head – problems – Pascal's law – absolute, gauge, atmospheric and vacuum pressures – simple problems – measurement of fluid pressure – Piezometer tube – simple manometer – differential manometer – inverted differential manometer – Bourdon's tube pressure gauge – problems – total pressure – total pressure on immersed surface – horizontal – vertical – inclined – problems

Buoyancy and Floatation

Buoyancy – Centre of Buoyancy – Types equilibrium of floating bodies, Metacentre and metacentric height

UNIT – II

Kinematics and Dynamics of fluid flow

Introduction – types of fluid flow – steady and unsteady flow – uniform and non-uniform flow – laminar and turbulent flow – compressible and incompressible flow – rotational and ir-rotational flow – one, two and three dimensional flow – rate of flow or discharge – equation of continuity of a liquid flow – simple problems – energy of a liquid in motion – potential energy – kinetic energy – pressure energy – total energy – total head of liquid in motion – Euler's equation of motion – Bernoulli's equation from Euler's equation – assumptions – simple problems – practical applications of Bernoulli's equation – venturimeter – Orifice meter – pitot tube – simple problems

Flow through Orifices, Notches, Pipes and Nozzles

Orifices – types of orifices – Vena contracta – coefficient of contraction – coefficient of velocity coefficient of discharge – problems

Notches – types of notches – Rectangular notches – triangular notch – trapezoidal notch – discharge over notches – simple problems

Simple pipes – loss of head in pipes – major energy losses – minor energy losses – loss of energy due to friction – Darcy's formulae for loss of head in pipes – Chezy's formula for loss of head in pipes – simple problems – loss of head due to sudden enlargement – loss of head due to sudden contraction – problems transmission of power through pipes – problems – water hammer

UNIT – III

Fluid Power

Introduction – Basic law – Applications of fluid power – types fluids used in industrial application – properties of fluids

Hydraulic system

Basic elements of hydraulic system – Oil reservoir pump unit – Principles of working of Positive displacement pump – Classifications – Gear pumps, Screw Pump, Vane pumps, Lobe pump, piston pumps, radial, bend axis type – method of coupling motor and pump by direct, flexible and pulley

Hydraulic actuators – Classifications – Rotary – Semi-rotary – Linear motion type – Hydraulic motors – Hydraulic cylinders – types - single acting, double acting, telescoping

Hydraulic control elements and components

Control valves – Functions – classifications – ratings – Describe the working of pressure controll valves viz, relief valves - pilot operated relief valve – poppet valve – sequence valve

Direction control valves – types – sliding spool type – rotary spool type – check valves – 1 way, 2 way, 3 way directional control valves, pilot operated check valve, solenoid control valve

Flow control valves – types – gate, globe, pressure compensated butterfly valves, non return valve, application circuits of control valves

Seals – packings – materials for seals and packings – purpose of sealing

Filters – types – necessity of filtration of fluids – intensifier – motors and accumulators – purpose of accumulators viz, shock suppressions, fluid makeup, leakage compensation, emergency power and holding – types of accumulators – weight loaded, spring loaded, gas loaded

Hydraulic Circuits

Describe with diagram of deceleration circuit – intensifier circuit – regenerative circuit – synchronizing circuit used for lifting forklift – automatic cylinder reciprocating circuit – hydraulic circuit for robotic arm

UNIT – IV

Pneumatic System

Comparison of pneumatic system with hydraulic system – identification of standard pneumatic symbols – basic pneumatic system – air filter – pressure regulator – lubricator – mufflers

Pneumatic control elements and components

Pneumatic control valves – construction and operation of manually operated 2 way, 3 way, 4way directional control valves - pilot operated and solenoid valves – construction and operation of manually and cam operated flow control valves

Air cylinders – types - light, medium, heavy, tandem, duplex, double ended types

Functions of different parts of cylinder such as tube, cover, packing glands, cushion assembly, piston and piston seal – installation, maintenance and applications of air cylinders

Pneumatic circuits

Basic pneumatic circuits – principle of working of power operated holding devices – power operated chuck, mandrel, collet and clamping circuits – pneumatic safety circuit for protection against pressure drop, overloads, interlocks for machine protection – emergency reversal , material handling circuit

UNIT – V

Hydro Pneumatic System

Comparison of hydraulic, pneumatic and hydro-pneumatic system – advantages and application of combinational system of air and oil – principle of working of air controlled hydraulic valves – air controlled multiple hydraulic circuits – use of air as a cushion for hydraulic system – hydro-pneumatic measurements viz, mechanical flow meters, electro-magnetic flow meters and ultra sonic flow meters and air gauges

Electrical control of fluid power

Control devices – switches – types – push button switch, pressure switches, limit switches, temperature switches, solenoids, relays, timers

Electro hydraulic switches – Reciprocation of cylinder using pressure switch – electro hydro circuit to control the cylinder using single limit switch – Electro pneumatic circuit to achieve two cylinders sequencing circuit

Micro-electronic control of fluid power

Introduction to Programmable Logic Controller (PLC) – Microprocessor and Microcontroller - PLC used in fluid power application – micro controller used in fluid power applications

REFERENCE BOOKS

1. Hydraulics and Fluid mechanics – R.S.Khurmi (S.Chand & Co.)
2. Hydraulics - R.K. Rajput (S.Chand & Co.)
3. Engineering Fluid Mechanics – K. L Kumar (S.Chand & Co.)
4. Hydraulics and Fluid mechanics – Dr. Jagadish Lal (Dhanpathrai)
5. Support material in pneumatics - TTTI, Chennai
6. Basic applied fluid power - John Oster
7. Design pneumatic control circuits efficient technique for practical applications - Bruce . E . Macord
8. Hydraulic Pneumatic Control - Shanmuga Sundaram (S.Chand & Co.)
9. Hydraulics and Pneumatic Controls - R. Srinivasan, (Vijay Nicol, Chennai)
10. Pneumatic Systems: Principles and Maintenance - Majumdhar, (Tata Mc Graw Hill)
11. Microprocessor and Microcontroller - Theagarajan, (SCITECH)
12. Concept of feature of Microcontroller - Raj Kamal (S.Chand & Co.)
13. Microcontroller - Ajay V. Deshmukh (Tata Mc Graw Hill)

SUBJECT TITLE : ELECTRICAL AND ELECTRONICS ENGINEERING
SUBJECT CODE : ME303 /TD 303 /AU 303
PERIODS/WEEK : 5
PERIODS/SEMESTER : 80

TIME SCHEDULE

UNIT	TOPICS	PERIODS
I	Lead Acid Cell D.C Generator D.C Motor	15
	Test 1	1
II	A C Circuits 3 Phase Circuits Transformer	15
III	A C Generator and Motor Measuring Instruments Utilization	15
	Test 2	1
IV	Electronics Components	16
V	Electronics Circuits ,Logic circuit & Instruments	16
	Test 3	1
	Total	80

OBJECTIVES

1.1.0 Understand the working and construction of lead acid cell
- 1.1.1 Describe the working of lead acid cell
- 1.1.2 Explain the constructional details of lead acid cell
- 1.1.3 State the method of charging and discharging of lead acid cell
- 1.1.4 Define the efficiency and rating of batteries.
- 1.1.5 Identify the various aspects for maintenance of lead acid cell

1.2.0 Understand the working and construction of D. C. Generator
- 1.2.1 Describe the principle of working of D C Generators
- 1.2.2 Explain the constructional details of a D C generator
- Classify the D.C. generators based on field connection

1.3.0 Understand the working and construction of motors
- 1.3.1 Describe the principle of working of D C Generators
- 1.3.2 Compare the working principle of D.C. generator and Motor.
- 1.3.3 Classify the D.C. motors based on field connection.
- 1.3.4 State the necessity for a starter
- 1.3.5 Draw the 3 phase starter details and connection for D.C. Motor
- 1.3.6 List the various applications of D.C. motor

2.1.0 Understand the principle of a c circuits, single phase, three phase and transformer.
- 2.1.1 State the working of a simple loop generator and comprehend the feature of alternating current.

2.1.2 Define cycle, , frequency, instantaneous , maximum value and effective values associated with alternating sinusoidal quantity.
2.1.3 Define phase and phase difference
2.1.4 Express the given alternating sinusoidal quantity in vector form
2.1.5 Define power and power factor.
2.1.6 Compute unknown quantity in a given series, parallel or series – parallel A C circuits containing RLC combination.
2.1.7 State the procedure of the production of 3 phase timing
2.1.8 Define phase sequence and phase and phase difference in 3 phase system
2.1.9 State the two method of 3 phase connection star/delta and explain with the circuits.
2.1.10 Compute the value of line voltage and phase voltage, line current and phase current in star/delta
2.1.11 Derive the equation of power in a 3 phase system
2.1.12 State the working principle of a single phase transformer
2.1.13 Derive the e.m.f equation
2.1.14 Explain the term transformer ration and derive the equation for the same
2.1.15 Classify the transformers based on a) function (Power) , Distribution and installation b) construction (core, shell) C) cooling method
2.1.16 Describe the basic principle of working of 3 phase transformer
2.1.17 Draw the different types of transformer connection in primary and secondary.
1.1.18 Describe the different types of methods employed for cooling transformers.
2.1.19 State the working principle of Auto transformer
2.1.20 Identify the advantages of Auto transformer over 2 winding transformer.
2.1.21 Differentiate the constructional details of welding transformer with power transformer
2.1.22 Identify the two types of instrument transformer CT and PT
2.1.23 Specify the uses of chokes.

3.1.0 Understand the working of ac generator, motor and measuring instruments.

3.1.1 State the working principle of A C generator
3.1.2 Identify the Alternator based on construction
3.1.3 State the two method of rotor construction
3.1.4 State the working principle of a 3 phase induction motor and explain the rotating magnetic field produced by 3 phase supply
3.1.5 Classify the Induction motor based on rotor construction
3.1.6 State the constructional details of squirrel cage and slip ring.
3.1.7 Draw star/delta , on line and auto transformer starter used induction motor
3.1.8 List the various application of induction motors
3.1.9 State the principle of voltage developed in single phase induction motor
3.1.10 Classify the single phase induction motor
3.1.11 State the working principle of capacitor start induction motor
3.1.12 Write the constructional details of capacitor start SP motor
3.1.13 Classify instruments based on function, construction and method of measurements
3.1.14 State the mechanism of production of deflecting , controlling and damping torques , their needs and relations in MC and MJ instruments
3.1.15 Draw the sketches and explain the constructional details of MI and MC instruments.
3.1.16 Describe the working principle of dynamometer types wattmeter with sketch
3.1.17 Describe the working of a Megger with sketch
3.1.18 Explain the sketch the working of a multimeter
3.1.19 Describe the method for measuring power in 3 phase circuit system using two Watt meter
3.1.20 State the principle of heat production from electric power
3.1.21 Differentiate between induction heating and dielectric heating
3.1.22 Write down the various industrial application of electric heating
3.1.23 List the functions of induction furnaces and Arc furnaces
3.1.24 Describe the working principle of a fluorescent lamp with a neat sketch

3.1.25 Draw the connection of sodium vapor lamp and mercury vapor lamp
3.1.26 Practice the procedure to be adopted in giving treatment for electric shock and burns on human body

4.1 Appreciate the use of electronic components and devices

4.1.0 Passive components
4.1.1 Identity the various electronic components such as resistors, capacitors and inductors
4.1.2 List the BIS symbolic representation of various components
4.1.3 State the constructional details of carbon and wire wound resistors
4.1.4 Identify the various resistors using colour coding
4.1.5 State the various types of capacitors.
4.1.6 Identify the needs of af and rf chokes (only brief idea)
4.1.7 Write in brief about i/p and o/p transformers, IF transformer
4.1.8 Give a brief description of PCB, plug, clip etc.
4.2.0 Active components
4.2.1 State the mechanism of thermionic, photo, field and secondary emission (only brief idea)
4.2.2 Classify the materials in conductor, semi conductor
4.2.3 Give a brief description of p & n type semi conductor
4.2.4 Describe with the sketch the principle of transistor - different configurations.
4.2.5 Identify the different characteristics of CE configuration
4.2.6 Describe the various types of transistors – FET , UJT, DIAC , TRIAC (only brief idea) regarding the constructional details, principle of working & applications with the circuits.
4.2.7 Explain the working principle of SCR
4.2.8 Write down the various industrial applications of SCR

4.3.0 Diode circuits

4.3.1 Describe the principle or working of a diode on a rectifier
4.3.2 Draw neat circuit of a diagram of half wave and full wave rectifier
4.3.3 Define ripple factor
4.3.4 Appreciate the use of filter in rectifier circuit

5.1.0 Understand the various electronic circuits ,logic circuit and measuring instruments

5.1.1 Classify the different type of amplifiers
5.1.2 Define the term related to amplifiers – gain of amplifiers, db.
5.1.3 Give a brief description of RC coupled amplifier, feed back amplifier power amplifier
5.1.4 State clearly the principle of oscillation. And condition of oscillation

5.2.0 Logic circuit describe

5.2.1 State and explain the need for best suited number system for digital operation
5.2.2 Explain the features of binary,octal,decimel and hexa decimel system
5.2.3 Explain the logic theory and application
5.2.4 Give circuit diagram and explain functions of AND, OR.NOT operation and give the logic symbols of each
5.2.5 State an idea of switching circuits and cables
5.2.6 State the needs for simplifying Boolan Expression
5.2.7 Give the basic principle of Kamangh map (k-map)
5.2.8 Explain De-morgans theorem
5.2.9 Give the symbols of NAND, NOR operation and discuss the advantages of using Universal Gate
5.3.0 Electronic measuring instruments
5.3.1 Appreciate the functions of CRO with neat block diagram
5.3.2 List various uses of CRO
5.3.3 Appreciate the function of digital multimeter
5.3.4 List the various specification of multimeter

CONTENT OUTLINE

UNIT – 1

Lead Acid Cell, Dc Generators and Motors

Construction and materials used – charging – discharging - efficiency and rating – care and maintenance – constructional details and principle of working of D.C. generator types – based on field connections – difference between generator and motor – principle of working of D.C. motors – need of starter for D.C. motor – applications of d. C. motors. Stepper motor - Principles of working, construction and classification, applications of stepper motor

UNIT – 2

A.C. Circuits, Three Phase Circuit And Transformers

Alternating quantities – production of alternating voltage – mathematical representation – explanation of cycle, period, frequency RMS value, average value, maximum value, form factor – vector representation of alternating quantities, phase difference – inductance and capacitance impedance current calculations in general RLC series circuit. Calculations of power and power factor inductance – capacitance. A.C. three resistance – 3 phase circuits, star and delta connections. Voltage and current relations, expressions for power – transformers. Principles of operations of a single-phase transformer. Used transformations ration- methods of cooling transformer - 3-phase transformer – autotransformer – principal, uses and advantage – welding transformer – use of choke. Instrumental transformer.

UNIT – 3

A.C. Generators And Motors, Measuring Instruments & Utilisation.

Construction and working of A.C. generators, classification. Salient pole and turbo types principles of working of phase induction motor. Types of induction motor. Applications method of starting of squirrel cage and slip ring induction motors. Principles of working of single phase induction motor – capacitor start type – uses. Measuring Instruments – Moving coil, moving iron – voltmeter and ammeter - dynamometer type wattmeter- megger, multimeter, Induction and dielectric heating – principle, advantages and applications – induction furnaces arc furnaces – direct and indirect types. Fluorescent, discharge lamp, mercury vapour lamp and sodium vapour lamp. Effect of shock and burns – procedure to be followed incase of electric shock

UNIT – 4

Introduction to electronics components

Introduction to electronics –passive components- Resister-types,capacitor-types, colour coding, inductors-type,symbolic representation of passive components. Semi conductors-Intrinsic and extrinsic, P-type ,N-type-formation and working of PN junction. Active components- Diodes, BJT,FET, SCR,Daic,Trac, UJT –principle of working-BJT configurations, Rectifiers – half wave and Full Wave C & L filters, ripple factor

UNIT – 5

Electronic circuits, Logic circuits, instruments

Amplifier –Gain- Band width, Ocillator- Condition of Ocillator

Fundamentals of digital Electronics- Logic gates- AND, OR, NOT, X-OR- Boolean Algebra – Simlification of expressions –De Morgan's theorem K-map –Universal gates –NAND ,NOR

Electronic instruments- CRO –Block Diagrm, CRT, Digital Multimeter, Parameter Specification.

REFERENCE

1. Electronic devices – Allan Mottershed
2. Electronic devices and circuits – Mittal
3. Electrical Engineering - B .J. Theraja.
4. Basic Electronics and Liener IC's -Kulksshethra, Bhargava, Gupta
5. Fundamentals of Digital Circuits -Arun Kumar
6. Digital Principle and Applications -Malvino
7. Fundamentals of Electrical and Electronics - P.Thyagarajan

SUBJECT TITLE : MACHINE DRAWING
SUBJECT CODE : ME 304 / AU 304 / WT 304
PERIODS/WEEK : 4
PERIODS/SEMESTER : 64

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I	Fastening Devices	
	Thread fastenings	6
	Rivet & Riveted joints	6
	Test	1
II	Assembly and detailed drawings	
	Cotter joints	6
	Couplings	9
	Test	1
III	Assembly and Detailed drawings of Bearings	9
	Assembly and Drawings of machine parts	18
IV	Piping Layout	5
	Test	3
	Total	64

CONTENT DETAILS

UNIT – I: FASTENING DEVICES

Basic Fastening Devices

Temporary and permanent fastenings – areas of applications – Bolts and nuts – different types of bolted joints for different applications – purpose of locking nuts – types & lock nuts – Types, proportion and specifications of rivets, - different types of riveted joints – single riveted lap joint, double riveted lap joint (Chain and zigzag), single riveted butt joint (Single strap and double strap)

Calculation of pitch and arrangements of rivets in row. Exercises in drawing bolted connection using standard proportion. Exercises in drawing riveted joints standard proportions.

Exercises in the selection of appropriate fastening devices to meet the given working conditions

UNIT – II: ASSEMBLY AND DETAIL DRAWINGS

Need and functions of assembly and detailed drawings – selection of sheet sizes – preparation of title block – bill of materials and parts list –

Steps in preparing assembly and detailed drawings, practice in tracing and inking

Exercises in assembly and detailed drawings of sleeve and cotter joint, socket and spigot joint, knuckle joint, gib and cotter joints

Exercises in assembly and detailed drawings of coupling such as Flanged coupling – protected pin type flexible – half lap muff coupling

UNIT – III:

ASSEMBLY AND DETAILED DRAWINGS OF BEARINGS

Assembly and detailed drawings

Plummer block, Bushed bearing, Foot step bearing

ASSEMBLY AND DETAILED DRAWINGS OF MACHINE PARTS

Slip bush, Turn buckle, Screw jack, Stuffing box, Non return valve, I.C. Engine connecting rod

UNIT –IV: PIPING LAYOUT

Classification of pipes and tubes components of a piping layout like pipe joints, valves, elbows etc., Exercises in schematic drawing with a – Single line diagram of layout using standard conventions – double line.

Note – Guidance for question paper setting.

Unit I – 15 marks
Unit II – 15 marks
Unit III – 35 marks
Unit IV – 10 marks

REFERENCE

1. Machine Drawing by P.I. Varghese & K.C. John
2. Machine Drawing by N.D. Bhatt
3. Machine Drawing by Gill
4. A test book of Machine Drawing by V. Lakshmi Narayan.
5. Machine Drawing ND Junnarkar (Pub. Pearson Education)

SUBJECT TITLE : ELECTRICAL TECHNOLOGY LAB
SUBJECT CODE : ME 305
PERIODS/WEEK : 3
PERIODS/SEMESTER : 48

TOPIC & CONTENT DETAILS

Study of measuring instruments – Ammeter – Volt meter – Watt meter etc. – Used in AC and DC circuits.
Studt of nstarters – 2 point, 3 point, DOL,star delta etc.
Study of CRO – observe wave form
Measurement of low,medium and high resister values by volt meter – ammeter method.
Measurement of carbon resister values using multimeter and compare it with a colour code values.
Load tester on DC serious motor to plot out put vs efficiency, T/N, curves
Load test on DC shunt m otors and plot out put vs efficiency , T/N, curves
Overall efficiency of a DC motor generator set and to plot efficiency curve
Load test on 3 phase squarrel cage induction motor,plot out put vs efficiency,out put vs speed out put vs slip
OC and SC test on single phase transformer and pre-determine the efficiency and regulations of a particular load.
VI characteristics of semi conductor diode
Rectifier – half wave and full wave measure the out put and compare it using CRO
Understand the logic functions using logic gate

SUBJECT TITLE : MATERIAL TESTING LAB
SUBJECT CODE : ME 306
PERIODS/WEEK : 3
PERIODS/SEMESTER : 48

UNIT	TOPIC
1.	Tension test on M.S. bar
2.	Impact Test
3.	Brinell hardness test
4.	Rockwell hardness test
5.	Bending test on steel beam/wooden beam
6.	Shear test on M.S. bar
7.	Torsion test on M.S. bar
8.	Torsion pendulum test
9.	Spring test
10.	Tension test on welded joint
11.	Compression test – Brittle materials

CONTENT DETAILS

1. Tension test on M.S. bar: To find yield point stress, ultimate stress, percentage elongation, and percentage reduction in cross sectional area. Young's modulus, drawing stress strain graph.
2. Impact test: To find out impact values (I rod) of M.S bar specimen
3. Brinell hardness test: To find brinell hardness values of M.S. bars and aluminium
4. Rock well hardness test: To find Rockwell hardness values of M.S. bars and aluminium
5. Bending test on steel beam: To find out Young's modulus of steel drawing deflection Vs load curve
6. Shear test on M.S. bar: To find ultimate shear stress by conducting double shear test
7. Torsion test on M.S. bar: To find modulus of rigidity from angle of twist and torque (plot graph angle of twist Vs torque)
8. Torsion pendulum test: To find modulus of rigidity from number of oscillation and torque
9. Spring test: to find out modulus of rigidity of the material of the spring (both compression and tension) by drawing deflection Vs load graph
10. Tension test on welded joint: To find out ultimate strength of lap and butt joint and the ultimate stress of the joint
11. To find the compressive strength of brittle material.

SUBJECT TITLE : WORKSHOP PRACTICE
SUBJECT TITLE : ME 307
PERIODS/WEEK : 6
PERIODS/SEMESTER : 96

TIME SCHEDULE

BATCH	TOPIC	PERIODS
I	1.Machine Shop	45
	Test	3
	2. Fitting	45
	Test	3

	Total	96
II	1. Sheet Metal and Aluminium Fabrication	45
	Test	3
	2.Welding	45
	Test	3
	Total	96

Note: For third semester workshop practice, devide the students into two batches (I&II)
First batch should practice 1.M/C shop and 2.Fitting.The 2nd batch should practice 1. Sheet metal and aluminium fabrication and 2.Welding.
In the fourth semester interchange the batches

CONTENT OUTLINE

TOPIC

1 .Machine Shop

Understand safety precautions

1. Lathe work

1.1 Familiarization with lathes- principle parts, work holding device measuring instruments
1.2 Plain turning to the given accuracy
1.3 Taper turning
1.4 Forming
1.5 Thread cutting
1.6 Combination of above operations
1.7 Test on lathe

2. Work on shaper

2.1 Familiarize with the operations
2.2 Shaping of a rectangular block
2.3 Shaping a 'V' in a rectangular block

3. Work on drilling machine

3.1 Marking and drilling holes
3.2 Boring and counter boring
3.3 Reaming

4. Work on milling machine

4.1 Familiarization with the different operations

4.2 Plain surface milling

5. Work on slotter

5.1 Familiarization with the various operations

6. Work on planner

6.1 Familiarization with the various operations

6.2 Planning flat surface

2. Fitting Practice

Study measuring gauges-dial gauges, feeler gauges, thread gauges

Working from a given blue print exercises involving marking filling, drilling, reaming and tapping to an accuracy of = 0.5mm

3. Sheet Metal & Aluminium fabrication

Understand safety precautions.

Familiarization of sheet metal tools – scribers, dividers, trammel points, set square, punches – prick punches, centre punches – hand Grover, rivet, set, chisels hammers, riveting hammers, ball pein hammers – mallet, snip shears, pliers, hand seamers (tongs) files stakes. Measuring instruments in sheet metal folding rule, common rule, steel circumference rule, vernier calipers, micrometer calipers, thickness gauges (slip gauge) sheet metal gauge.

Sheet metal operations – piercing, punching parting, notching, perforating, slotting, blanking, launching and cutting off.

Practice work

Sheet cutting, development, folding bending and pipe bending, making right angle, soldering, brazing and riveting, making – tray, oil, can and bucket.

Aluminium Fabrication

Aluminium fabrication and its scope

Tools – different types of files, hacksaw, screw driver, hammer, drill bits etc

Measuring tools – steel tape, try, square, bevel square, combination set etc.

Practice work – cutting, filing, drilling with hand drill, making key holes making of different types of joints such as straight joints, corner joints out joint with different aluminium sections.

4. Welding

Safety precautions

Study of various tools and equipment's used in the welding shop for both arc welding and gas welding.

Practice work

1.D.C. arc welding
2.A.C. arc welding
3.Gas welding
4.Horizontal flat , vertical end over head welding and single/double/
5.Edge preparation of welded joint such as V, double V and double U.
6.Pipe welding
7.Flame cutting

Reference

1. Workshop manual by P.Kannaiah &K.L.Narayana
Pub: SCITECH

Information Search Analysis and Presentation Skills Development

Periods/Week : 3
Periods/Semester : 48

Introduction

The average Engineer walking out of education institution is surprised by the amount of non-technical work he or she faces in the real world (by the amount of personal contact, the number of phone calls, meetings, reports and presentation etc). Further many cannot find appropriate jobs, because of the lack of these skills. The problem aggravates in the case of diploma pass outs who are supposed to have interactions with different cadres in an industrial environment.

The time allotted for ISAP skills development are to be utilized to provide a slice of practical training in a form that may be used in a class room setting. This is not to be taught in a conventional manner. Here the emphasis will shift from teacher oriented methods to students oriented methods. While the information – skills acquired by all students will be same, the actual methods & techniques used by each student will vary according to his or her initiative, enthusiasm, effort taken etc.

These hours are to be taken as a supplement to the theory classes. Students will acquire ISAP skills based on the fundamental knowledge he/she has acquired from the theory sessions.

Objectives

Educational researchers have found that 17 year olds, in a single academic year, learn about 200 to 300 new words, in a university environment. However, during the same period they acquire around 4000 words in their informal home and play environment. That is learning is higher in an informal environment than in an academic one designed specifically for that purpose. The primary objective here is to simulate the informal learning environment.

Student is provided an ideal opportunity to acquire skills in learning to learn which is essential for the professional growth. This will inculcate information skills in the students. These skills will be a life long asset to him or her in fact they grow with age.

Oral and written communication skills are of at most importance to any engineer for a positive professional growth. Emphasis is given for this aspect also.

Activities

A. Part One.

Write articles on various technical areas and basic research papers. Students can identify simple projects individually or groups of not more than 4 any technical area. Emphasis here is on the acquisition of ISAP skills.

Source of Information

a. People
b. Print media – Magazines, News papers, Journals, Vendors catalogues etc.
c. Electronic information – CD ROM, Usage of internet – User news groups, WWW.

B. Part Two

Transparency based Presentation

1. Preparation
   1.1 Audience Analysis.
   1.2 Information Gathering.
   1.3 Transparency design using Power Point/Presentation software.
   1.4 Production of transparency for OHP.
2. Delivery

Sample Projects

1. Prepare and deliver transparency based presentations on the topics,
    a. Technicians are not properly appreciated in the society.
    b. Engineers do not know about non technical topics.
    c. Lay people do not know enough about technical topics.
    d. India's products are not competitive in international markets as its quality is not good.
    e. India's software professionals are paid too much.
2. Prepare transparency based presentation for the opposite side of the issue you choose in project 1.
3. Prepare and deliver a brief autobiographical presentation.
4. Prepare and deliver a sales promotional presentation (Example – Washing machine, Computer , Air conditioner, Microwave oven or other items related to your branch of study)
5. Prepare and deliver a brief sales promotional presentation on a service (Example- Insurance Policy, Credit cards etc)
6. Prepare and deliver a technical presentation before lay audience (Example – Use of computers to common man, energy saving measures in a domestic environment or other topics related to specific branches of study)

C. Part Three Communication Skills

Written Communication

Preparation of

a. Reports
    Formal reports
    Progress reports
    Feasibility Reports
    Laboratory reports.
b. Technical Proposals.
c. Email.
d. User manuals
e. Job Hunting material
    Resumes
    Letters for job hunting
f. Business letters
g. Memo, Notices, Agenda and minutes

Oral Communication

Oral communication activities like,

a. Dyadic communication (Interaction between two persons, example Telephone conversation)
b. Meetings.
c. Job interview.
d. Group Discussions.
e. Debates.
f. Case studies.

EVALUATION

There is no separate evaluation for ISAP skills. But the teachers will consider this for the award of internal assessment marks related to the theory subjects in that semester. The performance of the student will be taken equivalent to an Assignment and an Examination while awarding the internal assessment marks.

SUBJECTS OF STUDY AND SCHEME OF EVALUATION

SEMESTER IV

Branch : Mechanical Engineering

Code	Subject	Periods Per Week			Evaluation (Marks)			
		Theory	Practical	Total	Theory	Practical	Internal	Total
ME 401	Thermal Engineering	5		5	75		25	100
ME 402	Design of Machine elements	6		6	75		25	100
ME 403	Manufacturing Process	5		5	75		25	100
ME 404	Hydraulics Machines	4		4	75		25	100
ME 405	Production drawing	1	2	3	75		25	100
ME 406	Hydraulics Laboratory		3	3		75	25	100
ME 407	Workshop Practice - iii		6	6		75	25	100
	ISAP* Skills Development		3	3				
	TOTAL	**21**	**14**	**35**	**375**	**150**	**175**	**700**
	* Information Search Analysis and Presentation							

SUBJECT TITLE : THERMAL ENGINEERING
SUBJECT CODE : ME 401
PERIODS/WEEK : 5
PERIODS/SEMESTER: 80

UNIT	TOPIC		PERIODS
I	1.1 Introduction		2
	1.2 Fundamentals of Thermodynamics		4
	1.3 Thermodynamic Processes		9
II	2.1 Air Cycles		10
	2.2 Fundamentals of I.C. Engines		5
		Test - I	1
III	3.1 Heat transfer		16
IV	4.1 Fuels and Combustion		15
		Test - II	1
V	5.1 Air Compressors		16
		Test – III	1
		Total	80

OBJECTIVES

On completion of the course, the student will be able to

UNIT – I

1.1.0 Understand the scope and application of Thermal Engineering
1.1.1 Explain the terms such as Thermal Engineering, Thermo dynamics and Heat Engines
1.2.0 Appreciate the fundamentals of Thermodynamics
1.2.1 Define a system
1.2.2 Classify the systems
1.2.3 Explain the terms boundary and surroundings
1.2.4 Distinguish between intrinsic and extrinsic properties
1.2.5 Explain the terms pressure, temperature, enthalpy, entropy etc and their S.I. Units
1.2.6 Explain the term thermal equilibrium
1.2.7 Explain specific heat of gases
1.2.8 State the relationship between specific heats of gases
1.2.9 Explain the Zeroth law, First law and Second laws of thermodynamics
1.2.10 Explain Boyle's law, Charle's law, Regnault's law, Joule's law and Avagadro's law
1.2.11 Derive the characteristic gas equation
1.2.12 Explain characteristic gas constant and universal gas constant
1.2.13 Apply the gas equation to solve simple problems
1.3.0 Analyse Thermodynamic Processes
1.3.1 Define a thermodynamic process

1.3.2 Explain the importance of PV diagram
1.3.3 Illustrate with p v diagrams the thermodynamic processes such as Isochoric, Isobaric, Isothermal, Isentropic, Polytropic and throttling processes
1.3.4 Derive the expressions for the flow work, change in internal energy, heat transferred, in each process listed in 1.3.3
1.3.5 Compute the flow work, change in internal energy, Heat transferred in each process

UNIT – II

2.1.0 Analyse Power Cycles
2.1.1 Define Power Cycles
2.1.2 State the assumptions made in Power Cycles – Air standard efficiency
2.1.3 Illustrate with P-V diagrams Carnot cycle, Otto Cycle, Diesel Cycle, Dual combustion Cycle, Joule Cycle
2.1.4 Derive the expressions for Air standard efficiency of the Cycles listed in 4.3 except Dual combustion cycle
2.1.5 Compute the air standard efficiency using standard expressions
2.2.0 Demonstrate the working of Internal Combustion Engines
2.2.1 Define I.C. Engines
2.2.2 Classify I.C. Engines
2.2.3 Explain with line sketches the construction and working of 2-stroke / 4 stroke Petrol engines and Diesel engines
2.2.4 State the functions of different parts of I.C. Engines
2.2.5 Compare two stroke and four stroke engines
2.2.6 Compare petrol engines and diesel engines

UNIT – III

3.1.0 Understand various modes of Heat Transfer
3.1.1 Explain the three modes of heat transfer, conduction, convection and radiation
3.1.2 Explain Fourier's law of thermal conduction
3.1.3 Define Thermal conductivity
3.1.4 Calculate conduction through a plane wall and through a composite plane wall
3.1.5 Estimate the rate of heat transfer due to conduction
3.1.6 Solve simple numerical problems
3.1.7 Explain thermal radiation – reflection, absorption and transmission of radiation
3.1.8 Define absorptivity, reflectivity and transmissivity
3.1.9 Explain the concept of a Black Body
3.1.10 Explain Stefan – Boltzman's law of total radiation
3.1.11 Explain the concept of Grey body
3.1.12 Solve simple numerical problems
3.1.13 Explain Newton Rikhman equation of Thermal convection
3.1.14 Explain free convection and forced convection
3.1.15 Calculate convective heat transfer coefficient
3.1.16 Calculate rate of heat transfer by convection
3.1.17 Solve simple numerical problems
3.2.0 Estimate the transfer of heat through various types of Heat Exchangers
3.2.1 Explain basic principles of heat exchangers
3.2.2. Classify of heat exchangers – Recuperator type and regenerative type, parallel flow, counter flow type, cross flow
3.2.3 Explain LMTD method of heat exchanger analysis for parallel flow and counter flow heat exchangers. (No proof)

UNIT IV

4.1.0 Understand the various types of Fuels and its value in engineering
4.1.1 Understand classification of fuels
4.1.2 Understand constituents of fuels

4.1.3 Explain the properties of fuels
4.1.4 Understand calorific value
4.1.5 Different methods to determine the calorific value of fuels.
4.1.6 Understand combustion and conservation of energy.
4.1.7 Understand the chemistry of fuels
4.1.8 Understand combustion equation
4.1.9 Understand products of combustion and its analysis
4.1.10 Understand combustion efficiency.

UNIT – V

5.1.0 Appreciate the construction and working of Air compressors
5.1.1 State the function of an air compressor
5.1.2 State the uses of compressed air
5.1.3 Classify the air compressors
5.1.4 Explain with simple sketches the working of reciprocating (single stage and two stage) compressors, rotary (fans and blowers) compressors, centrifugal compressors and axial flow compressors
5.15 Derive the expressions for work done on air and power required to drive compressors (single stage and two stages only) with the help of p-v diagrams
5.1.6 Compute work done on air and power required to drive the compressor (single and two stage only)
5.1.7 State the functions of intercoolers
5.1.8 List the advantages of multistage compression
5.1.9 Define the efficiencies of air compressors – mechanical efficiency, isentropic efficiency, volumetric efficiency
5.1.10 Derive expression for volumetric efficiency in terms of clearance volume and stroke volume
5.1.11 Compute the volumetric efficiency using the expression derived in 5.1.10
5.1.12 Explain the effect of clearance on the volumetric efficiency of the compressor

CONTENT DETAILS

UNIT – I

Brief explanation of terms such as:

System – open, closed and isolated system – boundary, surroundings, Intrinsic and extrinsic properties, pressure (absolute atmospheric, gauge and vacuum), temperature, S.T.P and N.T.P values – energy, internal energy flow work, enthalpy, entropy, specific volume, thermal and thermodynamic equilibrium, Specific heats of gases, specific heat at constant volume and specific heat at constant pressure – their relations

Thermodynamic Laws (Brief explanations)

1. Zeroth law 2. First law 3. Second law

Laws of perfect gases (Brief explanations)

1. Boyle's law 2. Charle's law 3. Regnault's law 4. Avogadro's law 5. Joule's law

Gas equation

Derivation of characteristic gas equation, characteristic gas constant and universal gas constant – simple problems

Thermodynamic Processes

Explanation, p-v diagram

Derivation of equations for flow work, change in internal energy, and heat transferred

Isochoric process, Isobaric process, Isothermal process, Isentropic process, Polytrophic process, Throttling process

Application in simple problems

UNIT – II

Air Standard Cycles

Assumption, Air standard efficiency

Brief explanation with P-V diagrams and derivation of air standard efficiency of

Carnot Cycle, Otto cycle, Diesel cycle, Joule cycle,

Brief explanation of dual combustion cycle with P-V diagram (No derivation of air standard efficiency), Simple and direct problems using standard expressions

Fundamentals of I.C. Engine

Definition, Classification, Two stroke engines, Two stroke petrol engines, Four stroke engines, Four stroke diesel engines (construction and working using simple line sketches), Four stroke petrol engines, Functions of different parts of I.C. Engines (No sketch required), Comparison between - Two stroke and four stroke engines, Petrol and diesel engines, Testing of IC engines –determination of indicated power – brake power – mechanical efficiency – indicated thermal efficiency brake thermal efficiency – specific fuel consumption –heat balance sheet – simple problems.

UNIT III

Principles of Heat transfer

Modes of heat transfer – conduction, convection and radiation. Fields of applications of heat transfer.

Thermal conduction, Fourier's law of thermal conduction, thermal conductivity, conduction through a plane wall, simple problems

Thermal radiation – Reflection, absorption, and transmission of radiation, absorptivity, reflectivity and transmissivity. Concept of black body. Stefan's Boltzman's law of total radiation, concept of grey body, Thermal convection – Newton – Rikhman equation Q = hAt, Free convection, forced convection

Principles of Heat Exchangers

Function of heat exchangers, types of heat exchangers – Recuperator type and regenerative type, parallel flow, counter flow and cross flow. Concept of Logarithmic mean temperature difference (LMTD) and AMTD. LMTD for parallel flow and counter flow heat exchangers (no derivation). Simple problems to calculate heat transfer by LMTD method.

UNIT IV

Various types of Fuels and its value in engineering – classification of fuels – solid fuels – liquid fuels – gaseous fuels – merits and demerits of Gaseous fuels requirements of a good fuel.

Calorific value of fuels – Gross or higher calorific value – net calorific value – (simple problems) – Determination of calorific values – bomb calorimeter- Gas calorimeter (Simple problems)

Combustion of fuels – Atomic theory- structure – Combustion equation of solid fuels – Minimum mass of air required for combustion.- Mass of carbon in flue gases. – Mass of flue gas per kg of fuel burnt (Simple problems)- Flue gas analysis – Orsat apparatus

UNIT – V

Air Compressors

a. Introduction: Function of air compressors – uses of compressed air

Classification of compressors: Working of reciprocating (single stage and two stage) compressors, Rotary compressors (fans, blowers), centrifugal compressors and axial flow compressors

P-V diagram of single stage and two stage compressors – derivation of work done – power required to drive the compressor (simple problems) – inter coolers – advantages of multistage compressors

Efficiencies of air compressor – mechanical efficiency, isothermal efficiency, isentropic efficiency, volumetric efficiency, derivation of volumetric efficiency in terms of clearance volume and stroke volume, effect of clearance on volumetric efficiency – simple problems.

REFERENCE BOOKS

A text book of Thermal Engineering - R.S. Khurmi & J.K. Gupta

Elements of Heat engines volume I&II - R.C. Patel & C.J. Karamchandani

Elements of mechanical engg: - Prof: Sadhu Singh

Thermodynamics for engineers. - Ramalingam

SUBJECT TITLE : DESIGN OF MACHINE ELEMENTS
SUBJECT CODE : ME 402
PERIODS/WEEK : 6
PERIODS/SEMESTER : 96

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I.	1.1 Introduction	2
	1.2 Basic Link Motion	8
	1.3 Bolts, Nuts and Keys	8
II.	2.1 Shafts	12
	2.2 Couplings	8
	Test I	1
III.	3.1 Clutches	6
	3.2 Bearings	6
	3.3 Power screws	6
IV	4.1 Cams	9
	4.2 Governors and Flywheels	9
	Test II	1
V	5.1 Belt, Rope and Chain drive	9
	5.2 Gear and Gear trains	10
	Test – III	1
		96

OBJECTIVES

Upon completion of the study of this subject, the student will be able to:

UNIT – I

1.1.0 Understand the factors governing the Design of Machine elements

- 1.1.1 List the factors governing the design
- 1.1.2 Explain the general procedure for design
- 1.1.3 Explain the methods of design – analytical and empirical
- 1.1.4 Define the design stress, working stress and factor of safety

1.2.0 Appreciate the working of Basic Link Mechanisms

- 1.2.1 Define and explain link, Kinematic pair, Kinematic chain, mechanism, inversion of mechanisms, constrained motions
- 1.2.2 Explain Kinematic pairs, Kinematic chains, four bar chain, single slider crank chain, double slider crank chain
- 1.2.3 Explain the inversions of single and double slider crank chain, quick return motion and Oldham's coupling

1.3.0 Design of Bolts, Nuts and Keys using analytical and empirical methods

1.3.1 Define important terms used in screw threads
1.3.2 List standard dimensions of screw threads and empirical formulae
1.3.3 Explain the designation of screw threads
1.3.4 Explain the stresses due to static loading, initial stresses and stresses due to external forces, stresses due to combined forces
1.3.5 Computation of size of the screw from above stresses
1.3.6 Design of cylinder covers
1.3.7 Simple problems related to design of cylinder covers
1.3.8 Explain the bolts of uniform strength
1.3.9 Explain types of keys
1.3.10 State the proportions of sunk key
1.3.11 Compute the strength of rectangular sunk key and square sunk key
1.3.12 Compute the key size using empirical proportions, simple problems

UNIT – II

2.1.0 Design Shafts and Power Transmitted by Shafts

2.1.1 State the torsion equation and explain each term
2.1.2 Design the diameter of solid and hollow shafts from strength and rigidity considerations
2.1.3 Compute the power transmitted by the shafts subjected to torque
2.1.4 Explain equivalent twisting moment and equivalent bending moment
2.1.5 Compute the diameter of the torsion and bending
2.1.6 Compare solid and hollow shafts in terms of their weight, strength and stiffness

2.2.0 Design coupling using analytical and empirical methods and check for safety

2.2.1 State the purpose of couplings
2.2.2 Design the dimensions of muff coupling
2.2.3 Design the dimensions of rigid flange coupling (protected and unprotected type) and check for safety
2.2.4 Sketch the above couplings after calculating the dimensions

UNIT – III

3.1.0 Estimate the application of friction in the design of clutches

3.1.1 State the purposes of clutches
3.1.2 Explain the types of clutches
3.1.3 List the characteristics of materials used for friction surfaces of clutches
3.1.4 Design single disc or plate clutch considering uniform pressure and uniform wear
3.1.5 Design multiple plate clutch

3.2.0 Justify the basic design procedure of bearings

3.2.1 Explain the functions of bearings
3.2.2 Classify the bearings
3.2.3 Explain generally as to what is meant by sliding contact and rolling contact bearings
3.2.4 Compute the proportions of solid journal bearing empirically based on journal diameter and sketch
3.2.5 Explain bearing characteristic number and the significance of bearing modulus
3.2.6 Compute the proportions of a foot step bearing empirically based on shaft diameter and sketch
3.2.7 Design of journal bearing given the load allowable bearing pressure and l/d ratio
3.2.8 Solve simple problems involving the design of collar bearing, solid journal bearings and foot step bearings

3.3.0 Analyze the working efficiency of screw jack

3.3.1 Compute the effort, torque required and efficiency of a square threaded screw jack with collar and without collar fiction
3.3.2 Analyze the maximum efficiency of a square threaded screw
3.3.3 Explain overhauling and self locking
3.3.4 Analyze the efficiency of self locking screw jack

UNIT – IV

4.1.0 Recognize different types of Cams and Followers

- 4.1.1 Explain various terms of cam terminology
- 4.1.2 Explain various displacement diagrams
- 4.1.3 Draw the cam profiles of a disc cam with offset and without off set for knife edge and roller follower
- 4.1.4 Draw the cam profile of a disc cam without offset for flat faced follower

4.2.0 Appreciate the purpose and uses of Governors and Flywheels

- 4.2.1 Explain the function of governors
- 4.2.2 Mention the types of governors
- 4.2.3 Explain the principle of working of simple watt governor and porter governor
- 4.2.4 Explain the terms used in governors – height of governors, equilibrium speed, mean equilibrium speed, maximum and minimum equilibrium speed, sleeve lift, sensitiveness, stability and hunting of governors
- 4.2.5 Solve simple problems on 4.2.3
- 4.2.6 Explain function of fly wheel
- 4.2.7 Compare the functions of flywheel with governor
- 4.2.8 Explain fluctuation of speed, fluctuation of energy, coefficient of fluctuation speed, coefficient of fluctuation of energy, energy stored in fly wheels turning moment diagrams
- 4.2.9 Solve simple problems on 4.2.8
- 4.2.10 Workout the proportions of flywheels using empirical formulae

UNIT – V

5.1.0 Appreciate the application of Belt, Rope and Chain Drive

- 5.1.1 State the application of belt drives
- 5.1.2 Explain the terms open belt, crossed belt, angle of lap belt, slack and light sides, velocity ratio, slip, creep, centrifugal tension and power transmitted
- 5.1.3 Solve simple problems related to V.R. slip and creep
- 5.1.4 Derive and compute the length of belt on an open belt and crossed belt
- 5.1.5 Derive and compute the ratio of tensions
- 5.1.6 Derive and compute the power transmitted by a belt
- 5.1.7 Compute the width of flat belt with and without considering centrifugal tension
- 5.1.8 State the conditions for maximum power transmission
- 5.1.9 Solve simple problems on 5.1.8
- 5.1.10 Explain V belt, rope of circular belt drive
- 5.1.11 Calculate the proportions of belt fully from empirical formulae and sketch the belt fully
- 5.1.12 Explain chain drive
- 5.1.13 Mention advantages and disadvantages of chain drive over belt drive

5.2.0 Design Gear proportions and gear trains

- 5.2.1 Explain the function of gear and friction wheel
- 5.2.2 Discuss the advantages and disadvantages of gear drive
- 5.2.3 Explain spur gear nomenclature including addendum, deddendum, module, pitch circle, circular pitch, pitch point, diametric pitch, clearance
- 5.2.4 Explain simple gear train, compound gear train, reverted gear train and epicyclic gear train
- 5.2.5 Solve simple problems on 5.2.4
- 5.2.6 Design on a gear box of an automobile given the module, V.R and center to center distance
- 5.2.7 Compute the size and number of arms, rim thickness of a spur gear wheel from empirical formulae.

CONTENT DETAILS

UNIT – I

Introduction

Classification of machine design – General considerations – General procedure – Design stress and working stress – factor of safety – use of design data handbook

Basic link motion

Definition and explanation of the terms Kinematic link or element, Kinematic par, Kinematic chain, mechanism, inversion of mechanism – types of constrained motions – classification of Kinematic pairs – types of Kinematic chain – four bar chain – single slider crank chain – double slider crank chain – immersions of single and double slider crank chains – quick return motion mechanisms – Oldham coupling

Bolts, Nuts and Key

Designation of screw threads – stresses in screwed fastenings due to static loading – initial stresses – stresses due to external forces – simple problems – stresses due to combined forces – design of cylinder covers – simple problems – bolts of uniform strength – types of keys – forces acting on a sunk key – strength of a sunk key – calculation of key size using empirical proportions – simple problems

UNIT – II

Shafts

Torsional stresses and strains – strength of solid and hollow shaft – comparisons – problems – power transmitted by shaft – problems – working stresses for shafts – design of shaft based on strength and rigidity – shafts subjected to twisting moment only, bending moment only, combined twisting and bending moment – problems – design of shafts on the basis of torsional rigidity – problems

Compare solid and hollow shaft in terms of their weight, strength and stiffness – problems

Couplings

Shaft couplings – requirement – types – design of sleeve or muff coupling – design of flange coupling – unprotected type – protected type – problems

UNIT – III

Clutches

Types of clutches – positive clutches – Friction clutches – characteristics of material used for friction surfaces – single disc or plate clutch – design considering uniform pressure and uniform wear – multiple disc clutches – problems

Bearings

Functions of bearings – classification of bearings – Radial bearings – thrust bearings – sliding contact bearings – rolling contact bearings – design of solid journal bearing – friction in journal bearing – design of thrust bearing considering uniform pressure – flat pivot or foot step bearing – collar bearing – coefficient of friction and bearing characteristic number – heat generated in journal bearings – problems

Power Screws

Screw jack – torque required to raise and lower the load – efficiency – maximum efficiency overhauling and self locking – efficiency of self-locking - problems

UNIT – IV

Cams

Classification of followers and cams – motion of the followers – uniform velocity, simple harmonic motion – uniform acceleration and retardation – cam terminology – displacement diagrams – construction of a radial of disc cam profile with reciprocating followers – knife edge follower, follower axis passes through the cam axis and offset – roller follower, follower axis passes through the cam axis and offset – flat faced follower when the follower axis passes through the cam axis

Governors and Flywheels

Functions of the governors – types of governors – simple watt governor – porter governor – simple problems – flywheels – comparison with governors – coefficient of fluctuation of speed – fluctuation of energy – maximum fluctuation of energy – coefficient of fluctuation of energy – energy stored in a flywheels – turning moment diagram – problems – size of fly wheel from empirical formulae - problems

UNIT – V

Belt, Rope and Chain Drives

Types of belts – flat belt, circular belt or rope, V-belt – types of flat belt drives – open and crossed belt drive – compound belt drive – stepped or cone pulley drive – velocity ratio – slip - creep – problems – length of an open belt – length of crossed belt – problems – power transmitted by a belt – ratio driving tensions for flat belt drive – angle of contact – problems – centrifugal tension – condition for the transmission of maximum power – problems – V-belt drive – rope or circular belt drive – pulleys – types of pulleys for flat belts – calculation of the diameter of the pulley, thickness of the pulley, width of the belt, dimensions of arms, dimensions of hub from empirical formulae – simple problems – chain drive – advantages and disadvantages over belt drive

Gears and Gear Trains

Functions of gears – friction wheels – advantages and disadvantages of a gear drive – spur gear nomenclature – simple gear drive – velocity ratio – power transmitted – gear trains – simple gear train – compound gear train – problems – reverted gear train – simple problems – epicyclic gear train – velocity ratio of epicyclic gear train problems – design of gear box of an automobile – computing spur wheel proportions, number and shape of arms, arm thickness, rim thickness from empirical formulae.

REFERENCE BOOKS

1. A text book of Machine Design – R.S. Khurmi and J.K. Gupta
2. A text book of Theory of Machines – R.S. Khurmi and J.K. Gupta
3. A text book of Strength of Materials – Dr. R.K. Bansal
4. A text book of Automobile Engineering – T.R. Banger and Nathu Singh
5. Machine Design – Dr. Sadhu Singh
6. Theory of Machines and Mechanisms – P.L. Ballaney

SUBJECT TITLE : MANUFACTURING PROCESS
SUBJECT CODE : ME 403
PERIODS/WEEK : 5
PERIODS/SEMESTER : 80

TIME SCHEDULE

UNITS	TOPICS	PERIODS
I	1. Metrology	8
	2. Metal cutting	6
	3. Cutting Fluids	2
	Test 1	1
II.	1. Metal Joining, Welding Soldering & Brazing	16
III	2. Lathe and Lathe work	15
	Test 2	1
IV	1. Shaping, Planning and Slotting Machines	12
V	1. Drilling and Milling Machines	14
	2. Powder Metallurgy	4
	Test 3	1
	Total	80

OBJECTIVES

1.1.0 Justify the methods of measurements using comparators

1.1.1 Define metrology
1.1.2 List the types of comparators
1.1.3 Explain methods of measurements taken by mechanical, electrical, optical and pneumatic comparators
1.1.4 Explain the various features of comparators
1.1.5 Explain the measuring machines
1.1.6 Explain the advantages of measuring machines with other measuring devices.

1.1.7 Understand various types of Measuring instruments (Temperature & Strain).
1.1.8 Explain the types of temperature measuring instruments.
1.1.9 Explain liquid – in – glass thermometer.
1.1.10 Explain Bimetalic thermometer
1.1.11 Understand the laws and elements of Thermo couple system.
1.1.12 Understand Thermocouple materials.

1.1.13 Explain Resistance thermometers and thermistors.
1.1.14 Explain Radiation and optical Pyrometer.
1.1.15 Explain types of Strain Gauges and Gauge factor.
1.1.16 Understand the strain measurement techniques.
1.1.17 Explain the requirements of a strain gauge.
1.1.18 Understand strain gauge material.
1.1.19 Explain resistance strain gauges (Bonded and Unbonded)
1.1.20 Appreciate the measurement of surface finishing
1.1.21 Identify the method of measurement
1.1.22 List the method of measurement
1.1.23 Explain briefly the various method of measurement
1.1.24 Explain briefly the working principle of inteferometers and collimators

1.2.0 Understand various aspects of metal cutting

1.2.1 Draw the geometry of orthogonal cutting.
1.2.2 Explain the action of cutting tool by orthogonal cutting and oblique cutting
1.2.3 Explain the chip formation with diagram
1.2.4 Name the various type of chips
1.2.5 Distinguish the effect of cutting speed , feed and depth of cut on cutting force
1.2.6 Explain about the tool signature of the single point cutting tool
1.2.7 List the various cutting tool material
1.2.8 State the properties of various cutting tool materials
1.2.9 List the factors affecting the life of cutting tools
1.2.10 List the qualitative measure of machinability of a material.
1.2.11 Give the nomenclature of a plain milling cutters.

1.3.0 Understand various cutting fluids

1.3.1 Explain the lubrication and cooling action of cutting fluids.
1.3.2 List the requirement of cutting fluids.
1.3.3 Understand the application of cutting fluids.
1.3.4 Understand the various types and selection of cutting fluids
1.3.5 Analysis the effect of coolants on cutting variables (speed, feed and depth of cut)

2.1.0 Justify the various process of metal joining

2.1.1 Define welding
2.1.2 List the various type of welding
2.1.3 List the safety measures to be taken in welding shop
2.1.4 Outline the advantages and limitations of welding.
2.1.5 Explain there principle of arc welding
2.1.6 Explain about D C generators
2.1.7 Explain about A C transformer
2.1.8 Analysis the advantages and limitations of D C generators and A C transformers.
2.1.9 List the work preparation for welding operation
2.1.10 List the welding positions
2.1.11 List the types of welded joints
2.1.12 Identify various welded joints by BIS symbols
2.1.13 Select electrodes for a particular weld
2.1.14 Identify various types of electrodes
2.1.15 Adjust current and voltage for a particular electrode
2.1.16 List the functions performed by the coatings
2.1.17 Define gas welding
2.1.18 Identify oxy –acetylene welding
2.1.19 List the major advantages and limitations
2.1.20 Identify the types of flame
2.1.21 Name the systems of oxy-acetylene welding
2.1.22 State the functions of oxy – acetylene cylinders
2.1.23 Stare the function of pressure regulators welding torch and nozzles
2.1.24 Select filler rod and flux

2.1.25 State the reasons for controlling the gas pressure before welding
2.1.26 Select nozzles size and angle of blowpipes
2.1.27 Explain the working of oxy- hydrogen welding
2.1.28 Explain briefly submerged are welding tungsten inert gas(TIG)welding , metal inert gas(MIG) welding, CO_2- MIG welding, Atomic hydrogen welding, Thermit welding.
2.1.29 List the defects in welded joints
2.1.30 Identify the causes of defects in welding
2.1.31 Classify the testing and inspection of welded joints
2.1.32 Explain briefly the various type of testing of welded joints
2.1.33 State the application of soldering and brazing
2.1.34 Explain briefly the soldering and brazing process
2.1.35 State the applications of soldering and brazing
2.1.36 State the advantages and limitation of soldering and brazing

3.1.0 Recognize various parts of lathe and lathe work

3.1.1 List the type of lathes
3.1.2 Sketch the centre lathes
3.1.3 Explain the functions of each part
3.1.4 List the work holding devices
3.1.5 Explain the work holding devices
3.1.6 List the tool holding devices
3.1.7 Explain the tool holding devices
3.1.8 List the sequence of steps to be followed in performing the following operations on lathe with line sketches if turning, facing, forming, taper turning, screw cutting, multiple threads, drilling, boring and reaming.
3.1.9 Calculate the included angle for taper turning
3.1.10 Calculate the gear train ratio for cutting specified screw threads
3.1.11 Select the correct feed, speed and depth of cut for different operators on different engineering materials
3.1.12 Choose the appropriate tool for performing a given operation. (indicate the tool profile by line sketches)
3.1.13 Explain about the lathe alignment
3.1.14 Check alignments of centre, and bed
3.1.15 Check correctness of lead screw
3.1.16 Select foundation bolt
3.1.17 Indicate the mode of specifying a lathe for the purpose of purchasing

4.1.0 Appreciate the operations on shaping, planing and slotting machines

4.1.1 State the working principles of the machines with line sketches
4.1.2 Identify their parts, and functions of each part
4.1.3 List the sequence of operations for a given job on these machines
4.1.4 Indicate the method of fixing tool and work on these machines
4.1.5 Select the correct type of tool for a given operation
4.1.6 Select the feed, speed and depth of cut for a given operation
4.1.7 Indicate with line sketches the method of adjusting the stroke length for the above machines.
4.1.8 Explain the quick return motion arrangements such as crank and slotted lever method, with worth method and hydraulic method for a shaping machine.
4.1.9 Identify the reason for chattering tool and warping of work
4.1.10 Explain the quick return arrangements for a slotter.
4.1.11 List the sequence of operation for key way cutting and spur gear cutting using slotter
4.1.12 Explain the method of table drive of a Planing machine
4.1.13 Write the sequence of operation for performing planing horizatal, Vertical and inclined surfaces using planing machines.
4.1.14 Explain the methods for cutting 'T' slot and Dove tail by using planer.
4.1.15 Indicate the mode of specifying these machines for procurement
4.1.16 Compare the shaper, slotter and planer.

5.1.0 Appreciate the operations on drilling and milling machines

5.1.1 State the principles of working of drilling and milling machines with line sketches.
5.1.2 Identify the parts and their functions.
5.1.3 Classify the machines.
5.1.4 Explain the method of fixing the tool and the work for different operations.
5.1.5 Select the correct drill bit for the given operation.
5.1.6 Select the right type of milling cuter for a given operation
5.1.7 List the work holding devices for milling and drilling
5.1.8 Explain the work holding devices for milling and drilling
5.1.9 List the drill bit holding devices
5.1.10 Explain the milling cutter holding devices
5.1.11 Explain twisted drill bit with sketch
5.1.12 State the drill bit materials usually used
5.1.12 Explain the sequence of steps to be carried out for drill bits grinding
5.1.13 Explain the milling operations.
5.1.14 Explain the milling methods briefly.
5.1.15 Name the parts of an indexing head.
5.1.16 Explain the sequence of operations carried our by milling machines such as spur gear cutting, bevel gear cutting and helical gear cutting
5.1.17 Classify the milling cutters.
5.1.18 State the speed and feeds of tool for various metals.
5.1.19 Specify the machines for procurement.

5.2.0 Recognize the importance of powder metallurgy

5.2.1 Explain the importance of powder metallurgy
5.2.2 Explain why making alloys by melting is unsuitable
5.2.3 List the various methods of manufacturing metal powder
5.2.4 Explain briefly various methods manufacturing metal powder such as mechanical pulverization, electrolytic process, chemical reaction and atomization
5.2.5 List the products of powder metallurgy
5.2.6 List the advantages of powder metallurgy
5.2.7 List the disadvantages of powder metallurgy

CONTENT OUTLINE

UNIT I

Metrology:

Comparators – Mechanical comparators, electrical comparators, optical comparators, pneumatic comparators, measuring machines – Advantages with other measuring devices.

Temperature Measurement – Classification of Temperature measuring instruments, Liquid-in-glass Thermometers, Bimetallic Thermometers, Thermocouples – Laws, Elements of Thermocouple system, Thermocouple materials, General Consideration, Resistance Thermometers and Thermistors, Radiation and Optical Pyrometers. Strain Measurements – Types of Gauges and gauge factor, Strain measurement techniques, requirement of Strain gauges, Strain gauge material, Resistance strain gauges (Bonded and unbonded)

Measurement of surface roughness – Method of measurement by qualitative assessment or visual inspection, nail test, comparison microscope and by quantitative assessment (Mechanical, Electrical, Optical, Pneumatic and Electronic method)

Metal cutting:

Mechanism of metal cutting – general principles, chip formation – forces on cutting tools, orthogonal cutting, oblique cutting, machinability. Cutting speeds and feeds of various cutting tools, materials. Single point cutting tool – tool parts, tool geometry. Cutting tool materials – high carbon steel, high speed steel, carbide, ceramic, diamond. Their properties, factors that affect the life of tools. Multi point cutting tools. Nomenclature of a plain milling cutting tools.

Cutting Fluids – Lubrication and cooling action – Requirements – Type of cutting fluids – Applications – Selection of a cutting fluid – Effect of coolants on cutting variables ie, Speed, Feed and Depth of cut

UNIT II

Metal joining

Welding – introduction , safety in welding shop , classification of welding, advantages and limitation of welding. Arc welding – Principles of arc welding , arc welding ,machines – D.C. generators, A.C. transformers. Advantages and limitations of each. Welding process – work preparation for welding operation – number of runs – flat, horizontal , vertical and overhead welding welded joints butt, lap corner , tee edge (v) (u) joints, symbols as per I S code.

Selection of welding electrodes – Electrode coatings – current voltage the functions of Electro coating. Gas welding - Oxy – Acetylene welding. Major advantages and limitations – type of flames – functions and operation of oxy – acetylene cylinders, pressure regulators welding torch, nozzle. Gas welding procedure – preparation of job, selection of filler rod and flux. Gas pressure and nozzle size, angle of rod and blow pipe and number of runs. Brief explanation of oxy Hydrogen submerged arc welding, tungsten inert gas welding, metal inert, gas welding, MIG welding, CO2 welding, Atomic hydrogen welding.

Thermit welding – brief description only. Defects in welding – causes and remedies of the defects, porosity, poor penetration, warping, under cut, distortion crack, poor appearances.

Testing and inspection of welding joints : brief description of 1. Visual inspection 2. Destructive test – tensile and bend test 3. Non descriptive tests – magnetic tests, electric testing and X-ray testing. Soldering and brazing – brief description only. Application of soldering and brazing. Advantages and limitations

UNIT III

Lathe and lathe work

Type of lathe – Centre lathe, Tool room lathe, Bench lathe and Speed lathe. Lathe construction – lathe parts, function of each part. Lathe accessories – work holing and tool holding devices. Metal cutting – speeds, feeds and depths of cut for different operation for different materials. Operations – cylindrical turning , time calculation and measurements, taper turning methods, thread standards and forms, thread calculation , gear changing for screw cutting, multiple threads, drilling, boring, and reaming. Lathe alignment - checking alignments of centre, bed checking correction of lead screw. Erection hint – foundation bolt. Lathe specification.

UNIT – IV

Shaping Machines

General use of a shaper – parts and their functions – shaper tool holding devices. Quick return motion arrangements and adjustments of stroke. crank and slotted lever method With worth method, Hydraulic method, Speed, feed and depth of cut for various materials. Work difficulties - chattering tool, warping of work. Shaper specifications.

Slotting Machines

General use of a slotter. Slotter parts and their functions. Tools and work holding devices. Speed , feed and depth of cut for various materials. Quick return arrangements. Operations.key way cuttings, spur gear cuttings.Slotter specifications.

Planing machines

General use of a planer, planner parts and their functions, Tool and work holding devices. Table drive and feeds. Speed , feed and depth of cut for various materials. Operations Planing Horizontal , vertical and inclined surfaces Planing T slots Planing dove tails, Planer specifications. Comparison of shaper, slotter and planer

UNIT - V

Drilling machines

Types of drilling presses. Bench type drill, Pillar type drill, Portable type drill, Radial drill, Parts and functions of drill press. Drill press accessories. Tool holding devices, work holding devices. Drill bits. Type of drill bits. Drill bit angle, Drill bit material and specifications. Drill bit grinding. Sped and feeds of tool on various metals such as cast iron, mild steel , alloy steel and brass. Drill press specifications.

Milling machines

General use of milling machines, Parts of milling machines and their functions, Types of milling machines (a) plain (b) universal. Cutter holding devices (a) arbours (b) collets (c) adopters, Setting of work –(a) work holding devices (b) alignment (c) speed feed and depth of cut on various materials Milling operations - plain milling, key and key ways, gang milling , T – slot milling , Milling methods (a) conventional milling (b) climb milling. Constructions on indexing head (name of the parts only). Special operation (A) spur gear cutting (b) bevel gear cutting (c) helical gear cutting
Types of milling cutters Milling machine specifications.

Powder metallurgy:

Introduction , process description , manufacture of metal powder – atomisation, mechanical pulverization, electrolytic processes and chemical reaction – products of powder metallurgy. Advantages, disadvantages and limitations of powder metallurgy.

REFERENCE

1. Dimensional metrology - M.K. Dhare, S. Vajpayee
2. Measuring instruments design and use - Yer G. G. Gorodetsky
3. W/S Technology - B.S. Reghuwanshi
4. Production technology - Er.R.K. Jain
5. Mechanical Measurement & Control - D. S. Kumar, Metropolitan Publishers
6. Mechanical & Industrial Measurements - R. K. Jain, Khanna Publishers
7. Mechanical Measurements & Instrumentation - A. K. Sawhney, Pub: Dhanpathrai & Sons
8. Production Technology - P.C. Sharma Pub: S. Chand and Co.
9. Engineering Metrology - Narayana Pub: Scitech
10. Metal Working & Metrology - Narayana/Sudhakar Pub: Scitech

SUBJECT TITLE : HYDRAULIC MACHINES
SUBJECT CODE : ME 404
PERIODS/WEEK : 4
PERIODS/YEAR : 64

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I	1 Impact of jets	12
	Test – I	1
II	1. Impulse Turbines	12
III	1. Reaction turbines	9
	2. Performance of Turbines	4
	Test—II	1
IV	1. Centrifugal Pumps	7
	2. Reciprocating Pumps	5
V	1. Pumping devices	5
	2. Hydraulic systems	5
	3. Hydel Power plants	2
	Test –III	1
	Total	64

OBJECTIVES

UNIT – I

1.1.0 Justify the Impact of Jets

1.1.1 Explain jet of water and its applications
1.1.2 Derive equations for force exerted by the jet striking on stationary vertical plate and stationary inclined plate(normal to the plate, in the jet direction and normal to the flow)
1.1.3 Solve problem on 1.1.2
1.1.4 Derive equations for force exerted by the jet striking on stationary curved plate at the center stationary curved plate at one end tangentially
1.1.5 Solve simple problems on 1.1.4
1.1.6 Derive equations for force of jet striking on hinged plate
1.1.7 Solve simple problems on 1.1.6
1.1.8 Derive equations for force of jet and work done by the jet striking on a moving, flat vertical plate, moving flat inclined plate and moving curved plate
1.1.9 Solve simple problems on 1.1.8
1.1.10 Derive equations for face of jet, work done and efficiency of jet striking on a series of vanes
1.1.11 Solve simple problems on 1.1.10
1.1.12 Derive equation for work done by a jet of water striking on unsymmetrical moving curved plates when the jet strikes tangentially at one of the tips
1.1.13 Solve simple problems on 1.1.12
1.1.14 Explain principle of jet propulsion
1.1.15 propulsion of ships by water jet (no derivation).

UNIT – II

2.1.0 Appreciate the working of Hydraulic Turbines

2.1.1 Explain development of water turbines
2.1.2 Explain advantages of water turbines
2.1.3 Classify water turbines
2.1.4 Explain impulse turbines
2.1.5 Describe the principle of working of Pelton wheel with sketches
2.1.6 Explain velocity triangles and derive the equations for work done, power produced and efficiency of Pelton wheel
2.1.7 Simple problems on 2.1.6
2.1.8 State the equations and solve the problems for number of jets of a Pelton wheel Pitch circle dia, dia of jets, and quantity of water supplied to the wheel
2.1.9 Explain governing of an impulse turbine with sketches
2.2.10 Understand about other Impulse turbines

UNIT - III

3.10 Describe the principle of working of reaction turbines, radial flow reaction turbine (Inward flow and outward flow) and solve simple problems

3.1.1 Compare impulse and reaction turbines
3.1.2 Describe the principle of working of Francis turbine and Kaplan turbine
3.1.3 State the equation of work done, power produced, discharge and efficiencies (Hydraulic, mechanical and overall) of reaction turbines (No derivations)
3.1.4 State the equation for discharge of Kaplan Turbine and solve simple problems
3.1.5 Explain with sketches different types of draft tubes
3.1.6 Know other reaction Turbines

3.2.0 Characteristics of Turbines

3.2.1 Understand the characteristics of turbines Unit power, Unit speed, and Unit discharge
3.2.2 Understand the significances of characteristics
3.2.3 Define specific speed
3.2.4 Understand the significances of the specific speed
3.2.5 Understand the selection of Turbines based on specific speed and head
3.2.6 Understand the characteristic curves of Pelton wheel and Francis Turbine (no derivation -simple problems)

UNIT - IV

4.1.0 Appreciate the working of Centrifugal pumps

4.1.1 Classify pumps
4.1.2 Explain different types of casing of centrifugal pumps
4.1.3 Explain the piping systems of centrifugal pump
4.1.4 State the equations for work done, power and efficiencies of centrifugal pump (with derivation)
4.1.5 Compute simple problems on 4.1.4
4.1.6 State and define specific speed of CP (no derivation -simple problems)
4.1.7 Know the selection of CP based on specific speed and head
4.1.8 Explain cavitation-priming
4.1.9 Study the characteristic curve – speed Vs discharge,discharge Vs head
4.1.10 Explain multistage CP with sketches

4.2.0 Appreciate the working of Reciprocating pump

4.2.1 Explain the principle of working of reciprocating pump
4.2.2 Explain various types
4.2.3 Compare centrifugal pump and reciprocating pump
4.2.4 State the equations for finding discharge
4.2.5 Explain slip and significance of negative slip
4.2.6 State the equations for power required to drive a reciprocation pump

4.2.7 Solve simple problems on4.2.4, 4.2.5 and 4.2.6
4.2.8 Explain Air vessels
4.2.9 Explain the indicator diagram of RP

UNIT - V

5.1.0 Appreciate the working of different Pumping Devices and hydraulic systems

5.1.1 State the different type of pumping devices
5.1.2 Explain Hydraulic ram with sketche
5.1.3 Explain air lift pump with sketche
5.1.4 Explain with sketches jet pump
5.1.5 Explain with sketches various rotary pumps
5.1.6 List various Hydraulic systems
5.1.7 Explain with sketches of Hydraulic systems (no derivation or problems)
5.1.8 Explain Hydraulic coupling with sketch

5.2.0 Understand hydel power plant

5.2.1 Explain with sketches Hydro electric power plant
5.2.2 Explain surge tank
5.2.3 Understand water hammering phenomena
5.2.4 Understand penstock pipes

CONTENT DETAILS

UNIT –I

Impact of Jets

Introduction – force exerted by the jet – stationary vertical plate – stationary inclined plate – stationary curved plate at the center stationary curved plate at one end tangentially – simple problems – angled plate – simple problems – moving flat vertical plate – moving flat inclined plate – moving curved plate – series of vanes – simple problems – force exerted by a jet of water on unsymmetrical moving curved plate when the jet strikes tangentially at one of the tips – simple problems – principle of jet propulsion – propulsion of ship.

UNIT II

Impulse turbines

Introduction-development of water Turbines-classification-impulse Turbine-Pelton wheel-components-velocity triangle and work done.Workdone-power produced efficiency-number of jets – design of Pelton wheel—governing—other impulse Turbines (simple problems)

UNIT III

Reaction turbines

Introduction –components—difference between impulse& Reaction—Classification of Reaction Turbines –discharge—power produced—efficiencies—Francis Turbine—Kaplan Turbine—Draught tubes—other reaction turbines.

Performance of turbines

Characteristics of Turbines –Significance—specific speed—selection of Turbine—selection based on specific speed and head of water—characteristic curve for Impulse and reaction Turbines (no problems)

UNIT IV

Centrifugal pump

Introduction – types of casing—piping system of CP—work done manometric head—efficiencies – discharge—power required to drive –multistage pumps –simple problems.

Performance—specific speed of CP—selection of pumps based on specific speed and head—cavitation—priming—characteristics curves

Reciprocating pump

Types–comparison of CP&RP–discharge-slip-power required–air vessels–indicator diagram of RP simple problems

UNIT V

Pumping devices & Hydraulic systems

Hydraulic ram—air lift pump—jet pump

Hydraulic press—hydraulic Accumulator –Hydraulic Intensifier –hydraulic crane—hydraulic lift—(no derivation or problems)—hydraulic coupling.

Hydro Electric Power plants

Hydel power plant-surge tank—water hammer—penstock pipes

REFERENCE BOOKS

1. Hydraulic, Fluid mechanics and Hydraulic machines – R.S.Khurmi
2. Fluid mechanics and hydraulic machines – Dr. R.K. Bansal
3. Hydraulics, Fluid mechanics and fluid machines – S.Ramamurtham
4. Hydraulic and Hydraulic machines – Dr. Jagadish Lal

SUBJECT TITLE : PRODUCTION DRAWING
SUBJECT CODE : ME 405
PERIODS/WEEK : 3
PERIODS/SEMESTER: 48

TIME SCHEDULE

UNIT	TOPICS		PERIODS
I	1.1 Introduction		
	1.2 Limits, Fits and Tolerances		10
II	2.1 Surface Finish		6
		Test	1
III	3.1 Interpretation of Drawing		
	3.2 Shop Floor Drawing		18
		Test	2
IV	4.1 Introduction to CAD		10
		Test	1
		Total	48

CONTENT DETAILS

UNIT – I

Need of preparing a production drawing - components of a production drawing
Limits, Fits and Tolerances, Definition of limits, fits and tolerances. Geometrical tolerance - Characteristics of geometrical tolerance – Dimensional tolerance – Hole basis and shaft basis system. Select dimensions form B. I. S. standard to obtain clearance, transition and interference fit for a given set of mating parts. Computation of fits and tolerances form B. I. S. table – Preparation of drawings of mating parts and representation of fits and tolerances.

UNIT – II

Surface Roughness – Surface Roughness terminology – Roughness grades number, value and symbol

Symbols indicating surface texture – Relation between surface finish and manufacturing process
Symbols representing direction of lay, operations

UNIT – III

Interpretation of Drawings

Exercises in identifying the type of production, extracting important functional dimensions, checking the number of parts in an assembly. Checking and listing missing dimensions. Identifying the sectional views

Shop floor drawing

Note: The main objective of introducing this subject at this point in the course is to enable the student to prepare drawing suitable or relevant to the production of the component (s) as represented by these drawings. Another objective is to develop the ability among students to read and interpret a given production drawing for the purpose of specifying the materials, the particular process of production, the type of tools needed to obtain the accuracy and surface finish specified by the designer and to identify those parts that are standard components that could be purchased from the market and to

specify them as per commercial/ B. I. S. standards for purchase. In order to develop these abilities among students, the use of actual production drawing from the local industries is of vital importance. Traditional or academic exercises from books may not help to achieve these objectives. It is suggested that about 6 exercises can be given to the students for the development of the abilities and skills mentioned below:

Prepare the relevant vies of the parts of a given assembly drawing needed for the purpose of production

Dimension the views obtained in 1, with relevant notes and indications as to the limits/tolerances, surface finish needed. Details of specific processes and the conventional / symbolic representation (like heat treatment, welding, counter boring etc) with reference to the function of the part in the whole assembly. Indicate the process of production, specification of relevant tools to obtain the accuracy and finish and specification of materials as per commercial/ B. I. S. standard, given the production drawing of actual parts

Identify those parts that are standard components that can be procured directly from the market, from a given production drawing and specify the part as per commercial/ B. I. S. standards for procurements. Specify the type of measuring instrument (s) to be used to check the prescribed accuracy.

Exercises in preparation of detailed production drawings as per BIS standard of the machine parts such as slip bush, socket and spigot joint, sleeve and cotter joint, over hung crank, plummer block, C-clamp, Oldham's coupling

UNIT – IV

Introduction to the Computer Aided Design and drafting – Basics of DOS – AutoCAD basics – Main menu, Starting a new drawing, Drawing editor, Entering commands, Using mouse, Pull down menu, Getting help, Data entry, Entity selection, Error correction – Working with AutoCAD – Setting limits of the drawing, Grid, Snap, Coordinates, Ortho modes, Zooming, Drawing lines, Arcs, Circles, Erase, Undo, Oops, Commands, Save and End commands, Editing – Editing commands, adding text and dimensions, hatching. Plotting the drawing

Note: Question papers should be with questions approximately for 15 marks from Unit I
10 marks from Unit II
35 marks from Unit III
15 marks from Unit IV

Use BIS tables and charts are permissible for Examination

REFERENCE BOOKS

1. Machine drawing - N.D. Bhat
2. Machine drawing - P.I. Vargheese
3. Machine drawing - K.C. John
4. AutoCAD - P. Dayanidhi, TTTI.
5. AutoCAD - K.C. John

SUBJECT TITLE : HYDRAULICS LABORATORY
SUBJECT CODE : ME 406
PERIODS/WEEK : 3
PERIODS/SEMESTER : 48

TOPIC

1. Bernoulli's theorem apparatus
2. Orifices & Notches
3. Venturimeter
4. Pipe friction apparatus
5. Pelton turbine, Francis turbine and Kaplan turbine
6. Centrifugal pump & Reciprocating pump
7. Hydraulic Ram
8. Pipe fittings, joints and valves
9. Hydraulics and Pneumatic circuit

OBJECTIVES

1.1.0 Demonstrate the use of Bernoulli's theorem apparatus

- 1.1.1 Explain Bernoulli's theorem
- 1.1.2 Verify Bernoulli's theorem using the apparatus
- 1.1.3 Draw the graph-length of pipe Vs total energy
- 1.1.4 Interpret the curve

2.1.0 Appreciate the coefficient of discharge through orifices and notches

- 2.1.1 Differentiate orifices and Notches and its functions
- 2.1.2 Determine the coefficient of discharge of each
- 2.1.3 Plot the graph – discharge Vs coefficient of discharge
- 2.1.4 Calibrate a given notch

3.1.0 Appreciate the coefficient of discharge through venturimeter

- 3.1.1 State the function and application of a venturimeter
- 3.1.2 Determine the coefficient of discharge
- 3.1.3 Calibrate a given venturimeter

4.1.0 Use the pipe friction apparatus to determine the coefficient of friction

- 4.1.1 Explain the term coefficient of friction in pipes
- 4.1.2 State the effort of friction in pipes
- 4.1.3 Determine the coefficient of friction of pipes of different diameters
- 4.1.4 Plot total energy line and hydraulics gradient line

5.1.0 Distinguish the characteristics curves of Pelton turbine, Francis turbine and Kaplan turbine

- 5.1.1 Differentiate the Pelton turbine, Francis turbine and Kaplan turbine
- 5.1.2 State the conditions under which each type is preferred
- 5.1.3 Plot the characteristics curves
- 5.1.4 Interpret the above curves

6.1.0 Distinguish the characteristics curves of centrifugal pump and reciprocating pump

- 6.1.1 Differentiate centrifugal pump and reciprocating pump
- 6.1.2 State the function principle of working of each type
- 6.1.3 State the application of each type
- 6.1.4 Conduct experiment on each type
- 6.1.5 Plot the characteristic curves

7.1.0 Construct the graph – discharge versus efficiency of hydraulic ram
- 7.1.1 State the function of hydraulic Ram
- 7.1.2 Explain the working of hydraulic Ram
- 7.1.3 Conduct the experiment on hydraulic Ram
- 7.1.4 Plot the graph – discharge Vs D'Abuisson's efficiency and Rankine efficiency
- 7.1.5 Interpret the above curves

8.1.0 Construct water supply piping systems
- 8.1.1 Identify the various types of pipe fittings joints and valves
- 8.1.2 Plumbing practice

9.1.0 Appreciate the hydraulic and pneumatic circuits in the available machine tools
- 9.1.1 Draw the hydraulic and pneumatic circuit in the available machine tools
- 9.1.2 Identify the various parts of the circuit

CONTENT DETAILS

1. Verification of Bernoulli's theorem using the apparatus
2. Tests on orifice and notches
   (i) Determination of the coefficient of discharge of different orifices and notches
   (ii) Calibration of notches and orifices
3. Test on venturimeters
   (i) Determination of coefficient of discharge of the venturimeter
4. Test on pipe friction apparatus
   (i) Determination of the friction factor using Darcy's formulae of pipes of varying cross section
   (ii) Plot TEL and HEL
5. Tests on Pelton turbine, Francis turbine and Kaplan turbine
   (i) Operations of the turbines
   (ii) Measurement of brake power and overall efficiency
   (iii) Plotting various characteristic curves
6. Test on centrifugal pump and reciprocating pump- operation of the pumps – plotting various characteristics curves
7. Study and test on hydraulics Ram operation – plotting characteristic curves
8. Piping systems. Practice the erection of domestic piping systems.
9. Study of the hydraulic and pneumatic circuit in the available machine tool

SUBJECT TITLE : WORKSHOP PRACTICE
SUBJECT TITLE : ME 407
PERIODS/WEEK : 6
PERIODS/SEMESTER : 96

TIME SCHEDULE

BATCH	TOPIC	PERIODS
I	1. Sheet Metal and Aluminium Fabrication	45
	Test	3
	2.Welding	45
	Test	3
	Total	96
II	1.Machine Shop	45
	Test	3
	2. Fitting	45
	Test	3
	Total	96

CONTENT OUTLINE

TOPIC

1.Machine Shop
Understand safety precautions
Lathe work
1.1 Familiarization with lathes- principle parts, work holding device measuring instruments
1.2 Plain turning to the given accuracy
1.3 Taper turning
1.4 Forming
1.5 Thread cutting
1.6 Combination of above operations
1.7 Test on lathe
Work on shaper
2.1 Familiarize with the operations
2.2 Shaping of a rectangular block
2.3 Shaping a 'V' in a rectangular block
Work on drilling machine
3.1 Marking and drilling holes
3.2 Boring and counter boring
3.3 Reaming
Work on milling machine
4.1 Familiarization with the different operations
4.2 Plain surface milling

Work on slotter
5.1 Familiarization with the various operations
Work on planner
6.1 Familiarization with the various operations
6.2 planning flat surface

2. Fitting Practice

Study measuring gauges-dial gauges, feeler gauges, thread gauges
Working from a given blue print exercises involving marking filling, drilling, reaming and tapping to an accuracy of = 0.5mm

Sheet Metal & Aluminium fabrication
Understand safety precautions.
Familiarization of sheet metal tools – scribers, dividers, trammel points, set square, punches – prick punches, centre punches – hand Grover, rivet, set, chisels hammers, riveting hammers, ball pein hammers – mallet, snip shears, pliers, hand seamers (tongs) files stakes. Measuring instruments in sheet metal folding rule, common rule, steel circumference rule, vernier calipers, micrometer calipers, thickness gauges (slip gauge) sheet metal gauge.
Sheet metal operations – piercing, punching parting, notching, perforating, slotting, blanking, launching and cutting off.
Practice work
Sheet cutting, development, folding bending and pipe bending, making right angle, soldering, brazing and riveting, making – tray, oil, can and bucket.
Aluminium Fabrication
Aluminium fabrication and its scope, Tools – different types of files, hacksaw, screw driver, hammer, drill bits etc , Measuring tools – steel tape, try, square, bevel square, combination set etc.
Practice work – cutting, filing, drilling with hand drill, making key holes making of different types of joints such as straight joints, corner joints out joint with different aluminium sections.

4. Welding

Safety precautions, Study of various tools and equipment's used in the welding shop for both arc welding and gas welding.
Practice work

D.C. arc welding, A.C. arc welding, Gas welding, Horizontal flat, vertical end over head welding and single/double/, Edge preparation of welded joint such as V, double V and double U. Pipe welding, Flame cutting

Reference

1. Workshop manual by P.Kannaiah &K.L.Narayana
Pub: SCITECH

SUBJECTS OF STUDY AND SCHEME OF EVALUATION

SEMESTER V

Branch : Mechanical Engineering

Code	Subject	Periods Per Week			Evaluation (Marks)			
		Theory	Practical	Total	Theory	Practical	Internal	Total
ME 501 / TD 501	Industrial Engineering & Cost Analysis	6		6	75		25	100
ME 502	Refrigeration & Air Conditioning	6		6	75		25	100
ME 503	Automobile Engineering	5		5	75		25	100
ME 504	CADD Laboratory – I		3	3		75	25	100
ME 505	Heat Engine Laboratory		6	6		75	25	100
ME 506	Servicing & Maintenance Laboratory		3	3		75	25	100
ME 507	Machine Shop Practice		3	3		75	25	100
	** Project /Seminar		3	3				
	TOTAL	**17**	**18**	**35**	**225**	**300**	**175**	**700**

SUBJECT TITLE : INDUSTRIAL ENGINEERING & COST ANALYSIS
SUBJECT CODE : ME 501 / TD 501
PERIODS/WEEK : 6
PERIODS/SEMESTER : 96

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I		
	1.1 Production planning and control	12
	1.2 Value Engineering	2
	1.3 Plant Location and Layout,maintenance &GT	8
II	2.1 Method study	6
	2.2 Work measurement	7
	2.3 Work sampling	5
	Test – I	1
III	3.1 Inspection	5
	3.2 Fundamentals of statistical concepts	4
	3.3 Construction of x –R chart	4
	3.4 Control chart for defectives	3
	3.5 C-chart	2
	Test – II	1
IV	4.1 Project analysis	2
	4.2 Elements of costing	9
	4.4 Fundamentals of estimating	7
V	5.1 Estimation of weight & material cost	7
	5.2 Estimation of machine time	12
	Test – III	1
	Total	**96**

OBJECTIVES

Upon completion of the study of this subject the student will be able to:

UNIT - I

1.1.0 Appreciate the scope of the subject Industrial Engineering

1.1.1 Explain the concept of industry, industrial engg., Production and Productivity
1.1.2 Differentiate production and productivity with examples
1.1.3 Identify the importance of productivity
1.1.4 Name the various methods of increasing productivity

1.2.0 Understand the procedure to implement production planning and control programme in Industries

1.2.1 Explain the types of production
1.2.2 List the characteristics of various types of production
1.2.3 Explain the concepts of P.P.C
1.2.4 Explain the benefits of P.P.C
1.2.5 Identify the various functions of P.P.C
1.2.6 Explain Pre-planning
1.2.7 List various activities of pre-planning
1.2.8 Explain forecasting and various methods of forecasting
1.2.9 Illustrate Routing and Routing procedure
1.2.10 Illustrate scheduling
1.2.11 Identify the three types of schedule charts
1.2.12 Prepare master schedule, parts schedule and machine loading schedule and machine loading schedule in the form of Gantt chart
1.2.13 Explain the concepts of just in time with examples
1.2.14 Define Dispatching
1.2.15 List various documents in dispatching
1.2.16 Define control
1.2.17 Explain briefly three types of control – labour utilization control, material utilization control and manufacturing cost control
1.2.18 Explain value engineering
1.2.19 Understand the concept of Group Technology
1.2.20 Explain the concept of group technology
1.2.21 Plant layout
1.2.20 Explain briefly the various factors to be considered in locating industrial plants
1.2.21 Explain the different types of plant layout adopted in modern industries
1.2.22 Explain briefly the various factors influencing the plant layout
1.2.23 Explain the procedure of preventive and predictive maintenance
1.2.24 Explain cost of maintenance
1.2.25 state the function and principle of material handling
1.2.26 List the factors effecting material handling
1.2.27 relation ship to plant layout

UNIT – II

2.1.0 Justify the Procedure for the conduct of Method study

2.1.1 Explain work study
2.1.2 Illustrate the application of work study to increase productivity
2.1.3 Explain the procedure for the conduct of method study
2.1.4 Prepare various process charts and diagrams
2.1.5 Explain the concepts of Therbligs
2.1.6 List the various Therbligs and its symbols
2.1.7 Prepare Simo chart
2.1.8 State the objectives of method study
2.1.9 principles of motion economy

2.2.0 Justify the procedure for calculating standard time

2.2.1 Explain the procedure for the conduct of stop watch time study
2.2.2 Compute standard time (simple problem)
2.2.3 Describe the concept of production study
2.2.4 State the various steps to develop standard data
2.2.5 Explain the concepts of PMTS
2.2.6 Explain the concepts of MTM
2.2.7 Explain the concepts of analytical estimating

2.3.0 Understand the Principles of work sampling

2.3.1 Explain the term work sampling
2.3.2 State the application of work sampling
2.3.3 List the various steps required in making a work sampling study
2.3.4 Explain random sampling
2.3.5 Explain the use of random numbers table

UNIT – III

3.1.0 Appreciate the importance of quality control and inspection methods

3.1.1 Explain the concepts of 'Quality' and 'Quality Control'
3.1.2 List the objectives of Quality control
3.1.3 Explain briefly the areas of application of Quality control programmes
3.1.4 State the three components of Quality costs
3.1.5 Identify the benefits of Q.C. programme
3.1.6 Explain the concepts on Inspection
3.1.7 Explain the inspection of incoming materials
3.1.8 Compare floor inspection and centralized inspection

3.2.0 Understand the fundamentals of Statistical concepts

3.2.1 Explain the concept of variability in measurement
3.2.2 Explain the terms variable and attribute with example
3.2.3 Explain the terms frequency, frequency distribution and frequency plot
3.2.4 Construct frequency plot and tally sheet
3.2.5 Construct histogram and frequency polygon
3.2.6 Explain normal distribution curve
3.2.7 Explain the terms mean mode, median and standard deviation.
3.2.8 Compute mean, mode and standard deviation

3.3.0 Justify the Procedure of Constructing X and R Charts

3.3.1 Describe the method of calculating mean and range
3.3.2 Explain the points to be considered for making X-R chart
3.3.3 Explain $\overline{X}$ & R control charts data calculation sheet
3.3.4 Explain the steps in the calculation of control limits
3.3.5 Plot the X & R chart

3.4.0 Justify the control chart for defective

3.4.1 Define fraction defective and percent defective
3.4.2 Compute average fraction defective
3.4.3 Compute the control limits
3.4.4 Construct the P chart and 100P chart
3.4.5 Analyse and interpret the control chart

3.5.0 Justify the construction of 'C' Chart

3.5.1 Explain the terms deffects and defective
3.5.2 Explain the characteristic of a 'C'; Chart
3.5.3 Compute the average of defects
3.5.4 Compute control limit for 'C' chart
3.5.5 Construct 'C' chart
3.5.6 Interpret the chart
3.5.7 State the advantages of 'C' chart

UNIT – IV

4.1.0 Compute the Selling Price of a Product

- 4.1.1 Explain the term costing
- 4.1.2 State the objectives of costing
- 4.1.3 Identify the elements of cost
- 4.1.4 Explain the classification of cost.
- 4.1.5 Compute selling price of aproduct given examples
- 4.1.6. Explain the various methods of allocation of over heads
- 4.1.7 Explain the term depreciation'.
- 4.1.8 List the various causes for depreciation
- 4.1.9 Explain the various methods of calculating depreciation
- 4.1.10 Compute the depreciation in the given examples
- 4.1.11 Outline the need, scope and functions of estimating department in industry
- 4.1.12 Write down the objectives of estimate
- 4.1.13 List the functions of the estimating department
- 4.1.14 Explain organization structure of estimating department
- 4.1.15 Write the principal constituents of estimating
- 4.1.16 Explain estimating procedures
- 4.1.17 Distinguish between estimating and costing

UNIT- V

5.1.0 Compute the weight of material and cost of particular product

- 5.1.1 Reproduce the important results of calculating areas and volumes of solids
- 5.1.2 Explain the principle of dividing the component drawing into smaller geometrical configurations
- 5.1.3 Compute the cost of the given items using volume of material cost

5.2.0 Compute the machining time for various operations by using empirical formulae and standard tables

- 5.2.1 Reproduce the basic formulae for the calculation of machining times for the given operations
- 5.2.2 Use standard tables for feeds and cutting speeds to calculate machining time
- 5.2.3 Compute the machining times for various operations like turning, drilling, shaping, boring, screw cutting, grinding and milling.
- 5.2.4 Compute machine hour rate
- 5.2.5 Consider various factors like depreciation interest, capital cost space cost energy cost scrap value future worth of machines etc.

CONTENT DETAILS

UNIT – I

Introduction

Explanation of the scope of the subject industrial engineering – concepts of industry – production and productivity – difference – importance – methods of increasing productivity – expectations form productivity.

Production planning and control

Meaning of the term production – types of production – job production batch production, mass production, continuous production – one time large production – explanation of production planning control – benefits of PPC – functions of PPC

Pre-planning activities – forecasting, plant location, product planning, design and development, material selection, process planning, determination of men, machines, material and tool requirements.

Methods of Fore-casting: - Historic estimate, trend line techniques , sales force estimate, co-relation techniques, sampling techniques. Process palnning – choice of machine in process planning – break even analysis – process sheet – process planning procedure

Routing – explain routing – routing procedure – route sheet – comparison of route sheet and process sheet, Scheduling – factors affecting scheduling – types – master schedule parts schedule, m/c loading schedule – preparation of schedule chart in Gantt chart form, Just in Time manufacturing – Explanation of the concept of JIT – benefits of JIT – application of JIT

Dispatching – functions – work in dispatching – list various documents prepared in dispatching

Follow up and control – types of control material utilization control, labour utilization control, manufacturing cost control

Value Engineering

Explain value engineering – applications of value engineering – advantages

Plant location and layout

Factors to be considered in locating industrial plants – plant layout – types of layouts – compare the advantages and disadvantages of each type – factors influencing the plant layout – plant maintenance – types of maintenance – maintenance cost - material handling –functions and principles of material handling – factors effecting material handling – relationship to plant layout - Automatic stage and retrieval system (ASRS). Group Technology – concept – group layout – advantages.

UNIT – II

Method study

Introduction to work study – advantages – application of work study to increase productivity

Introduction to method study – objectives of method study – method study procedure – state therblings and their symbols – process chart symbols – preparation of charts operation process chart, flow process chart, man-machine chart, right hand left hand chart, and simo chart – flow diagram – string diagram. Principles of motion economy – Rules concerning Human body, work place layout and amterial handling, tools and equipment design

Work measurement

Objectives of work measurement – procedure of stop watch time study, Standard time calculation – production study, Use of standard data – application – analytical estimating – P.M.T.S – M.T.M

Work Sampling

Explain work sampling – applications – steps in work sampling – Randam sampling use of random numbers

UNIT – III

Inspection and Quality control

Concept of Quality and Quality control – objectives of quality control – applications – material, process and product control – benefits of a quality control programme. State the components of qualities cost, Concepts of inspection – objectives – inspection of incoming materials – manufacturing inspection. Types of inspection – first piece inspection, working inspection, sample inspection, operation inspection, key operation inspection. Floor or patrolling inspection – centralized inspection – advantages and limitations

Fundamental statistical concepts

Explain the term variability in measurements – explain the terms variable, attribute, frequency, frequency distribution and frequency plot – normal distribution curve – tally sheet – explanation of the terms mean, mode, median and standard deviation – calculation of mean, mode, median and standard deviation

Construction of X & $\overline{R}$ Chart

Explain mean (X) and $\overline{R}$ange (R) preliminary consideration of making X and R $\overline{c}$harts – components of X & R charts – procedure f$\overline{o}$r constructing X & R charts – plot X & R $\overline{c}$hart – simple exampl$\overline{e}$s

Control Chart for defectives

Purpose of selection of P chart – determination – of size and frequency of samples – construction of P chart and 100 P chart – analyses and interpret

'C' Chart

C chart – characteristic – defectives and defect – control limits – construct – C chart – advantages of C chart

UNIT – IV

Project analysis – need and scope for project analysis - Explanation of the constituents elements of project analysis – production cost – market survey – selling price – capital investment – return on investment – element of costing – material – labour – expenses – classification of costs – explanation of the terms prime costs – total costs – method of allocation of overhead expenses – simple problems – depreciation – list the various causes for depreciation – types of depreciation –methods of calculating depreciation – obsolescence – simple problems – Calculation of machine hour rate – various factors that comes into calculations – simple problems- objective and functions of cost estimating – organization of estimating department – estimating vs costing

UNIT V

Principal constituents of estimating the cost of a component – design time – drafting time – method studies – time studies – planning and production time – experimental work – labour – material – overheads - miscellaneous allowance – steps in estimating procedure – standard estimate forms. Estimation of weights and materials – principles of dividing its component drawing into simpler and smaller geometrical configurations – calculation of volumes and weight of material - estimation of cost – exercise the calculation of weight of material and cost A table showing different engineering materials, their specific gravity and the present market rate would be given) – estimation of machine times – basic formulae for calculation of machining times for the operation such as turning – drilling – shaping – boring – screw cutting – grinding – milling – use of standard tables for feeds and cutting speeds – exercises in calculating the machine times for the above mentioned operations – simple problems

REFERENCE BOOKS

Industrial Engineering and Production management	– Martand Telsang
Industrial Engineering and Management	– Dr. O.P. Khanna
Industrial Organisation and Engineering Economics	– T.R. Banga & S.C. Sharma
Industrial Engineering & Management	– Dr. Balasundaram
Quality control	– T.T.T.I
Mechanical Estimating and Costing	– T.T.T.I
Mechanical Estimating and Costing	– T.R. Banga & S.C. Sharma

SUBJECT TITLE : REFRIGERATION AND AIR CONDITIONING
SUBJECT CODE : ME 502
PERIODS/WEEK : 6
PERIODS/SEMESTER : 96

TIME SCHEDULE

UNIT	TOPIC		PERIODS
I	1.1 Introduction		2
	1.2 Principles of Refrigeration		3
	1.3 Air Refrigeration system		8
	1.4 Vapour compression system		10
II	2.1 Vapour Absorption system		3
	2.2 Refrigeration Equipments		7
	2.3 Refrigerants		5
	2.4 Application of Refrigeration		4
		Test - I	1
III	3.1 Low temperature Refrigeration		16
IV	4.1 Psychrometry		6
	4.2 Psychrometric Processes		10
		Test - II	1
V	4.3 Air-conditioning		5
	5.1 Air conditioning systems		5
	5.2 Air-conditioning Load Estimation		8
		Test - V	1

		Total	96
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OBJECTIVES

UNIT – I

1.1.0 Know the importance of refrigeration, psychrometry and air conditioning.

1.1.1 Review the laws of thermodynamics
1.1.2 State the need for transfer of heat in the working of systems
1.1.3 Outline the importance of refrigeration, psychrometry and air conditioning.

1.2.0 Understand the Principles of Refrigeration

1.2.1 State the purpose of refrigeration
1.2.2 Define saturation temperature, latent heat, sensible heat, critical pressure, enthalpy, entropy and sublimation
1.2.3 Explain the change of state from liquid to vapour and vapour to liquid and solid to liquid and liquid to solid
1.2.4 Define refrigeration
1.2.5 Define COP of a refrigerator
1.2.6 Explain the unit of refrigeration
1.2.7 Analyse the reversed carnot cycle with the help of P-V and T-S diagrams
1.2.8 Derive COP of reversed carnot cycle

1.2.9 Compute the COP and capacity of a refrigerating machine from a given data
1.2.10 List the applications of refrigeration
1.2.11 Appreciate the working of Air Refrigeration System
1.2.12 Explain the working of air refrigerator based on Bell-Coleman cycle with the help of low diagram P-V and T-S diagrams
1.2.13 Derive COP of Bell Coleman cycle
1.2.14 Compute COP of Bell Coleman cycle from given data
1.2.15 Explain open and closed systems
1.2.16 List the advantages of disadvantages of Air refrigeration system

1.3.0 Appreciate the working of Vapour Compression system

1.3.1 Explain the principle of working of a vapour compression system
1.3.2 Analyse vapour compression system with the help of T-S and P-H diagram
1.3.3 Derive the COP of vapour compression systems
1.3.4 Derive the power required to drive the system
1.3.5 Compute COP and Power required from the given data
1.3.6 Explain the effects of sub-cooling and superheating the refrigerant
1.3.7 State the function of accumulation and flash chamber in a vapour compression system
1.3.8 Explain the flow diagram of a domestic refrigerator
1.3.9 Explain the electric circuit of a domestic refrigerator

UNIT II

2.1.0 Understand the working of vapour Absorption system

2.1.1 Explain the working of a simple absrbtion system with a flow diag
2.1.2 Explain the working of electrolux refrigerator with the help of a flow diagram
2.1.3 Compare vapour compression system and vapour absorption system

2.2.0 Understand the working of major components in a Refrigeration System

2.2.1 Explain with a simple sketch the working of a reciprocating compressor
2.2.2 Explain with a sketch the working of roller and vane type compressors
2.2.3 Explain with a sketch the working of a centrifugal compressor
2.2.4 Distinguish between hermetically sealed and semi-hermetically sealed compressor
2.2.5 Explain the working of air cooled condensers
2.2.6 Explain the working of water cooled condensers – shell and tube type, shell and coil type and double tube type
2.2.7 Explain the working of dry expansion type evaporator and flooded type evaporator
2.2.8 Distinguish between Natural convection type evaporators and forced convection type evaporators and forced convection type evaporators
2.2.9 Explain with suitable sketches the expansion devices such as capillary tube, automatic expansion valve and thermostatic expansion valve

2.3.0 Understand the Properties and applications of Refrigerants

2.3.1 Define refrigerant
2.3.2 Distinguish between Primary refrigerant and secondary refrigerant, with examples
2.3.3 Classify properties of refrigerants
2.3.4 Outline the desirable properties of refrigerants
2.3.5 Compare ammonia, carbon dioxide, freon 11, freon 12 and freon 22 on the basis of desirable properties
2.3.6 Outline the characteristics of environmentally safe refrigerants
2.3.7 Identify green refrigerants

2.4.0 Appreciate the various applications of Refrigeration

2.4.1 List various fields of applications of refrigeration
2.4.2 Explain with a layout, working of ice plants
2.4.3 Explain the working of water coolers – pressure type and storage type
2.4.4 Explain the working of a cold storage
2.4.5 Explain Dairy refrigeration – Pasteurization
2.4.6 Explain freeze drying
2.4.7 Explain Ice cream making process

UNIT - III

3.1.0 Understand the principles and working of low temperature refrigeration system

- 3.1.1 Define Cryogenic
- 3.1.2 Advantages of cryogenic refrigeration
- 3.1.3 Cascade refrigeration
- 3.1.4 Coefficient performance of a two stage cascade system
- 3.1.5 Understand Dry Ice or Solid Carbon Dioxide.
- 3.1.6 Method of manufacturing of solid carbon dioxide.
- 3.1.7 Liquefaction of Gases and Hydrogen

UNIT – IV

4.1.0 Understand the Principle of Psychrometry

- 4.1.1 Define Psychrometry
- 4.1.2 Define dry air, moist air, saturated, unsaturated and super saturated air, degree of saturation, dry bulb temperature, wet bulb temperature and dew point temperature
- 4.1.3 State Dalton's law of partial pressure
- 4.1.4 Distinguish between absolute humidity and specific humidity
- 4.1.5 Explain degree of saturation
- 4.1.6 Explain relative humidity
- 4.1.7 Derive enthalpy of moist air
- 4.1.8 Solve numerical problems relating the above parameters
- 4.1.9 Explain the construction and use of psychrometer
- 4.1.10 Explain the use of psychrometric chart (Simple problems using tables and charts.)

4.2.0 Understand the various Psychrometric processes

- 4.2.1 Explain and represent psychrometric process such as sensible heating, sensible ooling, humidifying, cooling and dehumidifying and adiabatic mixing of air streams on psychrometric charts
- 4.2.2 Explain by-pass factor of heating and cooling coil
- 4.2.3 Explain the concept of sensible heat factor
- 4.2.4 Derive efficiency of heating and cooling coils
- 4.2.5 Solve simple problems using psychrometric chart

4.3.0 Understand the principles of Air conditioning

- 4.3.1 Define air conditioning
- 4.3.2 Explain the factors affecting human comfort
- 4.3.3 Explain the concept of effective temperature
- 4.3.4 Explain the use of comfort chart in air conditioning

UNIT – V

5.1.0 Understand the Working of Air conditioning systems

- 5.1.1 Classify air conditioning systems on the basis of major function, season of the year and equipment arrangement
- 5.1.2 Explain industrial air conditioning, comfort air conditioning
- 5.1.3 Explain the working of summer air conditioning and year round air conditioning with line sketches
- 5.1.4 Explain the construction and working of window type air conditioner
- 5.1.5 Explain the construction and working of packaged type air conditioner
- 5.1.6 Explain the central plant system with suitable layout

5.2.0 Estimate the load and design Air conditioning systems

- 5.2.1 Survey the building
- 5.2.2 Identify design condition
- 5.2.3 Identify climate and outside condition
- 5.2.4 Explain the sources of heat gain or loss
- 5.2.5 Estimate heat gain from various sources
- 5.2.6 Design the suitable systems

5.2.7 Select major components
5.2.8 Know the barriers of building management systems
5.2.9 State the purpose of BMS
5.2.10 List the components in BMS
5.2.11 Describe thw working of BMS
5.2.12 Study visit to R & AC central plants.

CONTENT DETAILS

UNIT – I

Introduction

Introduction to heat transfer – importance of refrigeration, psychrometry and air conditioning.

Principles of Refrigeration

Review of thermodynamic principles – saturation temperatures; change of state; latent heat; sensible heat; critical pressure; enthalpy; entropy; sublimation

Definition of refrigeration; reversed carnot cycle, concept of C.O.P, unit of Refrigeration. Application of refrigeration, Laws of refrigeration simple problems.

Air Refrigeration systems

Working of Air refrigerator based on Bell-Coleman cycle, PV and TS diagram of Bell Coleman cycle. Simple problems. Open and closed systems of Air refrigeration. Advantages and limitations

Vapour Compression Refrigeration systems

Principles and working of a vapour compression system with the help of flow diagram. Analysis of vapour compression system with the help of TS and PH diagrams. C.O.P of vapour compression systems. Power required to drive the system. Simple problems. Effect of sub-cooling and super heating, use of accumulator and flash chamber. Domestic refrigerator

UNIT – II

Vapour Absorption system

Simple absorption system, Electrolux system, comparison with vapour compression system

Refrigeration Equipments

Compressors: Principle of working of reciprocating compressors, rotary compressor – roller and vane type – centrifugal compressor (Explanation with simple diagram only)

Condensers: Air cooled condensers, water cooled condensers – shell and tube type and double tube type (Explanation with line diagram)

Evaporators: Types, Dry and flooded type, Natural and forced convection type

Expansion Devices: Capillary tube, Thermostatic expansion valve, automatic expansion valve

Refrigerants

Definition: Primary and secondary refrigerants, their fields of application, desirable properties of refrigerants, Physical – chemical – thermodynamic – ozone depletion potential, green house depletion potential properties of ammonia, carbon dioxide, R-11, R-12 and R-22, environmentally safe refrigerants such as R134, R 152a etc:

Application of refrigeration

Ice plants, water coolers, cold storage, dairy refrigeration, freeze drying, ice cream cabinets

UNIT – III

Low temperature refrigeration (Cryogenics)

Definition for the term cryogenics. Historic development – present areas involving cryogenic engineering –field of application – superconductive devices – cryogenic in space technology – in biological and medicine – properties – mechanical and thermal, electrical and magnetic etc:- – Limitations of vapour compressor refrigeration system for production of low temperature – cascade refrigeration system Co efficient of performance of a two stage cascade system (Simple Problems) – Solid carbon Dioxide or Dry Ice. – Manufacture of solid carbon dioxide. Liquefaction of gases – Isentropic – free irreversible – Joule Thomson effect – (definition only) - liquefaction of hydrogen

UNIT – IV

Psychrometry

Definition, Dry air, moist air, saturated, unsaturated and super saturated air, absolute humidity, relative humidity, specific humidity. Dalton's law of partial pressures, degree of saturation, dry bulb temperature, wet bulb temperature, dew point temperature. Enthalpy of moist air, psychrometer, psychrometric chart and tables.

Psychrometric Processes

Sensible heating, sensible cooling – by pass factor, humidifying, dehumidifying – sensible heat factor, heating and humidifying, cooling and dehumidifying, efficiency of heating and cooling coil. Simple problems using psychrometric chart and tables.

UNIT – V

Air Conditioning

Definition, factors affecting human comfort, effective temperature, comfort chart

Air conditioning systems

Classification – industrial, comfort air conditioning, working of summer air conditioning, winter and year round air conditioning, construction and working of window type, package type, and central plant systems

Design and Load estimation of Air Conditioning systems

Introduction – building survey – heating load – design conditions – climatic and outside conditions. Heat source – External and Internal source, solar radiation through window – conduction of heat due to temperature difference. Heat addition by the occupants and equipments. Infiltration of air – ventilating estimation. Procedure of sensible heat load – latent heat load – total load – SHF.

Estimation of load for a given data – Design of air conditions – supply air quantity, fresh air loads. Installation of AC unit – different parameters for the selection of position of A/C Installation.

Modern development in refrigeration and air-conditioning –

Building management systems –B M S-.

REFERENCE BOOKS

Fundamentals of Engineering Heat and Mass Transfer	– Sachdeva
Heat and Mass Transfer	– S.Domkudwar
Refrigeration & Air conditioning	– R.S. Khurmi & J.K. Gupta
A course in Refrigeration & Air Conditioning	– S.C. Arora & S. Domkudwar
Refrigeration & Air Conditioning	– A.S. Sarao & P.S. Gabi
Refrigeration & Air Conditioning	– P.L. Ballaney
Cryogenic Systems	- Randll Darron
Cryogenic engineering	- R. D. Scott
Cryogenic Engineering	- A. H. Boll jr:

SUBJECT TITLE : AUTOMOBILE ENGINEERING
SUBJECT CODE : ME503
PERIODS/WEEK : 5
PERIODS/YEAR : 80

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I.	Power Systems	16
	Clutch	
	Transmission System	
	Over drive	16
	Test – I	1
III	Suspension system	
	Front axle	
	Rear axle	
	Steering	15
IV	Wheels	
	Tyres	
	Brakes	15
	Test – I1	1
V	Air pollution,	
	Noise and its effects	
	Modern Trends in Automobile Engg.	15
	Test- III	1
	Total	80

OBJECTIVES

Upon completion of the study of this subject, the student will be able to:

UNIT – I

1.1.0 Understand the working of different systems of I.C. Engines

1.1.1 Draw a neat layout of the fuel system of petrol engine
1.1.2 State the function of each component in the fuel system
1.1.3 Mention correct air fuel ratio for different engine speeds
1.1.4 Explain the working of A.C. Mechanical pump
1.1.5 Define carburetion
1.1.6 Functions of carburetor
1.1.7 Explain with simple sketches, the working of simple carburetor, solex carburetor and SU carburetor
1.1.8 Draw a layout of the fuel system of a Diesel engine
1.1.9 Explain the construction and working of primary filter and micro filter of Diesel oil
1.1.10 Explain the construction and working of Bosch pump, Injector and injection nozzles
1.1.11 Explain the concept of electronic fuel injection system
1.1.12 Explain with sketches the working of coil ignition and magneto ignition systems
1.1.13 Explain with sketch the working of electronic ignition system – transistorized ignition system
1.1.14 State the functions of cooling system
1.1.15 Classify the cooling system

1.1.16 Explain air cooling and different types of water cooling
1.1.17 Compare air cooling and water cooling systems
1.1.18 Explain different types of radiators
1.1.19 Explain the working of thermostat, temperature indicators and water pumps in cooling system
1.1.20 State the purpose of lubrication in I.C. Engines
1.1.21 Explain the different properties of lubricants
1.1.22 Explain splash system, forced system and petrol system
1.1.23 Explain quantity governing, quality governing, hit and miss governing and combination system

UNIT – II

2.1.0 Understand the working of Transmission systems of Automobiles

2.1.1 Explain the working of the transmission system of Automobiles
2.1.2 State the functions and list the requirements of a good clutch
2.1.3 Explain with sketches the construction and working of a single plate and multiple clutches Diaphragm clutch ,automatic clutches , centrifugal clutch and fluid coupling.
2.1.4 List the functions of gear box
2.1.5 Explain with neat sketches the working of sliding mesh and constant mesh gear boxes Synchromesh gear box.
2.1.6 Explain the working principle of a Epicyclic gear box ,torque converter and overdrive.
2.1.7 Explain with sketches the function, construction and working of propeller shaft, universal joint, C V joint final drive and differential.

UNIT-III

3.1.0 Understand the working of suspension system.

3.1.1 Explain stub axle and wheel mountings
3.1.2 Explain types of live rear axle
3.1.3 Explain semi plotting rear axle, three quarter plotting axle and full floating axle.
3.1.4 Explain independent suspension and advantages.
3.1.5 Explain rear suspension – Independent, leaf spring, spring shakle, and air suspension system.
3.1.6 Explain the steering components – steering wheel , column
3.1.7 Explain types of steering gears – worm and worm sector – rack and pinion
3.1.8 Understand recirculating ball steering gear
3.1.9 Explain power steering and centre point steering.
3.1.10 Explain steering geometry – camber, caster, king pin inclination, toe in and toe out.

UNIT IV

4.1.0 Wheels,Tyres and Breaks

4.1.1 Understand types of wheels – spoked wheels, disc wheels and cast wheels
4.1.2 Distinguish wheel size and wheel balance
4.1.3 Distinguish tube less tyres and tubed tyres.
4.1.4 Distinguish parts of tyre – Carcass – bead – tread – side walls.
4.1.5 Distinguish types of tyres – bias ply tyre – radial ply tyre.
4.1.6 Distinguish tyre material and tread pattern
4.1.7 Distinguish inflation pressure and tyre wear.
4.1.8 Distinguish types of brakes .
4.1.9 Distinguish hydraulic brake system
4.1.10 Explain mechanical brake system.
4.1.11 Explain dual brake system
4.1.12 Explain the functioning of a master cylinder
4.1.13 Explain leading and trailing brake.
4.1.14 Explain brake shoes, brake lining and brake drum materials.
4.1.15 Explain bleeding of brakes
4.1.16 Explain functioning of disc brake and pneumatic brake system.

UNIT V

5.1.0 Understand the various emissions from automobile engines that hazardous to environment and its control mechanism

- 5.1.1 Explian emissions from automobiles – nitrogen oxides – soot – carbon monoxide, hydrocarbons, aldehydes and other exhaust components
- 5.1.2 Explain pollution control techniques
- 5.1.3 Explain pollution in SI engine

5.2.0 Understand noise specification and its effect on human beings

- 5.2.1 Explain the source of noise – combustion – mechanical – intake and exhaust – transmit ion – brake noise – road noise – tyre noise – wind noise and body noise.
- 5.2.2 Explain noise reduction Techniques
- 5.2.3 Understand gasoline injection system

5.3.0 Appreciate the modern trends in Automobile Engineering

- 5.3.1 Explain the working of gasoline injection system
- 5.3.2 Explain the working of electronic ignition system
- 5.3.3 Explain the working of Digital injection system
- 5.3.4 Explain the working of common rail fuel injection system
- 5.3.5 Explain the working of semi and fully automatic transmission system.
- 5.3.6 Explain the working of parking aid with ultra sonic sensors.
- 5.3.7 Explain the working of central locking system and power windows.
- 5.3.8 Explain the working of electronic control module (ECM)

CONTENT DETAIL

UNIT I

Study the working of different power systems of I C Engines.

Different systems of I C engines, Fuel systems, - components – air fuel ratio for different engine speeds.-A C mechanical pump –carburetion – functions of carburetor –working –Solex carburetor – S U carburetor –fuel systems of diesel engine –fuel filter – working of bosch pump – injector and injection nozzle – electronics fuel injection - working of coil ignition and magneto ignition system – electronic ignition system – cooling system – classification of cooling system – radiators – thermostat- temp indicators – water pump – I C engine lubrication – properties of lubricants – splash system – forced system – governing – quantity governing – quality governing – hit and miss governing.

UNIT II

Understand the working of transmission systems.

Transmission systems in automobile – working – clutch functions – requirements of clutch – single plate - multi plate – diaphragm – automatic and centrifugal clutch.fluid coupling.- gear box functions – sliding mesh – constant mesh – synchromesh – working – epicyclic gear box – torque converter over drive. Propeller shaft – universal joint – C V joint – final drive – differential.

UNIT III

Understand the working of suspension systems and steering..

Stub axle – wheel mountings – types of live rear axle – semi floating – three quarter floating and full floating axles – independent suspensions – leaf spring – spring shackle – air suspension – steering wheel - steering column – steering gears – worm and worm sector – rack and pinion - recirculating ball – power steering – centre point steering – steering geometry – camber –caster – king pin inclination – toe in and out.

UNIT IV

Understand wheels tyres and brakes.

Types of wheels – spoked wheel – Disc wheels – cast wheels – size of wheel – wheel balance – tubeless tyres and tubed tyres – parts of tyre – carcass – bead – tread – side walls – plyrating – bias – radial – tyere material – tread pattern – inflation pressure – tyre wear – brakes – hydraulics – pneumatic – mechanical – dual brake system – master cylinder – leading and trailing brake – break shoes – lining – drum material – bleeding of brakes – disc brake – pneumatic brake and antilock braking system

UNIT- V

Understand air pollution noise and newer developments in vehiles.

Emission from automobiles – nitrogen oxide – soot – carbon monoxide – hydrocarbons – aldehides – pollution control techniques – noise specification – effects – source of noise – mechanical – combustion – transmission – brakes – wind and body – noise reduction – pollution Ifreom SI engines – gasoline injection system (MPFI) – electronic ignition – digital ignition – common rail fuel injection (CRDI) –semi and fully automatic transmission – parking aid with sensors – centre locking system – power windows – emission standards – Euro II – Euro III.

REFERENCE BOOKS

Automobile Engineering 2 nd edition - Ramaligam. , Seitech Publications..
Automobile Engineering Ist and IInd Volume - Kripal singh
Automobile Engineering - R.B.Gupta , Khanna Publishers
Automonile Engineering - Station Aby.

SUBJECT TITLE : CADD Laboratory I
SUBJECT CODE : ME 504
PERIODS/WEEK : 3
PERIODS / SEMESTER : 48

TIME SCHEDULE

UNIT	TOPICS	PERIODS
I	1.1 Introduction to Computer Aided Drafting	3
	1.2 Advantages using CAD	3
II	2.1 Working with CAD	12
	Test	3
III	3.1 Editing, Adding Dimensions and Text	9
IV	4.2 Production Drawing Development	9
V	5.1 Pictorial drawing	6
	5.2 Creating Isometric Drawing	
	Test	3
	Total	48

CONTENT DETAILS

UNIT – I

Introduction to Computer Aided Drafting, History – application – Advantages over manual drafting – Hard ware requirements – Soft ware requirements – Different software - Auto CAD – Pro E – IDEAS and Open Source drafting software etc:-, CAD basics – main menu, starting a new drawing, drawing editor, entering commands using mouse, pull down menu, getting help, data entry, entity selection, error correction

UNIT – II

Working with CAD, Setting limits of Drawing, grid, snap, co-ordinates, orthomode, zooming, drawing lines, arcs, circles, erase, undo, oops – commands, save and end commands

UNIT – III

Editing, Adding dimensions and text, Editing drawings using various modified commands. Add dimensions and text on drawings, copy, mirror, array, fillet, chamfer, hatching the sectional views. Developing simple orthographic views and dimension it with text. Developing detailed orthographic views with all features

UNIT – IV

Production drawing development and getting hard and soft copy, Sleeve and cotter joint, slip bush, rivet heads, locking screw assembly etc:, Pictorial Drawing and getting hard copy, Develop 3D drawings such as Isometric views of simple objects – cylinder, cone, hexagonal prism, cube, hexagonal nut and bolt, v-block, T-joint , muff couplings etc:

REFERENCE BOOKS

Machine drawing - N.D. Bhat
Machine drawing - P.I. Vargheese
Machine drawing - K.C. John
AutoCAD - P. Dayanidhi, TTTI.
AutoCAD - K.C. John

SUBJECT TITLE : HEAT ENGINE LABORATORY
SUBJECT CODE : ME 505
PERIODS/WEEK : 6
PERIODS/SEMESTER : 96

TIME SCHEDULE

UNIT	TOPIC	PERIODS
1.	Petrol Engines	18
2.	Diesel Engines	18
	Test – 1	3
3.	Air compressor	15
4.	Viscosity, Flash & Fire point	9
5.	Calorific value of fuels	9
6.	Refrigeration plant	12
	Test – II	3
	Revision	9
	Total	**96**

OBJECTIVES

Perform the tests on the petrol engine – load test, heat balance test, valve timing, Morse test
Identify the parts and functions of the petrol engine
Identify the various systems, in take system, exhaust system, oil /cooling system, electrical system/full system
Perform load test, Morse test, heat balance test, value timing
Compute the values and draw various characteristics curves

Perform the tests on the diesel engine – load test, heat balance test, valve timing, economic speed test
Identify the parts and functions of diesel engine
Identify the various systems, intake system exhaust system lubricating system, fuel system, cooling system
Perform load test, heat balance test, value timing economic speed test
Compute the values and draw various characteristics curves

Perform the tests on the air compressor volumetric efficiency – isothermal efficiency – adiabatic efficiency
Identify the various parts and indicate the functions
Perform the test on the air compressor
Determine the volumetric efficiency
Determine the isothermal and adiabatic efficiency

Perform the test on lubricating oils
Determine the viscosity of the given oil
Determine the flash and fire point of the given oil

Determine the calorific value of fuels
Determine the calorific value of the given liquid full

Perform tests on the refrigerators
Study the refrigeration plant; identify parts and its function
Determine the COP of the refrigerator

SUBJECT TITLE	**: SERVICING AND MAINTENANCE LAB**
SUBJECT CODE	**: ME 506**
PERIODS/WEEK	**: 3**
PERIODS/SEMESTER	**: 48**

UNIT	TOPIC
I	Servicing and Maintenance of general purpose Tools and Equipment
II	Dismantling and Assembling of Automobile systems
III	Servicing and Maintenance of Refrigerators & Air conditioners
IV	Servicing and Maintenance of Pumps

CONTENT DETAILS

UNIT – I

Use of tools and equipment in general purpose servicing and maintenance of Bench Vice, screw Jack. Hydraulic jacks, Trolly jacks, bucket grease guns, pressure control valves

UNIT – II

Dismantling and assembling of automobile systems such as fuel pumps (petrol engine), feed valve (diesel engine). Distributor, Air cleaner carburetor fuel and oil filters, oil pumps and fuel pumps injectors, rocker shafts, cylinder heads, cylinder blocks, crank shafts, clutch assembly, gear box, differential assembly, spider joints, masker cylinder, wheel cylinders

UNIT – III

Servicing and maintenance of refrigerators and air-conditioners, familiarization of refrigeration tools. Practice operations such as tube bending, cutting, flaring jointing, leak testing, leak prevention, vacuum testing, charging.

UNIT - IV

Servicing and maintenance of various pumps such as centrifugal, reciprocating, jet pump and air lift pump. Identification of parts, and their functions

Note:

This course is practice oriented with the general procedure of servicing and maintenance, preventive maintenance, lubrication and preparation of estimate for servicing and maintenance works. 70% of the exercises are to be carried out in Servicing and Maintenance lab and 30% of exercises in other sections. The students are expected to develop skills in diagnosing and rectifying faults, installation and commissioning of equipments and plants.

REFERENCE BOOKS

Servicing and maintenance lab manual - TTTI extension centre, Kalamassery

SUBJECT TITLE : MACHINE SHOP PRACTICE
SUBJECT CODE : ME 507
PERIODS/WEEK : 3
PERIODS/SEMESTER : 48

TIME SCHEDULE

UNIT	TOPIC	PERIODS
1.	Lathe Work	12
2.	Shaping Practice	9
	Test I	3
3.	Milling Practice	12
4.	Slotting Practice	6
5.	Planing Practice	3
	Test 2	3
	Total	48

OBJECTIVES

Perform the various machine tools operations
Perform special turning operation to produce machine handle eccentric turning, male & female fit assembly.
Practice the various operation of a shaper , milling machine and a planer.
Perform key way-cutting , T – Slot cutting , gear cutting , spline cutting etc.
Testing & inspection of machine tool operation
Dismantle and assemble machine tools.
Recondition the parts, if needed

CONTENT OUTLINE

UNIT – 1
Lathe Work
Lathe operations such as drilling, boring, threading, knurling etc.

UNIT – 2
Shaping Practice
Cube - V -Blocks, Key - way cuttings.

UNIT – 3
Milling Practice
Simple milling operations, Plain milling – side milling – vertical milling etc:-

UNIT - 4
Slotting practice
Splines on slotting machine

UNIT - 5
Planning Practice
Practice on planning machine.

SUBJECTS OF STUDY AND SCHEME OF EVALUATION

SEMESTER VI

Branch : Mechanical Engineering

Code	Subject	Periods Per Week			Evaluation (Marks)			
		Theory	Tutorial/ Practical	Total	Theory	Practical	Internal	Total
GE 601	Industrial Management & Entrepreneurship	5	1	6	75		25	100
ME 601 / TD 601	Industrial Automation & Mechatronics	5	1	6	75		25	100
ME 602	Advanced Production Process	5	1	6	75		25	100
ME 603	Power Plant engineering	5	1	6	75		25	100
ME 604	CADD Laboratory – II		3	3		75	25	100
ME 605	Advanced Machine Tool Laboratory		3	3		75	25	100
ME 606	Project/Seminar		5	5		50	50	100
	TOTAL	**20**	**15**	**35**	**300**	**200**	**200**	**700**

**** Project and Seminar to be started from 5th semester onwards and it include two weeks inplant training.**

SUBJECT TITLE : INDUSTRIAL MANAGEMENT & ENTREPRENEURSHIP
SUBJECT CODE : GE 601 (COMMON TO ALL)
PERIODS/WEEK : 5 + 1 Tutorial
PERIODS/ SEMESTER : 80 + 16

TIME SHEDULE

UNIT	TOPIC	PERIODS
I	1.1 Principles of Management	10
	1.2 Human Resource Management	5
II	2.1 Quality Planning and Control	5
	2.2 ISO-9000 & Installation	5
	2.3 TQM and Organizational Excellence	5
	Test – I	2
III	3.1 Project Management PERT / CPM	6
	3.2 Marketing & Sales	2
	3.3 Wages & Incentives	4
	3.4 Material Requirement Planning (MRP)	3
IV	4.2 Operations Research and Applications	10
	4.3 Management by Objectives (MBO)	3
	4.4 Management Information System (MIS)	2
	Test – II	2
V	5.1 Industrial Psychology	3
	5.2 Entrepreneurship Development	4
	5.3 Industrial Safety	4
	5.4 Environmental Pollution & Control	4
	Test – III	1
	Total	80 + 16

OBJECTIVES

UNIT – I

1.1.0 Understand the Principle of Management

1.1.1 Explain the meaning and concepts of management
1.1.2 Outline the characteristics of management
1.1.3 Illustrate the development of management theory
1.1.4 Illustrate the Taylor's scientific management and contributions
1.1.5 Illustrate Henry Fayol's principles of management
1.1.6 Compare the contributions of Taylor and Fayol
1.1.7 State the functions of management
1.1.8 Explain various administrative steps of each function
1.1.9 Describe different types of ownership
1.1.10 Explain different types of organization structure
1.1.11 Explain the concept of Leadership, Motivation & communication.

1.2.0 Appreciate the functions of Human Resource Management

1.2.1 Outline the importance of HRD
1.2.2 Explain the process of man power planning
1.2.3 Explain Job analysis, job evaluation, merit rating, performance appraisal
1.2.4 Training & Methods of Training

UNIT – II

2.1.0 Understand quality planning & control

2.1.1 Define quality
2.1.2 List the dimensions of quality
2.1.3 List the objectives of quality planning
2.1.4 Describe various quality control measures in brief
2.1.5 Explain quality assurance concept and definition
2.1.6 Describe in brief the Three Prong Approach to Quality Planning
2.1.7 Explain the need for quality management system
2.1.8 Draw quality loop

2.2.0 Understand the elements of ISO 9000, its Installation and audit

2.2.1 Describe the concept and role of ISO 9000
2.2.2 List the elements of ISO 9000
2.2.3 List the steps for installing quality system
2.2.4 Explain different ways of quality audit
2.2.5 Identify the agencies who give ISO certification
2.2.6 Discuss the role of accreditation board
2.2.7 Explain various stages of ISO 9000 implementation
2.2.8 Describe briefly the benefits of becoming an ISO 9000 company

2.3.0 Understand the concept of TQM and Organizational Excellence

2.3.1 Explain the concept of TQM
2.3.2 Outline the ten "Manthras" of TQM
2.3.3 Discuss in brief the link between ISO 9000 and TQM with TQM model
2.3.4 Draw the organizational structure of TQM
2.3.5 Explain the different techniques of TQM
2.3.6 Discuss the concepts and characteristics of Quality Circle
2.3.7 Discuss the brain storming technique used in quality circle for arriving at solutions
2.3.8 Explain the organizational excellence by TQM approach and through "SWOT" analysis
2.3.9 Write mission statement

UNIT – III

3.1.0 Apply the principles of CPM & PERT

3.1.1 Outline the network technique
3.1.2 List different applications of CPM & PERT

3.1.3 Out line scope of PERT & CPM
3.1.4 Define the terms used in CPM & PERT
3.1.5 Explain the procedure for finding the critical path
3.1.6 Compute the project duration, slack and critical path by using AON &AOA
3.1.7 Distinguish between CPM & PERT
3.1.8 Define the terms used in PERT
3.1.9 Explain the procedure for pert
3.1.10 Estimate activity time
3.1.11 Compute the project duration slack and mark the critical path
3.1.12 Solve the problems in PERT & CPM

3.2.0 Understand various steps in Marketing & Sales planning

3.2.1 Define marketing
3.2.2 List the objectives of marketing
3.2.3 Outline the core marketing concepts with the help of block diagrams
3.2.4 Discuss in brief the marketing mix, buying process and behaviour
3.2.5 Outline the importance of sales of products and services
3.2.6 List the functions of sales department
3.2.7 Explain the steps in market planning, market segmentation
3.2.8 Discuss the importance and functions of sales management
3.2.9 Discuss sales planning
3.2.10 Explain the market research and market information system

3.3.0 Understand the Principles of a good Wage Payment System

3.3.1 Outline the importance of a good wage plan
3.3.2 Define the different types of wages
3.3.3 List the requirements of a good wage plan
3.3.4 Define Incentives
3.3.5 Identify financial, non financial and semi financial incentives
3.3.6 Discuss different types of financial incentives plan
3.3.7 Compute the wages under different incentive plans with examples
3.3.8 Understand the concept of MRP
3.3.9 Understand the application of MRP

UNIT – IV

4.1.0 Understand various methods in Operations Research and its application

4.1.1 Outline the concept of optimization
4.1.2 Outline the scope of O.R
4.1.3 List the phases and processes of O.R
4.1.4 List the different methods of O.R.
4.1.5 Explain Linear programming graphical method & analytical method
4.1.6 Compute maximization of profit by linear programming - graphical method and analytical method (simple problems only)
4.1.7 Compute minimization of total cost by Linear programming - graphical method and analytical method (simple problems only)
4.1.8 Explain the transportation problem
4.1.9 Compute the initial feasible solution by north west corner rule and Vogel approximation method (simple problems only)
4.1.10 Explain the game theory
4.1.11 Compute the saddle point of the game two – person – zero sum using maximize and minimize principle (simple problems only)
4.1.12 Explain the queuing theory
4.1.13 List information required for formulating a mathematical model

4.2.0 Understand the concept of Management By Objective (MBO)

4.2.1 Outline the nature and purpose of MBO
4.2.2 Identify sequential MBO processes
4.2.3 List the merits and demerits of MBO

4.2.4 List the steps required for MBO
4.3.5 List the guidelines for setting objectives for MBO

4.3.0 Appreciate Management Information System (MIS)

4.3.1 Define MIS
4.3.2 Distinguish between data and information, data processing & MIS
4.3.3 State the need for information
4.3.4 Discuss the systems concept of management
4.3.5 Discuss a firm and its environment
4.3.6 List the objectives and inputs of an effective MIS
4.3.7 Explain the integrated MIS
4.3.8 List major functional and activity subsystems in MIS
4.3.9 Describe MIS development (system development) with the help of a line diagram
4.4.10 List applications of MIS

UNIT – V

5.1.0 Justify the concept of Industrial Psychology

5.1.1 Describe the meaning of Industrial Psychology
5.1.2 Outline the importance of good working conditions and environment
5.1.3 Explain the concept of Behavioural dynamics
5.1.4 Distinguish the interpersonal behaviour and interpersonal needs
5.1.5 Discuss the development of interpersonal relationship
5.1.6 Describe the development of better qualities (personality traits)

5.2.0 Formulate the feasible project report to start a small scale industry

5.2.1 Explain the concept of entrepreneurship
5.2.2 Describe the profile of an entrepreneur
5.2.3 List the functions of an entrepreneur
5.2.4 List the risk taking qualities of an entrepreneur
5.2.5 Explain the concept of entrepreneurial development
5.2.6 List the different factors contributing to the failure of entrepreneurial ventures
5.2.7 Identify industrial support needed programs existing in India
5.2.8 State the concept of small scale and ancillary industrial undertaking
5.2.9 List the steps involved in starting small-scale industry
5.2.10 Describe the procedure of registration of SSI
5.2.11 Identify the net work of financial assistances given to SSI
5.2.12 Identify the different constituents of feasibility study
5.2.13 Prepare the feasibility report / project report

5.3.0 Recognize the features of Industrial Safety

5.3.1 Explain the importance and need for safety measures in industries
5.3.2 Define the meaning of the term – factory, accident, frequency rate, security rate, accident pronnes, unsafe acts, unsafe conditions, job safety analysis, plant safety inspections
5.3.3 Identify the various accident factors, mechanical factors, environmental factors, personal factors
5.3.4 Discuss the 4 E's of accident prevention technique
5.3.5 List the precautions to be observed while working in an hazardous environment
5.3.6 Explain briefly the artificial respiration methods

5.4.0 Recognize the causes of environmental pollution and steps to be taken to control the pollution

5.4.1 Define the terms Ecology and Ecosystem
5.4.2 Explain the impact of industrial development on environment
5.4.3 Explain the causes and effects of air and water pollution on plant, animal life and materials
5.4.4 Identify the characteristics of industrial and municipal waste
5.4.5 Outline the various treatment processes
5.4.6 Identify the sources of air pollutants

5.4.7 State the effects of air pollution
5.4.8 Outline the methods of prevention and control of air pollution
5.4.9 Explain the term solid waste management
5.4.10 List the salient features of environmental pollution control legislation
5.4.11 State the functions of pollution control board
5.4.12 Define NOISE
5.4.13 Identify the causes of noise pollution
5.4.14 Explain the various methods of noise control

CONTENT DETAILS

UNIT – 1

1. Principles of management

Introduction – meaning of management: - Management as an art of getting things done, management as a process, management as an activity

Management and administration – Development of management theory: - Taylor's scientific management, contributions of F.W. Taylor, Henry Fayols principles of management (Brief description), compare F.W. Taylor & Henry Fayol's contributions

Functions of management: -

a) Planning: - concept, steps in planning
b) Organizing: - concept and process steps, steps in organizing
c) Staffing: - concept, list functions of staffing
d) Directing: - concept, list the elements of directing
e) Controlling: - Concept, list the steps in controlling process
f) Decision making: - concept, steps in decision making, scientific approach to decision making

Different types of ownership: - Sole proprietorship, partnership, private Ltd., company, public Ltd., company, co-operative society (brief description only)

Organizational structure: - Definition of organization, different types of organizational structure: - line, functional, line & staff organization (brief description with advantages & disadvantages)

Leader ship - Define leadership, different types of leadership, qualities of a good leader

Motivation - characteristic of motivation, importance, Marlow s need hierarchy theory, Techniques of motivation

Communication – Types of communication, Barriers in communication.

2. Human Resource Management

Concept of HR Management – Development of HR Management – Components of HRD – Job analysis – Job description – Job speciation , Manpower planning – Requirements of manpower planning – Factors affecting the manpower planning – Job evaluation – Steps required for job evaluation – Methods for job evaluation – Merit rating – objectives and methods – performance appraisal. Training – Importance of training – Methods of training – advantages of training (Brief description only)

UNIT - II

1. Quality Planning and Control

Definitions of quality, Requirements of quality, list objectives of quality planning – quality control: - operator's quality control, inspectors quality control, Mangers quality control, total quality control.

Quality Assurance: - Concept, definition, responsibility of quality assurance department, planning for quality assurance – three prong approach to quality planning: - (1) Product planning (2) Managerial & Operational planning (3) Documentation. Quality management system, quality loop.

2. ISO 9000 & Installation

Concept and role of ISO 9000, what is ISO 9000, whom does it help, elements of ISO 9000, steps for installation of quality system - preparatory step, implementation step, registration & certification step. Quality Audit - objectives, types off audits: - Adequacy audit, compliance audit, system audit, product audit, first party audit, second party audit, third party audit. Steps required to apply for ISO – 9000 Registration. Benefits of becoming an ISO 9000 company.

3. Understand the concept of TQM and Organizational Excellence

Concept, ten mantras of TQM, the link between ISO 9000 and TQM with the help of TQM Model – organization of TQM. Techniques of TQM - PDCA, Total Employee Inolvement (TEI), POKA – YOKA – Failure proofing, JIT manufacturing.

Quality Circles - concept, characteristics, Brain storming method for solving Q.C. Problems. Organizational excellence through TQM - List the strength, weakness, opportunity and threat (SWOT analysis) of an organization by an example and analyse the current status – mission statement.

UNIT – III

1. Management Techniques – CPM & PERT

Introduction to Network analysis, application of CPM & PERT, scope of CPM & PERT commonly used terms in CPM: - Operation, pre-operation, post operation, concurrent operation, earliest finish time EFT), latest finish time (LFT), Critical activities, critical path, EVENT, SLACK or FLOAT, Dummy activity, - procedure for CPM, problems on CPM, projects duration, slack, mark critical path (by AOA and AON method).

PERT - comparison between CPM & PERT, procedure for PERT, Estimation of activity time, commonly used terms in PERT, Event, Activity, successor Event, Predecessor event, Earliest Expected Time, Latest allowable time, slack – problems in PERT.

2. Marketing & Sales

Marketing - introduction, definitions, objectives, core concepts: - block diagram, distinguish between marketing and sales, marketing MIX. Buying process & behaviour of consumer, steps in market planning – market segmentation. Sales - importance of sales, functions of sales management, market research, market information system. Fore casting related to marketing and sales

3. The Principles of a good wage payment system

Importance of good wage plan, types of wages - nominal, real, living, fair, minimum wages – requirement of a good wage payment system. Incentives - definitions, types of incentive plan for direct workers - non financial and semi financial incentives – financial incentive plans - straight piece rate system, straight piece rate with guaranteed minimum wage, differential piece rate system, Halsey plan, Rowan plan, Gantt (simple illustrative problems)

4. Material requirement planning (MRP)

MRP objectives & functions – Terminology – MRP systems – MRP outputs – Management information from MRP – Lot sizing considerations – Examples – applications – introduction to MRP – II - Just in time (JIT). (Brief description only)

UNIT – IV

1. Operations Research & Application

Concepts of OR, scope of OR, phases and process of OR, methods of OR -

1. Linear programming: - a) graphical & analytical method b) transportation method: - North west corner rule, Vogel approximation method
2. Waiting line or Queuing theory
3. Game theory

Linear programming: - concepts, formulation of LPP, Do problems on maximization of profit, minimum of total cost (by graphical & analytical method)

Transportation problem: - meaning, compute the initial feasible solution by northwest corner rule & Vogel approximation method (simple problems)

Game theory: - concept, two-persons zero sum game, the maxi-min- mini-max principle –optimal strategy, saddle point, example problems to compute saddle point – waiting line or queuing theory - concept, the information required for formulating a mathematical model (simple problems)

2. Management by objectives (MBO)

Concepts & definition, contents of MBO, sequence of MBO process with block diagram, steps required for MBO, guidelines for setting objectives

3. Management Information Systems (MIS)

Definition of MIS, Data, Information, management, systems concepts of management, a firm and its environment, objectives, contents of MIS, need for information, integrated MIS, functional and

activity subsystems, MIS development - line diagram, application of MIS - inventory management, Human resource management, personal decision making.

UNIT – V

1. Industrial Psychology

Meaning, importance of good working conditions and environment: - physical working conditions, psychological working conditions, working conditions related to time, related to social situation. Behavioural dynamics: - self concept and self understanding, inter personal needs, developing interpersonal relationship: - framing fint impression, developing mutual expectations, hounouring psychological contracts, developing trust & influence, projecting positive qualities and hiding negative points – developing better behaviour and qualities a TQM approach: - conducting 'SWOT' analysis for self understanding, prepare incremental projects to reduce weakness and threats - mission statement

2. Small Scale Industries – Entrepreneur

List steps required to start small scale industry, procedure for registration (provisional and permanent registration) – sources of financial assistance, govt., assistance for development of SSI, preparation of project report, Tax: - an overview of income tax – excise duty, sales tax – procedure to be followed for sales tax

3. Industrial Safety

Define Accident, Frequency rate, severity rate, and accident proneness.

List the causes of accidents: - Mechanical, Environmental, personnel factors accident prevention techniques – 4 E'S of Accident prevention technique

4. Environmental Pollution and control

Ecology and Eco system, Impact of industrial development on environment, Causes and effects of air and water pollution on plant, animal life and material, Characteristics of industrial and municipal waste, Treatment processes:- Primary, secondary and territory, Sources of air pollutants on human beings, Effects of air pollutants on human beings, Prevention and control of air pollution, Solid waste management, Environment pollution control legislation and functions of pollution control boards, Causes of noise pollution and its control

Special Instruction to Question Setters

1. All units should be given equal weightage of marks
2. Problems from wage plan, CPM-PERT, and O.R should be included in every question paper in order to measure the application capability of students

REFERENCE BOOKS

1. Industrial Engineering & production management – Martand.T.Telsang S.chand & Company
2. Industrial Engineering & Management - O. P. Khanna
3. Operations Research - Premkumar Guptha, D.S. Hira
4. TQM - Productivity Council
5. ISO - Tapan.P.Bagachi
6. Entrepreneurship Development - Jagmer Singh Saihi
7. Industrial Management & Engineering Economics - Banga & Sharma
8. TQM - B. Senthil Arasu & J.Praveen Paul Scitcch Publications

SUBJECT TITLE : **INDUSTRIAL AUTOMATION AND MECHATRONICS**
SUBJECT CODE : **ME 601 /TD 601**
PERIODS/WEEK : **6**
PERIODS/SEMESTER : **96**

TIME SCHEDULE

UNIT	TOPIC		PERIODS
I	1.1 Theory of mechatronics		18
II	2.1 Sensors and Transducers		20
		Test – I	2
III	3.1 Actuators 3.2 Hydraulics & Electrical		16
IV	4.1 Programmable Logic controls 4.2 Micro controller		16
		Test – II	2
V	5.1 Mechatronics systems 5.2 Fault finding		20
		Test – 111	2
		Total	96

OBJECTIVES

UNIT – I

1.1.0 Introduction to mechatronics

1.1.1 Define automation
1.1.2 Explain the advantage and disadvantages of automation
1.1.3 Define mechatronics
1.1.4 Explain advantages of mechatronics
1.1.5 Benefits of mechatronics in products
1.1.6 Explain the mechatronics technology
1.1.7 Mechanical systems and its design
1.1.8 Traditional systems vs mechatronics
1.1.9 Explain the mechatronics approach
1.1.10 Explain the replacement mechanism
1.1.11 Explain enhancement mechanism
1.1.12 Explain simplication mechanism
1.1.13 Explain the synthesis mechanism
1.1.14 Explain design process

UNIT II

2.1.0 Understand sensors and transducers

2.1.1 Describe the performance terminology – range and span –error – accuracy – sensitivity – hysteresis error – non linearity error – reproducibility – stability – dead band – resolution and out put impedence.

2.1.2 Explain static and dynamic characteristics

2.1.3 Explain displacement, position, proximity

2.1.4 Explain eddy current proximity sensors

2.1.5 Explain inductive proximity switch

2.1.6 Explain optical encorders

2.1.7 Explain incremental encorders

2.1.8 Explian techogenerator

2.1.9 Explain fluid pressure measurement devices – diaphragm bellows and tube pressure sensors

2.1.10 Explain liquid flow sensors – orifice plate turbine meters floats

2.1.11 Explain temperature sensors bimetallic strips resistance temperature detectors – thermistors – thermo couples

2.1.12 Explain light sensors – photo diodes photo transistors – photo resisters

2.1.13 Explain the selection of sensors – inputting data by switches – mechanical switches – debouncing of mechanical switches.

UNIT III

3.1.0 Understand actuators

3.1.1 Explain pneumatic actuation system

3.1.2 Explain power supplies

3.1.3 Explain direction control valve – spool valve- poppet valve – pilot operated valve – and directional valve.

3.1.4 Explain pressure regulating valve–pressure limiting valve and pressure sequence valves.

3.1.5 Explain hydraulic and pneumatic cylinders.- single acting and double acting – cylinder sequencing.

3.1.6 Explain process control valve – diaphragm actuators – rotary actuators.

3.1.7 Explain electrical actuation systems – switching devices – solenoid type devices and drive systems.

3.1.8 Explain solid state switches – diodes – thyristors – triacs – bipolar transistors .

3.1.9 Explain solenoid principle of working.

3.1.10 Explain basic principles of D C motors A C motors and Stepper Motor.

UNIT – IV

4.1.0 Programmable Logic Control

4.1.1 Understand programmable logic control.

4.1.2 Explain the basic structure – input – output processing

4.1.3 Explain lader diagram

4.1.4 Explain mnemonics

4.1.5 Explain timers – internal relays and counters

4.1.6 Explain working of ship register

4.1.7 Explain master and jump controls

4.1.8 Explain data handling

4.1.9 Explain analog input / out put

4.1.10 Explain selection of PLC

4.1.11 Explain micro controller functions – 8051

UNIT V

5.1.0. Understand Mechatronics systems

5.1.1 Distinguish traditional and Mechatronics designs

5.1.2 Explain Industrial design ergonomics.

5.1.3 Explain the elements of product design

5.1.4 Explain information transfer – from m/c to man – Human response to stimulate –

Information from man to machine

5.1.5 Explain fault detection ethnic

5.1.6 Explain common hardware faults

5.1.7 Describe possible design solutions

5.1.8 Explain timed switch – bath room scales.

CONTENT DETAILS.

UNIT – I :

Theory of Mechatronics

Automation – definition – need, advantages and disadvantages of automation-

Mechatronics - What is mechatronics – Definition of mechatronics – benefits of mechatronics - Mechatronics in manufacturing – Mechatronics in products – Mechatronics &Engg. Design – A modular approach to mechatronics & Engg. Design – The engineer & mechatronics – mechatronics technology – Mechanical systems & design – Tradition Vs Mechatronics – The mechatronics approach – Replacement mechanism – simplification mechanism – Enhancement mechanism – Synthesis of mechanism – control – The design process.

UNIT – II :

Sensors and Transducers:

Sensors and Transducers – Performance terminology- Displacement, position and proximity – Velocity and motion – Force – Fluid pressure, Liquid flow, liquid level – temperature light sensors – selection of sensors.

UNIT – III :

Actuators

Pneumatic and Hydraulic System, Actuation systems, pneumatic and hydraulic systems, Directional control valves, Pressure control valve, Cylinders, Process control valves, Rotary actuators.

Electrical actuation systems: Electrical systems, mechanical switches, solid state switches, solenoids principle of working, types, specification and control of DC motor – AC motors , Stepper motors.

UNIT – IV :

Programmable Logic Controller

Basic structure – Input / Output processing – Programming – mnemonics – Timers, internal relays and Counters – shift register – Master and jump controls – Ladder logic circuit -Data handling – Analogue input/output – selection of PLC – Microcontrollers and applications.

UNIT – V :

Mechatronics systems and Fault finding

Man-M/c interface - Traditional and mechatronics design – Introduction – elements of product design – ergonomic factors for advanced manufacturing systems. Information transfer – from M/c to Man- Human response to stimuli - Information from man to m/c

Fault finding - Fault detection techniques – common hardware faults. Possible design solutions – Timed switch , bathroom scales.

REFERENCES:

1. Mechatronics – Second Edition - W.Bolton –Pearson Education Asia.
2. Mechatronics – Hmt. Tata Mcgraw-Hill Publishing Company Limited, New Delhi 1998
3. Mechatronics: (Electronics In Products And Processes) - By .A. Bradley and others Chapman And Hall
4. Mechatronics - By N. Shanmugam, Anuradha Publications
6. Mechatronics in Manufacturing System - D. S. Kumar, Satya Prakasan & Tech India Pub.
7. Robotic Technology and Flexible Automation - - DEB, Tata MGH
8 .Microprocessor and Micro controller - By R.Theagaraja – Scitech Publications.
9. Micro controller and application - By Dr. R.Theagaraja – Scitech Publications.

SUBJECT TITLE : ADVANCED PRODUCTION PROCESS
SUBJECT CODE : ME 602
PERIODS/WEEK : 6
PERIODS/SEMESTER : 96

TIME SCHEDULE

UNIT	TOPIC	PERIODS
I.	1. Turret and Capstan Lathe	10
	2. Automatic and Copying Lathe	10
	Tests – I	1
II	1. Broaching	4
	2. Gear Manufacture	10
	3. Press Tools	5
III	1. Jigs and Fixtures	6
	2. Grinding	10
	Test II	1
IV	1. Other Surface Finishing Methods	4
	2. Jig Boring Machine	4
	3. Non- Conventional Machining	6
V	1. Numerical control machine Tools	10
	2. Robots And Robotics	8
	3. Flexible Manufacturing system	6
	Test III	1
	Total:	96

OBJECTIVES

UNIT I

1.1.0 Understand the working of turret and capstan lathe

1.1.1 Indicate the parts by drawing sketches of turret and capstan lathe
1.1.2 Explain the working of head stock of turret and capstan lathe
1.1.3 List the work holding devices
1.1.4 Explain with sketches the work holding devices
1.1.5 List the tool holding devices
1.1.6 Explain with the sketches the tool holding devices
1.1.7 Sketches the tool layout in sequence for a given set of operations of a work
1.1.8 Explain the principle of Hydraulic controls
1.1.9 Indicate the mode of specifying a machine for the purpose of procurement

1.2.0 Comprehend the working of automatic and copying lathe

1.2.1 Define the automation
1.2.2 Define the principle of automatic control
1.2.3 List the areas of uses of automatic machines
1.2.4 Explain the diagram the working of single spindle automatic lathe

1.2.5 Classify the multi spindle automatics
1.2.6 List the advantages of single spindle Vs multispindle automatics
1.2.7 List the various purposes of the automatic machines
1.2.8 Explain the sketch the automatic screw cutting machine
1.2.9 Lit the various feeder mechanisms of automatic machines
1.2.10 Explain the stop and safety mechanisms of automatics
1.2.11 Explain the conveyor systems of automatics
1.2.12 Define the tool layout of an automatic
1.2.13 State the copying principles
1.2.14 Classify the copying machines
1.2.15 Explain , with sketch, the pantograph copying system
1.2.16 Explain , with sketch the Hydraulic servo copying system
1.2.17 Explain , with the sketches, the electric copying system.

UNIT II

2.1.0 Understand the working of broachers

2.1.1 Define the principle of broaching
2.1.2 Identify the purpose of broaching
2.1.3 Explain with the diagram the broaching tool details
2.1.4 Explain the types of broaching tools
2.1.5 Explain the broaching tool material and its specifications
2.1.6 Classify the broaching machines.
2.1.7 Explain the line diagram , the various broaching machines
2.1.8 Explain the desirable properties of coolants used

2.2.0 Understand the various methods of gear manufacturing

2.2.1 List the methods of gear manufacture
2.2.2 Explain the forming process in milling (review only)
2.2.3 Explain the gear manufacturing in process by casting and template gear cutting processes
2.2.4 Explain the various generating process , with sketches, wherever required
2.2.5 Define hobbling
2.2.6 Explain the sketches , the principle of gear hobbling
2.2.7 Distinguish between the advantages and disadvantages of gear hobbling
2.2.8 Specify the gear materials.

2.3.0 Understand about the press tools and their operations

2.3.1 Define the press operations
2.3.2 Explain with the various press working operations
2.3.3 Explain with the sketches, the various components of a press tool
2.3.4 Explain, with sketches , the die assembly.
2.3.5 Classify the dies.
2.3.6 Explain , with sketch, the principle of metal cutting
2.3.7 List the various type of die clearances.

UNIT III

3.1.0 Appreciate the importance of jigs and fixtures

3.1.1 Define the jigs and fixtures
3.1.2 Classify the jigs and fixtures
3.1.3 State the advantages of jigs and fixtures
3.1.4 List the type of jigs
3.1.5 Explain with the sketches, the constructional details of a jig
3.1.6 Explain with the sketch drill jigs, universal jigs and indexing jigs
3.1.7 List the various types of fixtures
3.1.8 Explain the importance of various fixtures
3.1.9 Explain the principle of location
3.1.10 Explain the principle of minimum locating points.

3.1.11 Identify the location of a job for drilling holes
3.1.12 Explain the various components of a jig set up (body , locating elements, clamping devices, tool guide and additional) with line sketches.

3.2.0 Compare the grinding machines and its operations

3.2.1 Define grinding operations
3.2.2 List the component element of a grinding wheel
3.2.3 Classify the abrasives
3.2.4 Explain the examples , the various types of natural and artificial abrasives
3.2.5 List the bonding material
3.2.6 Identify the various bonding materials
3.2.7 List the factors affecting the selections of grinding wheel
3.2.8 Explains the factors affecting the selection of grinding wheels
3.2.9 Classify the various grinding machines
3.2.10 Explain the principle of cylindrical grinding with a line sketch
3.2.11 Explain how to arrange work between Centers
3.2.12 Make the necessary setting up of grinding wheel
3.2.13 Explain with sketch the working principles of a centre less grinder
3.2.14 Explain the basic features of finishing, honing , lapping and super finishing
3.2.15 State the method of balancing a wheel
3.2.16 Explain the method of truing and dressing a grinding wheel
3.2.17 elect speed, feed and depth of cut for various materials for grinding.

UNIT IV

4.1.0 Understand about the special surface finishing methods.

4.1.1 State the purpose of providing some other surface finishing method other than grinding.
4.1.2 Explain briefly the various types of other surface finishing methods.

4.2.0 Appreciate the working of jig boring machine.

4.2.1 Define the jig borers
4.2.2 State the reason for the need for greater accuracy like jigs
4.2.3 Classify the jig boring machines
4.2.4 Explain the precision lead screw system, the end measure system, the scale and microscopes system and the electromagnetic system
4.2.5 Explain the locating holes by layout, buttoning, transfer and co-ordinate system of dimensioning for the location of holes

4.3.0 Understand the working of non-conventional machines

4.3.1 List the unconventional method of machining
4.3.2 Explain with sketches, the working of USM , EDM and chemical milling.
4.3.3 Appreciate the surface finish due to the unconventional machining
4.3.4 State the application of the above operations

UNIT V

5.1.0 Understand the working of numerically controlled machine tools

5.1.1 State what is numerical control machine tool
5.1.2 Explain the various components with block diagram of N.C machines.
5.13 Explain the essential steps required for operation
5.1.4 Classify the N.C machines
5.1.5 Explain the line sketches wherever necessary the point to point positioning, open loop system
5.1.6 Explain the block diagram, the computer numerical control (CNC)
5.1.7 State the advantages of CNC machines.
5.1.8 State the principle of CAM and CAD
5.1.9 State the advantages of CAM and CAD
5.1.10 List the application of areas of CAM and CAD
5.1.11 Explain the functioning of CAM and CAD

5.2. 0 Know about the robots and robotics

5.2.1 Define robotics
5.2.2 State the reason for using robots
5.2.3 List the basic elements of robots
5.2.4 State the essential requirements of mechanical design
5.2.5 Draw the various type of joints
5.2.6 Identify the notations of robot manipulator
5.2.7 Explain the configurations Robots with diagram
5.2.8 Classify the Robots
5.2.9 State what is robot arm, robot hands and robot grippers

5.3.0 Appreciate the advantages of flexible manufacturing system

5.3.1 State the meaning of FMS
5.3.2 Define the flexible automation
5.3.3 List the components of FMS
5.3.4 Explain with the block diagram the flexible manufacturing cell (FMC)
5.3.5 Explain how to achieve the flexibility in manufacturing systems
5.3.6 Explain briefly the components of FMS
5.3.7 Identify the problems in implementing FMS
5.3.8 Explain briefly the transport mechanism in FMS in relation with the material handling system (MHS)
5.3.9 Explain the Artificial intelligence (AI) tools for MHS planning
5.3.10 Explain briefly AGVS
5.3.11 List the requirements to fulfill the main purpose of FMS communication systems.

CONTENT OUTLINE

UNIT – I

Turret and Capstan Lathe.

Construction and parts (a) Head stock, (b) work holding devices (c) tool holding devices – straight and circular holder, flanged tool holders. Tool layout, sequence of operation.
Turret indexing mechanism and work feeding mechanism
Principle of hydraulic controls
Machine specifications.

Automatic and Copying Machines

Automation :-

(a) definition
(b) automatic control principles
(c) areas of use
(d) types - single spindle lathe, multispindle lathe
(e) purpose – machining, screw cutting, drilling, grinding,
(f) other features – stop and safety mechanisms , feeder mechanisms
(g) conveyor systems –Belt type, link type
(h) tool layouts

Copying machines

Copying principles – types
(1) Mechanical (pantograph copying systems)
(2) Hydraulic servo copying systems
(3) Electrical copying system

UNIT II

Broaching Machines

Introduction – definition - purpose, Broaching tools – parts of the tool, tool details
Types (a) internal (b) external (c) surface material and specifications.
Broaching machines (brief description with line sketches).
Horizontal (Hydraulic and mechanical operations), single raw (or screw), duplex raw (or screw)
Drum or turret
Special surface and continuous

(b) vertical (Hydraulic operated)
pull up, pull down, push down
gear manufacture, Review of terminology of tooth shapes, Method of making gears
review of gear cutting on milling machine, casting of gears, template gear cutting process of cutting bevel gears, generating gears, generation by rack, generation by pinion cutters, description of a gear shaper
gear hobbling, description of gear hob, operation of gear hobbling machines
Gear materials and specifications.

Press Tools

Introduction – components of presses. Press working operation – piercing , blanking, bending , notching , trimming , shaving , slitting, launching, nibbling . components of dissembling, classification of dies. Principles of metal cutting. Different types of die.

UNIT III

Jigs and Fixtures

Introduction, definition of jigs and fixtures, classification of jigs
classification of fixtures, advantages
Types of jigs – constructional details . Advantages and limitations of each type (a) drill jigs Universal jigs (c) index jigs
Types of fixtures – constructional details – advantages and limitations of each (a) drill jigs (fixtures for milling Boring, grinding welding
Different elements of jigs – body , locating elements – clamping devices, tool guide and additional.

Grinding

Introduction – action of grinding wheels on metals
Abrasives : (a) natural , (b) artificial
Bonding materials
vitrified (b) silicate (c) shellac (d) rubber
Factors affecting the selection of grinding wheels, size and shape of the wheel
kind of abrasives
grain size, grade and strength of bond, kind of bond material, functions of the grinding wheels
grinding machines : classifications, cylindrical grinders, Surface grinders, Special purpose of grinders.
Cylindrical grinders.
arrangement of work between centers, Set up of a grinding wheel
Methods of supporting work in a centre less grinder,
I) action of grinding wheel
Action of regulating wheel
Feed of the work piece
Basic features of finishing by grinding
(i) honing
(ii) lapping
(iii) super finishing
Wheel manufactures, methods of balancing a wheel, Methods of turning and dressing, Coolants used
Various speed, feed and depth of cut for materials such as - cast iron, high carbon steal, alloy steel

UNIT IV

Other surface finishing methods

Introduction – purpose – types – electroplating, hot dipping , Metal spraying, organic coating oil base paints (b) varnish (iii) enamels (iv) rubber base coating

Measurements of surface roughness, Method of measurement by qualitative assessment or visual inspection, nail test, comparison microscope and by quantitative assessment (mechanical , electrical optical, pneumatic and electronic) method, Collimators and interferometers

Jig Boring

Introduction – definition, need for greater accuracy on objects like jigs, types of jig boring machines precision lead screw systems, the end measure system, scale and microscope system and

The Electro magnetic system, 3.locating – layout , buttoning, transfer and co-ordinate system of dimensioning for location of holes.

Non – conventional machining

Ultrasonic machining

Machining principle

brief description of the equipment (line sketch}, cutting speed and accuracy, Application

Electro Discharge Machining

Principle, type – contact initiated, spark initiated and electrolytic, Brief description of the equipment Surface finish and accuracy, Application

Chemical Milling

Principle, Description of the process, Surface of finish and tolerances, Applications.

UNIT – V

Numerically Controlled Machine Tools

Introduction , Block diagram of N.C machine, Steps in operation, preparation of program manuscript Preparation of the programmed tape, Insertion of the tape in the machine control

Types of Numerical control system, according to the control system – (Explain point to point positioning), according to feed back system (Explain open loop system and closed loop system)

Computer Numerical Control (CNC)

Machine tools (brief description only), Computer aided design (CAD) and computer aided manufacturing (CAM), Introduction, advantages of CAM and CAD, Robots and robotics

Robotics - Reason for using robots, Basic elements of robots, Mechanical design of a robot, Types of joints, Notations of Robot manipulator, Configuration of robots, Robot arms, Robot hands, Grippers

Flexible Manufacturing System (FMS)

Introduction, Flexible Automation, Flexible Manufacturing Cell (FMC), Achieving Flexibility in Manufacturing Systems, Components of FMS, Problems in Implementing FMS,Transport Mechanism Materials Handling System (MHs), Artificial Intelligence (AT) Tools for MHS Planning Automated Guided Vehicle Systems (AGVS), FMS Communication – Information

REFERENCE BOOKS

1. Production Technology - R.K. Jain
2. Production Technology Vol I & II - O.P Khanna
3. A Text Book of Production Engineering - P.C. Sarma
4. Modern Machining Methods - M. Adjthian
5. Machine Tools Vol. I - R.N. Datta
6. Computer Integrated Design and Manufacturing- Bed worth
7. CAD,CAM,CIM -Radhakrishnan
8. CNC Machines - B.S.Pabla &M.Adithan Pub:New Age
9. Numerical control and computer aided manufacturing - T.K.Kundra, P.N.Rao Pub:TMH
10. Industrial robotics - Gordon.N.Mair Pub:PHI

SUBJECT TITLE : POWER PLANT ENGINEERING
SUBJECT CODE : ME 603
PERIODS/WEEK : 6
PERIODS/SEMESTER : 96

TIME SCHEDULE

UNIT	TOPIC		PERIODS
I	1.1 Introduction		2
	1.2 Steam Generators		10
	1.3 Properties of Steam		8
	1.4 Thermodynamic Vapour Cycle	Test - I	1
II	2.1 Steam Engines		3
	2.2 Steam Nozzles		6
	2.3 Steam Turbines		6
	2.4 Steam Condensors		6
III	3.1 Gas Turbines		10
	3.2 Jet Propulsion		4
	3.3 Diesel Power plant		2
		Test – II	1
IV	Nuclear Power Engineering		18
V	Renewable Sources of Energy		18
		Test - III	1
		Total	96

OBJECTIVES

UNIT – I

1.1.0 Understand the scope and application of power plant engineering

1.1.1 Explain the terms such as heat, heat energy, power and power engineering

1.2.0 Appreciate the working of modern commercial steam boilers, their mountings and accessories

1.2.1 Define a boiler
1.2.2 State the function of a boiler
1.2.3 Classify the different types of boiler
1.2.4 Explain with a line diagram the construction and working of a Nestler boiler
1.2.5 Explain with a line diagram the construction of La-Mont boiler
1.2.6 Compare fire tube boilers and water tube boiler
1.2.7 Write the specifications of a boiler
1.2.8 State the functions of boiler mountings such as stop valve, safety valve, water level indicator, pressure gauge and fusible plug
1.2.9 Explain the working of boiler mountings listed above with line diagram
1.2.10 State the functions of boiler accessories such as economizer, feed pump, super heater and air preheater
1.2.11 Explain the working of boiler accessories listed above with line diagram

1.2.12 List the materials for steam piping
1.2.13 Explain the need of pipe insulation and method of pipe insulation
1.2.14 Define boiler draught
1.2.15 Explain Natural draught, forced draught, induced draught and balanced draught
1.2.16 List the sources of heat loss in a boiler

1.3.0 Recognize the properties of steam using steam tables and Mollier chart

1.3.1 List the uses of steam
1.3.2 Explain the formation of steam at constant pressure with a graph indicating the effect of pressure and temperature
1.3.3 Distinguish between wet steam, dry steam and superheated steam
1.3.4 Define the properties of steam given in the steam tables
1.3.5 Compute the enthalpy of wet, dry and super heated steam at the given pressure and state using steam tables
1.3.6 Compute the heat required to produce steam at given pressure and state from feed water at a temperature
1.3.7 Construct T-S and Mollier charts and represent various pressures in them
1.3.8 Determine the condition of steam given the enthalpy and pressure using Mollier chart

1.4.0 Understand the various thermodynamic vapour cycles.

1.4.1 Carnot cycle with steam as working substance
1.4.2 Rankine cycle.

UNIT – II

2.1.0 Appreciate the Construction and Working of Steam Engines

2.1.1 State the uses and applications of steam engines
2.1.2 Classify the steam engines
2.1.3 Explain with a line sketch the working of a double acting steam engine
2.1.4 State the functions of different parts of a steam engine

2.2.0 Recognize the use and application of Steam Nozzles

2.2.1 State the functions of a steam Nozzle
2.2.2 Explain convergent nozzles and convergent – divergent nozzles
2.2.3 Derive the expression of velocity of steam leaving a nozzle
2.2.4 Compute the velocity of steam leaving a nozzle with the help of a Mollier chart

2.3.0 Appreciate the working of Steam Turbines

2.3.1 State the function of steam turbines
2.3.2 List the advantages of steam turbines over steam engines
2.3.3 Classify steam turbines
2.3.4 Explain impulse turbines and reaction turbines
2.3.5 Explain the working of a simple De-Laval turbine with sketch
2.3.6 State the purpose of compounding steam turbines
2.3.7 Explain pressure compounding, velocity compounding, pressure velocity compounding and parson's reaction turbine with sketches
2.3.8 Explain the principle of working of bade pressure turbines and exhaust turbines
2.3.9 Explain Rankine cycle with steam as working substance

2.4.0 Recognize the different types of Steam Condensers

2.4.1 State the functions of steam condensers
2.4.2 Classify steam condensers
2.4.3 Explain with simple sketches the working of jet condensers and surface condensers
2.4.4 Define vacuum efficiency
2.4.5 Compute vacuum efficiency
2.4.6 List the factors affecting vacuum efficiency
2.4.7 Compute the quantity of cooling water required for a given steam consumption of the prime mover
2.4.8 State the function of cooling towers
2.4.9 Explain different types of cooling towers – Natural draught, forced draught, induced draught and balanced draught

2.4.10 State the function of air pumps
2.4.11 State the effects of air leakage to condenser
2.4.12 Explain the working of dry air pump and wet air pump with simple sketches

UNIT – III

3.1.0 Appreciate the working principle of Gas Turbines

3.1.1 State the function of gas turbine
3.1.2 List the types of gas turbines
3.1.3 Explain with flow diagram and TS diagram the working of constant pressure gas turbine (both open type and closed type)
3.1.4 Explain the work done by the constant pressure closed gas turbine
3.1.5 Explain the work done by the constant pressure open type gas turbine
3.1.6 Compute the work done by the above turbines (simple problems)
3.1.7 Name the fuels used in gas turbines
3.1.8 State the application of gas turbines
3.1.9 List the advantages and limitations of gas turbines
3.1.10 Compare gas turbines with steam turbines

3.2.0 Understand the principle of Jet Propulsion

3.2.1 Explain the principle of Jet propulsion
3.2.2 Explain with sketches the working of turbo jet engine, turbo-prop engine and prop-jet engine
3.2.3 Explain the principles of Rocket propulsion
3.2.4 Explain the working of Diesel Power Plant
3.2.5 Explain with a block diagram the working of diesel power plant

UNIT – IV

4.1.0 Justify the theory of Nuclear Power Engineering

4.1.1 Explain atomic mass unit – isotopes and radio activity
4.1.2 Explain the mass energy equivalence with the help of Einstein's equation
4.1.3 Explain binding energy and mass defect
4.1.4 Explain Nuclear reaction, fission and chain reaction and fusion
4.1.5 Name fertile materials
4.1.6 Explain radio active decay and half-life
4.1.7 Explain neutron ejection in fission
4.1.8 Comprehend the energy released in fission
4.1.9 Explain artificial radio activity and artificial radio nuclides
4.1.10 Solve simple problems using Einstein's equation
4.1.11 Compute binding energy, mess defect and half-life from given data
4.1.12 Explain the working of a Nuclear power plant with the help of a schematic diagram
4.1.13 Name the principle parts of a nuclear reaction and state their functions
4.1.14 List the main products of a reactor
4.1.15 Classify the nuclear reactors on the basis of neutron energy, fuel used, coolant used moderator used and their type of core
4.1.16 Explain the principle and working of pressurized water reactor, condenser type reactor, gas cooled reactor, liquid metal cooled reactor and fast breeder reactor
4.1.17 Brief description of the fuel materials – uranium, thorium, plutonium, and ceramic fuels
4.1.18 Brief descriptions of the moderation – graphite, beryllium, beryllium oxide, light and heavy oxide
4.1.19 Brief descriptions of coolants – water, liquid metal gas and organic liquids
4.1.20 Brief description of reaction control by control rods
4.1.21 Explain the working of a heat exchanges in a nuclear reactor with the help of a schematic diagram

UNIT – V

5.1.0 Justify the renewable source of energy

5.1.1 Identify the renewable sources of energy
5.1.2 Outline the availability date of solar energy
5.1.3 List the uses of solar energy
5.1.4 Explain with simple sketches solar grain drier and solar cooker
5.1.5 Explain the conversion of solar energy for power generation
5.1.6 Explain solar cells, flat plate collectors and parabolic concentrators
5.1.7 Identify the types of wind mills and their uses
5.1.8 Explain the principle of working of wind mills
5.1.9 List the advantages and limitation of wind mills
5.1.10 Explain Biomass energy
5.1.11 Explain the principle of working of Bio plant
5.1.12 Explain the uses of biogas
5.1.13 Explain the principle of working of Tidal power station
5.1.14 Explain geothermal sources such as dry steam field wet steam field and hot water springs
5.1.15 Explain the principle of working of a Geothermal station
5.1.16 Explain the direct conversion devices such as MHD and fuel cells
5.1.17 List the importance of conversion of energy from waste
5.1.18 Explain the conversion of raw waste to synthetic fuel by hydro generation, pyrolysis and bio conversion

CONTENT DETAILS

UNIT – I

Introduction

Scope, objectives and applications of Heat Power Engineering

Steam Generators

Introduction, Function, Classification – fire tube and water tube
Modern package type industrial boiler – Nestler boiler, Modern high pressure boiler – La-Mont boiler
Comparison between water tube and fire tube boiler
Boiler specifications
Boiler mountings – functions with sketches of - Stop valve, Safety valve, Water level indicator, Pressure gauge, Fusible plug
Boiler accessories – function with sketches of - Feed pump, Economiser, Super heater, Air preheater
Steam piping -- Materials and specifications, Steam trap, Steam separator, Pipe insulation
Boiler Draught - Natural draught, Forced draught, Induced draught, Balanced draught
Heat loss in boilers

Properties of Steam

Formation of steam at constant pressure
Properties of steam such as - Total heat of water, Latent heat of steam, Enthalpy of steam
Definition such as Wet steam, Dry steam, Superheated steam, Dryness fraction
Use of steam tables – calculation of heat required to produce steam at a given pressure and state (simple problem)
Construction of T-S and Mollier diagram
Representation of various thermodynamic pressure in T-S and Mollier diagram
Exercises in finding the conditions of steam using Mollier diagram

Thermodynamic vapour cycle.

(1) Carnot cycle with steam as working substance.- efficiency of carnot cycle, (simple problems)
Performance criteria for thermodynamic vapour cycle.
Efficiency ratio – work ratio – specific steam consumption
Rankine Cycle - rankine efficiency. (Simple Problems.)

UNIT – II

Steam engine

Introduction – uses of steam engines, Classification, Brief explanation (with line sketch) of working of double acting steam engine, Functions of different parts of steam engine

Steam Nozzles

Introduction – functions, types – convergent, convergent divergent types, Velocity of steam leaving the nozzle (derivation and simple problems using mollier chart)

Steam Turbines

Introduction, advantages over steam engine, Classification – impulse turbine, reaction turbines, simple De-Laval turbine, demerits of De-Laval turbine, Compounding of steam turbines – purpose, type of compounding, pressure compounding, velocity compounding, pressure velocity compounding, Parson's reaction turbine, Industrials steam turbines – pressure turbine, exhaust turbines, Rankine cycle with steam as working substance – schematic diagram – PV and TS diagram (no derivation)

Steam Condensers

Introduction – functions of condensers

Types – a) Jet condensers – counter flow and parallel flow type
b) Surface condensers

Vacuum efficiency (simple problems), Factors effecting the vacuum efficiency

Quality of cooling water required for a given steam consumption of the engine or turbine (simple problems), Cooling tower – function and types

Air pumps - a) Functions, b) Dry air pump, c) Wet air pump

UNIT – III

Gas turbines

Introduction, advantages of gas turbines over I.C. Engines, Types of gas turbines – constant pressure gas turbine – open and closed type – calculate the work done by the turbines (simple problems only) – fuels used in gas turbine – application of gas turbines – advantages and limitations

Jet Propulsion

Introduction, Turbo – jet engine – turbo – prop engine – prop jet engine, Principles of rocket propulsion

Diesel Power Plant

Explain the working principle with the block diagram

UNIT – IV

Nuclear Power Engineering

Introduction – Nuclear fuels – advantages and limitation of nuclear power, Atomic mass unit – isotopes and radio activity,Neutron emission, Einstein's equation, Binding energy, Nuclear reaction

Mass defect – fission and fusion, Fertile materials – radio active decay – half life, Requirements of fission process – thermal neutron fission – neutron collision in fission – prompt neutron – delayed neutrons – properties of fission fragments, Energy released in fission – artificial radio activity – artificial radio nuclides, Simple problems involving Einstein's equation, Nuclear reaction – working of a nuclear power plant with the help of a schematic diagram, Classification of nuclear reaction, Types of reaction – pressurised water reactor – boiler water reactor – condenser type – gas cooled – liquid cooled – fast breeder reaction (explanation with line sketches), Advantages and disadvantages of different types of reaction

UNIT – V

Renewable sources of energy

Solar Energy - Availability of data, Uses , Solar grain drying, Solar cookers, Conversion of solar energy for power production, Solar cells

Flat plate collection for power generators, Parabolic concentrators for power generation

Wind Energy - Wind mills – types, Principles of working and use, Advantages and limitations

Biomass Energy - Principles of working of Biogas plant, Use of biogas for – Cooking, Electric power generator, Running of engines, Lighting, Tidal Energy – Principles of working of a Tidal power plant

Geothermal energy – Geothermal sources, Dry steam field, Wet steam field, Hot water springs, Principle of working of a geothermal station

Direct conversion devices – MHD (Magneto Hydro Dynamic), Fuel cells, Energy from water

Conversion of raw waste to synthetic fuel by, Hydrogenation, Pyrolysis

REFERENCE BOOKS

1. Text Book of Thermal Engg., - R.S. Khurmi & J.K. Gupta
2. Non-Conventional Energy sources - G.D. Rai
3. Heat Power Engineering - N. Rangassamy & E. Sundara moorthy
4. Elements & Heat Engines, Vol. I, II & III - R..C. Patel and C. J Karan chandani
5. Introduction to Non conventional Energy resources - Raja et. al.
6. Power plant Engineering - Ramalingam

SUBJECT TITLE : CADD Laboratory II
SUBJECT CODE : ME 604
PERIODS/WEEK : 3
PERIODS / SEMESTER : 48

TIME SCHEDULE

UNIT	TOPICS	PERIODS
I	1.1 Revision to Computer Aided Drafting	3
	1.2 Working with Layer Property Manager	3
II	2.1 Crating Blocks wiith CAD	6
	Test	3
III	3.1 Solid modelling	9
IV	4.2 Orthographic Views, Production Drawing	9
V	5.1 Assembly drawing	6
	5.2 CAD Project	6
	Test	3
	Total	48

CONTENT DETAILS

UNIT – I.

Revision to Computer Aided Drafting, Working with Layer Property Manager, Creating new layers – assigning colors – naming layers – assigning line type - set up a hard and soft copy.

UNIT – II

Crating Blocks with CAD, Creating and inserting blocks – detecting blocks – studs – rivets – bolts etc:

UNIT – III

Solid Modeling – Unoined – subtract – Extrude – revolve etc:-, Solid journal bearing, Universal joint, foot step bearing, plummer block etc:-

UNIT – IV.

Drawing Orthographic views - from slid models – Dynamic views – sections etc:-
Universal coupling – Foot step bearing – Crank – C- Clamp etc:-

UNIT V

Assembly drawings- Crosshead Assembly – Eccentric – Lathe tool holder – connecting rod
CADD project – A shop flop drawing – Identifying task and their duration – production methods – materials - etc:-

REFERENCE BOOKS

1. Machine drawing - N.D. Bhat
2. Machine drawing - P.I. Vargheese
3. Machine drawing - K.C. John
4. AutoCAD - P. Dayanidhi, TTTI.
5. AutoCAD - K.C. John
6. Auto CAD - B. Vishal

SUBJECT TITLE : **ADVANCED MACHINE TOOL LABORATORY**
SUBJECT CODE : **ME605**
PERIODS/WEEK : **3**
PERIODS/SEMESTER : **48**

TIME SCHEDULE

UNIT	TOPIC	PERIODS
1.	Lathe Work	12
2.	Shaping Practice	9
	Test I	3
3.	Milling Practice	12
4.	Slotting Practice Planing Practice	6
5.	Grinding & CNC Machining	3
	Test I	3
	Total	48

OBJECTIVES

Perform the various machine tools operations

Perform special turning operation to produce machine handle eccentric turning, male & female fit assembly.
Practice the various operation of a shaper , milling machine and a planer.
Perform key way-cutting , T – Slot cutting , gear cutting , spline cutting etc.
Testing & inspection of machine tool operation
Dismantle and assemble machine tools.
Recondition the parts, if needed

CONTENT OUTLINE

UNIT – 1
Lathe Work
Advanced lathe operations such as machine handle manufacturing, male and female assembly etc.

UNIT – 2
Shaping Practice
V -Blocks, Key - way cuttings.

UNIT – 3
Milling Practice
Key- way cutting T- Slot Cutting, Gear cutting.

UNIT - 4
Planning Practice & Slotting practice
Practice on planning & slotting machine.

UNIT - 5

Practice on Cylindrical & Surface grinding, Jig boring machine and CNC

SUBJECT TITLE : PROJECT WORK & SEMINAR
SUBJECT CODE : ME 606
PERIODS/WEEK : 5
PERIODS/YEAR : 128

CONTENT DETAILS

Note: - The following activities are envisaged in this course of study.

Two weeks continuous In- Plant training should be completed before the commencement of VI semester.
Identification and selection of a product or process that has a demand in the market
Preparation of production / process drawing
Procure the raw materials, equipments and tools needed for manufacturing a specified quality
Manufacture the product / process with available facilities in the polytechnic
Checking the finished product / process with original drawings and design and making suitable modification

Preparing project report consisting of production / process drawings, plant layout needed for raw materials, equipments, tools, cost of manufacturing and all other details. The actual Performa for obtaining financial assistance etc has to be included

The project and seminar should be started in V^{th} semester and final assessment / exam should be at the end of VIth semester only.

The types of projects will have to be selected by the Polytechnics in consultation with the local industries. The final assessment of this course will be through a viva-voce examination by a committee comprising of industrialists, bankers and other departmental enginee

Seminars: To develop the communication skill of the student, seminar should be conducted once in every week; presentation of papers should be made compulsory for all students

SUGGESTED LIST OF PROJECTS

1. Washing machine with spin and drier
2. Window Grills and Gate
3. Semi rotary pump
4. Service Trolly with adjustable platform
5. Shearing machine
6. Wet Grinder
7. PVC pipe threading apparatus
8. Milling fixture for lathe
9. Project report for setting a small scale industry
10. Gobar Gas plant
11. Power hacksaw
12. Hand forge with hand blower
13. Garbage Gas plant
14. Coil winding machine
15. Swiveling chair
16. Agro processing unit

17. Grinding Attachment in Lathe
18. Taper turning attachment in Lathe
19. Honing attachment to a drilling machine
20. Boring attachment
21. Ball turning attachment for Lathe
22. Flush door lock
23. Vacuum cleaner
24. Motor cycle stand – telescopic type
25. in 1 flushing systern
26. Power operated elevating chair
27. Smokeless chulas for Hostel
28. Auto stop mechanism for hydraulic pumps
29. Solar power plant
30. Coconut dehusking machine
31. Solar distillery
32. Dehumidification attachment for window air conditioner, (OV air conditioner cum dehumidifier)
33. Salt crusher
34. Wind powered air compressor
35. Leaf jig to drill bolt holes
36. Mechanical side fabrication for robots
37. Improved carts for animal traction
38. Wind powered chain pump
39. Fabrication laboratory equipments/test rigs
40. Reconditioning of machines/laboratory machines

Project work in Automobile Engineering

1. Fuel filling station-cum-garrage
2. Major engine reconditioning workshop
3. A repair workshop for two wheeler and three wheeler
4. Body building workshop
5. Tyre reconditioning unit
6. Battery reconditioning unit
7. Spray painting unit
8. Vehicle testing, turning and servicing station
9. Running the petrol car with any other fuel
10. Running the diesel engine with diesel and gobar gas
11. Hydraulic type driver's seat
12. Pneumatic bumper
13. Water scatter
14. Electric car
15. Running the compressor by the help of exhaust gas

List of Faculty who made Contributions to the Curriculum Revision 2006

Sl. No	Name	Designation
1	Sri. Aathipagavan	Scientist, VSSC
2	Sri. Philip Kurian	Asst. Professor&Head in Charge, NITTTR Extn Centre, Kalamassery
3	Sri. Ramachandran	Principal
4	Sri. Hemachandran	Head of Section in Mechanical Engg
5	Sri. Samuel	Head of Section in Mechanical Engg
6	Sri. N. Vijayakumar	Head of Section in Mechanical Engg
7	Sri. Nasarudeen B	Head of Section in Mechanical Engg
8	Sri. George Joseph	Head of Section in Mechanical Engg
9	Sri. Sreenivasan	Head of Section in Mechanical Engg
10	Sri. Sebastian Thomas	Head of Section in Automobile Engg
11	Sri. V.M. Venukuttan	Lecturer in Mechanical Engg
12	Sri. Chandranganathan	Lecturer in Tool & Die Engg
13	Sri. S.R. Rajendranathan Nair	Lecturer in Automobile Engg
14	Sri. Hamsha Koya K	Lecturer in Automobile Engg
15	Sri. V.V. Jayaprasad	Lecturer in Automobile Engg
16	Sri. V. Ramachandran	Lecturer in Automobile Engg
17	Smt. Cisy Simon	A/L in Wood & Paper
18	Sri. Prabhakaran	A/L in Wood & Paper
19	Sri. Karunakaran C.K	A/L in Tool & Die Engg
20	Sri. Sudheer	Demonstrator in Wood & Paper