SRI RAMAKRISHNA MISSION VIDYALAYA
POLYTECHNIC COLLEGE

(AN AUTONOMOUS & ISO 9001:2015 CERTIFIED INSTITUTION)

REGULATIONS AND SYLLABUS

[APPLICABLE TO STUDENTS ADMITTED FROM 2021 - 2022 ACADEMIC YEAR ONWARDS]

(R6 - SCHEME)

DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING

Sri Ramakrishna Vidyalaya Post, Coimbatore - 641 020

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(AN AUTONOMOUS INSTITUTION)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

R6 - SCHEME

[Applicable to students admitted from 2021 - 2022 academic year onwards]

R E G U L A T I O N S

Description of the Course:

The Course for the full time Diploma in Engineering shall extend over a period of three academic years, consisting of 6 semesters. This curriculum for the diploma course is applicable for the candidates admitted from 2021 - 2022 academic year onwards.

Eligibility for the Award of Diploma:

No candidate shall be eligible for the Diploma unless he has undergone the prescribed course of study in this College for a period of not less than three academic years when joined in first year and two years if joined under lateral entry scheme in the second year and passed the prescribed examination. The minimum and maximum period for completion of diploma course is as given below:

Diploma Course	Minimum Period	Maximum Period
Full Time Regular	3 Years	6 Years
Full Time (Lateral Entry)	2 Years	5 Years

Age Limit: No age limit

Subjects of Study and Curriculum Outline:

The subjects of study shall be in accordance with the syllabus prescribed from time to time, both in theory & practical. The curriculum outline under R6-Scheme is given in Annexure-I.

Autonomous Examination - Exam Pattern:

The Autonomous examinations for all the diploma courses are being conducted in the following pattern:

Semester	Span of Study	Examination
I, III & V Sem	June - October	October
II, IV & VI Sem	December - April	April

Autonomous Examinations in all subjects of all the semesters under the scheme of examinations will be conducted at the end of each semester. The internal assessment marks for all the subjects will be awarded on the basis of continuous internal assessment earned during the semester concerned. For each subject 25 marks are allotted for internal assessment and 75 marks are allotted for end semester external examinations.

Continuous Internal Assessment:

A. FOR THEORY SUBJECTS:

The internal assessment marks for a total of 25 marks, which are to be distributed as follows:

i) Subject Attendance **05 Marks**

Award of marks for subject attendance to each subject Theory / Practical will be as per the range given below:

80% - 83%	1 mark
84% - 87%	2 marks
88% - 91%	3 marks
92% - 95%	4 marks
96% - 100%	5 marks

ii) Test **10 Marks**

Two Tests each of 2 hours duration for a total of 50 marks are to be conducted. Out of which the best one will be taken and the marks to be reduced to **05 marks**

The Test - III is to be the Model test of 3 hours duration for a total of 100 marks covering all the five units and the question paper will be end semester examination pattern. The marks obtained will be reduced to **05 marks**

Total 10 marks

Test	Units	When to conduct	Marks	Duration
Test I	Unit - I & II	End of 6th week	50	2 Hrs
Test II	Unit - III & IV	End of 12th week	50	2 Hrs
Test III	Model Examination: All the 5 units. (End sem. exam question pattern)	End of 16th week	100	3 Hrs

iii) Assignment **05 Marks**

For each subject three assignments are to be given each for 20 marks and the average marks scored should be reduced for 05 marks.

iv) Seminar Presentation **05 Marks**

The students have to select the topics either from the subjects or general subjects which will help to improve the grasping capacity as well as the capacity to express the subject in hand. The students will be allowed to prepare the material for the given topic using the library hour and they will be permitted to present the seminar. (For Second Year, the students will be permitted to present the seminar as a group not exceeding six members and each member of the group should participate in the presentation. For the Third Year, the students should present the seminar individually).

The seminar presentation is mandatory for all theory subjects and carries 05 marks for each theory subject. The respective subject faculty may suggest topics to the students and will evaluate the submitted materials and seminar presentation. (2½ marks for the material submitted in writing and 2½ marks for the seminar presentation). For each subject minimum of two seminars are to be given and the average marks scored should be reduced to 05 marks.

All test papers, assignment papers and the seminar presentation written materials after getting the signature with date from the students must be kept in safe custody in the department for verification and audit. It should be preserved for one semester after publication of end semester exam results.

B. FOR PRACTICAL SUBJECTS:

The internal assessment mark for a total of 25 marks which are to be distributed as follows:-

a)	Attendance (Award of marks same as theory subjects)	05 Marks
b)	Procedure / observation and tabulation / Other practical related work	10 Marks
c)	Record writing	10 Marks
	TOTAL	**25 Marks**

- *All the experiments / exercises indicated in the syllabus should be completed and the same to be given for final semester examinations.*
- *The record for every exercise should be submitted in the subsequent Practical classes and marks should be awarded for 20 for each exercise as per the above allocation.*
- *At the end of the semester, the average marks of all the exercises should be calculated for 20 marks and the marks awarded for attendance is to be added to arrive at the internal assessment mark for practical. (20 + 5 = 25 marks)*
- *The students have to submit the duly signed bonafide record notebook / file during the end semester practical examinations.*

- *All the marks awarded for assignments, tests and attendance should be entered in the Personal Log Book of the staff, who is handling the subject. This is applicable to both theory and practical subjects.*

Project Work and Internship:

The students of all the branches have to do a project work in the final semester as part of the Curriculum and in partial fulfillment for the award of Diploma by the State Board of Technical Education and Training, Tamil Nadu. The project work must be reviewed twice in the same semester. The project work is approved during the fifth semester by the properly constituted committee with guidelines. Proper record should be maintained for the two project reviews and preserved for one semester after the publication of end semester exams results.

a) Internal assessment mark for Project Work & Internship:

a)	Attendance (Award of marks same as theory pattern)	05 Marks
b)	Project Review - I	10 Marks
c)	Project Review - II	10 Marks
	TOTAL	**25 Marks**

b) Allocation of Marks for Project Work & Internship in Autonomous Examination:

a)	Demonstration / Presentation	25 Marks
b)	Project Report	25 Marks
c)	Viva-Voce	30 Marks
d)	Internship Training Report	20 Marks
	TOTAL	**100 Marks**

c) Internship Report:

The internship training for a period of two weeks shall be undergone by every student at the end of IV / V semester during vacation. The certificate shall be produced along with the internship training report for evaluation. The evaluation of internship training shall be done along with final year "Project Work" for 20 marks. The internship shall be undertaken in any Industry / Government or Private certified agencies which are in Social Sector / Government Skill Centers / Institutions / Schemes. A neatly prepared PROJECT REPORT as per the format has to be submitted by the individual student during the end semester examination.

END SEMESTER AUTONOMOUS EXAMINATIONS
QUESTION PAPER PATTERN FOR FIRST YEAR SUBJECTS
***(General Question paper pattern for theory subjects, unless specified*)**

Time: 3 Hrs **Max. Marks: 100**

PART – A (5 x 1 = 05 marks)

Sl. No. : 1 to 5

Five questions will be asked. 1 question from each unit. Answer all the FIVE questions. Each question carries 1 mark.

PART – B (10 x 2 = 20 marks)

Sl. No. : 6 to 20

Fifteen questions will be asked. 3 questions from each unit. Answer any TEN questions. Each question carries 2 marks.

PART – C (5 x 15 = 75 marks)

Sl. No. : 21 to 25

Five questions will be asked. 1 question from each unit. Each question carries 15 marks. In each question, answer either A or B. Questions A and B have two subdivisions (i) and (ii) carrying 8 marks and 7 marks.

END SEMESTER AUTONOMOUS EXAMINATIONS
QUESTION PAPER PATTERN FOR SECOND AND THIRD YEAR SUBJECTS
***(General Question paper pattern for theory subjects, unless specified*)**

Time: 3 Hrs ***Max. Marks: 100***

PART - A (10 x 3 = 30 marks)

Sl. No. : 1 to 10

Ten questions will be asked with at least two questions from each unit. All the Ten Questions are to be answered. Each question carries 3 marks.

PART - B (5 x 14 = 70 marks)

Sl. No. : 11 to 15

Five Questions will be asked with one question from each unit in ***either - or*** pattern. Students have to answer all the five questions. Each question carries 14 marks. (Based on the discretion of the question setter, he / she can ask two seven mark questions (with sub division (i) & sub division (ii)) instead of one 14 marks question, if required).

Any tables required, should be mentioned in the question paper like Steam table, IS Code Book, Steel table, Design Data Book, Mollier chart, Psychometric Chart etc.,

*Examination will be conducted for 100 marks and will be converted to 75 marks.

Scheme of Examinations:

The Scheme of examinations for subjects under R6-Scheme is given in Annexure - II.

Requirements to appear for Examinations:

A candidate will be permitted to appear for the end semester Autonomous Examinations, only if he secures a minimum of overall 80% attendance in the semester concerned and pay the required examination fees in time.

Criteria for Pass:

1. No candidate shall be eligible for the award of Diploma unless he has undergone the prescribed course of study successfully and pass all the subjects prescribed in the curriculum.
2. A candidate shall be declared to have passed the examination in a subject if he secures not less than 40% in theory subjects and 50% in practical subjects out of the total prescribed maximum marks including both the internal assessment and the end semester examinations marks put together, subject to the condition that he secures at least a minimum of 30 marks out of 75 marks in the theory examinations and a minimum of 35 marks out of 75 marks in the practical examinations.

Condonation of Attendance:

The minimum overall percentage of attendance required for a candidate to become eligible to write the Autonomous End Semester Examination is 80%. Under extraordinary circumstances, for genuine and valid reasons including medical reasons, the Principal may condone up to a maximum of 10% shortage to a candidate, subject to the condition that he satisfies all the other requirements to appear for the Autonomous Examinations.

Under no circumstances a candidate with attendance less than 70% shall be permitted to write the Autonomous Examinations. The condonement of 10% shortage shall not be done as a routine to all candidates, but only for genuine cases; it shall not be claimed as a matter of right by all candidates.

Classification of successful candidates:

Classification of candidates who will pass out the final examinations from April 2024 onwards (Joined in first year in 2021-2022) in R6-scheme is being done as specified below.

First Class with Superlative Distinction:

A candidate will be declared to have passed in *First Class with Superlative Distinction*, if he secures not less than 75% of the marks in all the subjects and passes all the semesters in the first appearance itself and passes all subjects within the stipulated period of study of 3 / 2 years (3 years for regular entry / 2 years for lateral entry) without any break.

First Class with Distinction:

A candidate will be declared to have passed in *First Class with Distinction*, if he secures not less than 75% of the aggregate marks in all the semesters put together and passes all the semesters except the I and II semester in the first appearance itself and passes all subjects within the stipulated period of study of 3 / 2 years (3 years for regular entry / 2 years for lateral entry) without any break.

First Class:

A candidate will be declared to have passed in *First Class,* if he secures not less than 60% of the aggregate marks in all the semesters put together & passes all the subjects within the stipulated period of study 3 / 2 years (3 years for regular entry / 2 years for lateral entry) without any break.

Second Class:
All other successful candidates will be declared to have passed in *Second Class*.

Duration of a period in the Class Time Table:
The duration of each period of instruction is 1 hour and the total period of instruction hours excluding interval and lunch break in a day should be 7 hours corresponding to 7 periods of instruction (Theory & Practical).

ANNEXURE - I
Subjects of Study and Curriculum Outline (R6 - Scheme)

FIRST SEMESTER

No. of weeks per semester: 16 weeks

Subject Code	Subject	Hours per Week			
		Theory	Drawing	Practical	Total
6011	Communicative English - I	5			5
6012	Engineering Mathematics - I	5			5
6013	Engineering Physics - I	5			5
6014	Engineering Chemistry - I	5			5
6015	Engineering Graphics - I		6		6
6016	Engineering Physics Practical - I			2	2
6017	Engineering Chemistry Practical - I			2	2
6018	Workshop Practical - I			3	3
6002	Computer Applications Practical			2	2
	TOTAL	**20**	**6**	**9**	**35**

Extra / Co-curricular Activities:

Sub. Code	Subject	Hrs / Week
6003	Physical Education	2
6004	Library	1
6005	Value Education	1

SECOND SEMESTER

No. of weeks per semester: 16 weeks

Subject Code	Subject	Hours per Week			
		Theory	Drawing	Practical	Total
6021	Communicative English - II	4			4
6022	Engineering Mathematics - II	5			5
6023	Engineering Physics - II	5			5
6024	Engineering Chemistry - II	5			5
6025	Engineering Graphics - II		5		5
6026	Engineering Physics Practical - II			2	2
6027	Engineering Chemistry Practical - II			2	2
6028	Basics of Industries and Workshop Practical - II	2		3	5
6001	Communication Skill Practical			2	2
	TOTAL	**21**	**5**	**9**	**35**

Extra / Co-curricular Activities:

Sub. Code	Subject	Hrs / Week
6003	Physical Education	2
6004	Library	1
6005	Value Education	1

THIRD SEMESTER

No. of weeks per semester: 16 weeks

SUB. CODE	SUBJECT	HOURS PER WEEK			
		THEORY	DRAWING	PRACTICAL	TOTAL
6331	Electronic Devices and Circuits	6	-	-	6
6332	Electrical Circuit Theory	7	-	-	7
6333	Electrical Machines - I	6	-	-	6
6334	Electronic Devices and Circuits Practical	-	-	4	4
6335	Electrical Circuits and Machines Practical	-	-	4	4
6336	Electrical Workshop and Winding Practical	-	-	4	4
6337	Simulation - I Practical	-	-	4	4
TOTAL		**19**	**-**	**16**	**35**

Extra / Co-curricular Activities:

SUB. CODE	SUBJECT	HRS / WEEK
6003	Physical Education	2
6004	Library	1
6005	Value Education	1

FOURTH SEMESTER

No. of weeks per semester: 16 weeks

SUB. CODE	SUBJECT	HOURS PER WEEK			
		THEORY	DRAWING	PRACTICAL	TOTAL
6341	Electrical Machines - II	6	-	-	6
6342	Measurements Instruments and Transducers	6	-	-	6
6343	Analog and Digital Electronics	6	-	-	6
6344	E - Vehicle Technology and Policy	5	-	-	5
6345	Electrical Machines and Instrumentation Practical	-	-	4	4
6346	Analog and Digital Electronics Practical	-	-	4	4
6347	Simulation - II Practical	-	-	4	4
TOTAL		**23**	**-**	**12**	**35**

Extra / Co-curricular Activities:

SUB. CODE	SUBJECT	HRS / WEEK
6003	Physical Education	2
6004	Library	1
6005	Value Education	1

FIFTH SEMESTER

No. of weeks per semester: 16 weeks

SUB. CODE	SUBJECT	HOURS PER WEEK			
		THEORY	DRAWING	PRACTICAL	TOTAL
6351	Generation, Transmission & Switchgear	6	-	-	6
6352	Microcontroller and its Applications	7	-	-	7
6353.1	Control of Electrical Machines	6	-	-	6
6353.2	Programmable Logic Controller				
6353.3	Renewable Energy Sources				
6354	Microcontroller Practical	-	-	4	4
6355	Computer Aided Electrical Drawing	-	-	4	4
6356.1	Control of Electrical Machines Practical	-	-	4	4
6356.2	Programmable Logic Controller Practical				
6356.3	Renewable Energy Sources practical				
6357	Entrepreneurship and Startups	-	-	4	4
TOTAL		**19**	**-**	**16**	**35**

Extra / Co-curricular Activities:

SUB. CODE	SUBJECT	HRS / WEEK
6003	Physical Education	2
6004	Library	1

SIXTH SEMESTER

No. of weeks per semester: 16 weeks

SUB. CODE	SUBJECT	HOURS PER WEEK			
		THEORY	DRAWING	PRACTICAL	TOTAL
6361	Distribution and Utilization	6	-	-	6
6362	Power Electronics	6	-	-	6
6363.1	Energy Conservation and Audit	5	-	-	5
6363.2	Bio-Medical Instrumentation				
6363.3	Computer Hardware and Networks				
6364	Power Electronics Practical	-	-	6	6
6365.1	Electrical Estimation and Costing Practical	-	-	6	6
6365.2	Bio-Medical Instrumentation Practical				
6365.3	Computer Hardware and Networks Practical				
6366	Project Work and Internship	-	-	6	6
TOTAL		**17**	**-**	**18**	**35**

Extra / Co-curricular Activities:

SUB. CODE	SUBJECT	HRS / WEEK
6003	Physical Education	2
6004	Library	1

ANNEXURE - II: SCHEME OF EXAMINATIONS

FIRST SEMESTER

Sub. Code	Name of the Subject	Periods / Week	Periods / Semester	Scheme of Examination				
				Exam Duration in Hrs	Allocation of Marks			Minimum for Pass
					Internal	External *	Total	
6011	Communicative English - I	5	80	3	25	75	100	40
6012	Engineering Mathematics - I	5	80	3	25	75	100	40
6013	Engineering Physics - I	5	80	3	25	75	100	40
6014	Engineering Chemistry - I	5	80	3	25	75	100	40
6015	Engineering Graphics - I	6	96	3	25	75	100	40
6016	Engineering Physics Practical - I	2	32	3	25	75	100	50
6017	Engineering Chemistry Practical - I	2	32	3	25	75	100	50
6018	Workshop Practical - I	3	45	3	25	75	100	50
6002	Computer Applications Practical	2	32	3	25	75	100	50

SECOND SEMESTER

6021	Communicative English - II	4	64	3	25	75	100	40
6022	Engineering Mathematics - II	5	80	3	25	75	100	40
6023	Engineering Physics - II	5	80	3	25	75	100	40
6024	Engineering Chemistry - II	5	80	3	25	75	100	40
6025	Engineering Graphics – II (Computer Aided Drawing Practical)	5	80	3	25	75	100	50
6026	Engineering Physics Practical - II	2	32	3	25	75	100	50
6027	Engineering Chemistry Practical - II	2	32	3	25	75	100	50
6028	Basics of Industries and Workshop Practical - II	5	80	3	25	75	100	50
6001	Communication Skill Practical	2	32	3	25	75	100	50

THIRD SEMESTER

6331	Electronic Devices and Circuits	6	96	3	25	75	100	40
6332	Electrical Circuit Theory	7	112	3	25	75	100	40
6333	Electrical Machines -1	6	96	3	25	75	100	40
6334	Electronic Devices and Circuits Practical	4	64	3	25	75	100	40
6335	Electrical Circuits and Machines Practical	4	64	3	25	75	100	50
6336	Electrical Workshop Practical	4	64	3	25	75	100	50
6337	Simulation - 1 Practical	4	64	3	25	75	100	50

FOURTH SEMESTER								
6341	Electrical Machines - II	6	96	3	25	75	100	40
6342	Measurements Instruments and Transducers	6	96	3	25	75	100	40
6343	Analog and Digital Electronics	6	96	3	25	75	100	40
6344	E - Vehicle Technology and Policy	5	80	3	25	75	100	40
6345	Electrical Machines and Instrumentation Practical	4	64	3	25	75	100	50
6346	Analog and Digital Electronics Practical	4	64	3	25	75	100	50
6347	Simulation - II Practical	4	64	3	25	75	100	50
FIFTH SEMESTER								
6351	Generation, Transmission & Switchgear	6	96	3	25	75	100	40
6352	Microcontroller and its Applications	7	112	3	25	75	100	40
6353.1	Control of Electrical Machines	6	96	3	25	75	100	40
6353.2	Programmable Logic Controller							
6353.3	Renewable Energy Sources							
6354	Microcontroller Practical	4	64	3	25	75	100	50
6355	Computer Aided Electrical Drawing	4	64	3	25	75	100	50
6356.1	Control of Electrical Machines Practical	4	64	3	25	75	100	50
6356.2	Programmable Logic Controller Practical							
6356.3	Renewable Energy Sources practical							
6357	Entrepreneurship and Startups	4	64	3	25	75	100	50
SIXTH SEMESTER								
6361	Distribution and Utilization	6	96	3	25	75	100	40
6362	Power Electronics	6	96	3	25	75	100	40
6363.1	Energy Conservation and Audit	5	80	3	25	75	100	40
6363.2	Bio-Medical Instrumentation							
6363.3	Computer Hardware and Networks							
6364	Power Electronics Practical	6	96	3	25	75	100	50
6365.1	Electrical Estimation and Costing Practical	6	96	3	25	75	100	50
6365.2	Bio-Medical Instrumentation Practical							
6365.3	Computer Hardware and Networks Practical							
6366	Project Work and Internship	6	96	3	25	75	100	50

FIRST SEMESTER

6011 COMMUNICATIVE ENGLISH - I

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
6011 COMMUNICATIVE ENGLISH - I	5 Hrs	80 Hrs	Internal Assessment	External Exam*	Total	
			25	75	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

Unit	Name of the Topics	Hrs
I	**Functional Grammar and Usage** Parts of SpeechFunctional Units Use of Main Verb & Auxiliary Verb Application of Tense Forms (Simple Present, Present Continuous, Present Perfect, Simple Past, Past Continuous, Past Perfect, Simple Future, Future Continuous only) Framing Yes / No QuestionsFraming Wh-Questions Application of Active Voice and Passive Voice Use of Prepositions Articles	17
II	**Vocabulary Enrichment** Synonyms and Antonyms Word Conversion (selective 25 words) Collocation – Noun with Verb, Adjective with Noun (Selective 25 Collocations) Homophones (selective 25 homophones)One-word Substitution (Textual) Idiomatic expressions for Daily Life (frequently used 25 expressions) Frequently Used Phrasal verbs (selective 25 Phrasal verbs)	15
III	**Situational English** Dialogue for Day to Day Situations Short Messages for e-Communication Letter Writing for Academic Purpose (Leave Application, Requisition for Bonafide Certificate, Applying for TC) Writing the Essentials Comprehension Framing questions based on the given situation	15
IV	**Creative English** Review Writing (Book / Movie / TV Program)Visual Description Advertisement Writing Word Cloud Transforming Verbal Passage into Graphics	15
V	**English for Scholarly Presentation/ Fluency** "A Snake in the Grass" by R.K. Narayan “Of Parents and Children” by Francis Bacon"On His Blindness" by John Milton "When I Have Fears" by John Keats	11

Reference Books:

Glossaries

https://www.engineering-dictionary.com/ https://techterms.com/definition/ http://dictionary.tamilcube.com/ https://www.lexilogos.com/english/tamil_dictionary.htm

Grammar

1. Just Enough English Grammar Illustrated, Gabriele Stobbe, McGraw-HillOsborne Media, 2008
2. Visual Guide to Grammar and Punctuation, DK Publishing, 2017
3. English Grammar in Use, Raymond Murphy, Cambridge University Press, 2019
4. Intermediate English Grammar, Raymond Murphy, Cambridge University Press,Second Edition.
5. Essential English Grammar, Raymond Murphy, Cambridge University Press,New edition.

Enrichment of Study

1. Enrich Your Vocabulary: Vocabulary for General, Placement & Competitive Exams by Edin Brow

Motivation

1. An Autobiography; Or, The Story of My Experiments with Truth, Mahatma Gandhi, Penguin Books, 2001
2. You Can Win, Shiv Khera, New Dawn Press, 2004
3. Chicken Soup for the Soul, Jack Canfield, Mark Victor Hansen, 2001
4. How to Win Friends and Influence People by Dale Carnegie

QUESTION PAPER PATTERN

End semester Examination Time: 3 Hrs. Max. Marks: 100

Sl. No	Questions	Portions	Marks
1	Answer any TEN out of 16 questions	Unit I & II - Grammar items	10 x 4 = 40
2	Answer any FOUR out of 6 questions	Unit III - Composition items	4 x 5 = 20
3	Answer any FOUR out of 5 questions	Unit IV - Composition items	4 x 5 = 20
4	Answer any FOUR out of 5 questions	Unit V - Prose & Poetry	4 x 5 = 20
		TOTAL	**100**

6012 ENGINEERING MATHEMATICS - I

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6012 ENGINEERING MATHEMATICS – I	5 Hrs	80 Hrs	25	75	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

Unit	Name of the Topics	Hrs
I	**ALGEBRA** **1.1 MATRICES AND DETERMINANTS** **MATRICES**: Definition, concept and types of matrices. **DETERMINANTS:** Determinant of a square matrix - 2nd and 3rd order determinants - singular & non-singular matrices - simple problems. **1.2 APPLICATIONS OF MATRICES AND DETERMINANTS** Co-factor, Adjoint of matrix, Inverse of matrix and rank of a matrix by determinant method - simple problems. Solution of simultaneous equations using Cramer's rule - simple problems. **1.3 BINOMIAL THEOREM** Introduction - Factorial, Permutation and Combinations - Values of nPr and nCr (Results only - not for examination). Statement of Binomial theorem for positive integral index - Expansion of Binomial - Finding general term - Middle term - Coefficient of x^n and Term independent of x - Binomial theorem for rational index up to 3. Applications of Binomial theorem - simple problems.	**4** **5** **5**
II	**COMPLEX NUMBERS** **2.1 ALGEBRA OF COMPLEX NUMBERS** Introduction - Complex numbers - Conjugates - Algebra of complex numbers (without geometrical proof), Properties of complex conjugates - Modulus and amplitude - Polar and Euler form of a complex number - simple problems. Argand diagram - Collinear points, four points forming square, rectangle, rhombus and parallelogram only - simple problems. **2.2 DE MOIVRE'S THEOREM** De Moivre's Theorem (statement & applications)-related simple problems. **2.3 ROOTS OF COMPLEX NUMBERS** Finding the nth roots of unity - solving the equations of the form $X^n \pm 1 = 0$, where $n \leq 7$ - simple problems.	**5** **5**

		5
III	**TRIGONOMETRY** **3.1 TRIGONOMETRIC IDENTITIES** Trigonometric ratios of sum and difference of two angles - Multiple and sub-multiple angles - Functions of 3A angles - simple problems. **INVERSE TRIGONOMETRIC FUNCTIONS** Sum and product identities - Inverse trigonometric functions - Principal value - Properties of inverse trigonometric functions - simple problems.	**7** **8**
IV	**DIFFERENTIAL CALCULUS - I** **4.1 LIMITS** Definition of limits - Problems using the following results $(i)\ \underset{x\to a}{Lt}\ \frac{x^n - a^n}{x-a} = na^{n-1}$ $(ii)\ \underset{\theta\to 0}{Lt}\ \frac{Sin\theta}{\theta} = 1$ $(iii)\ \underset{\theta\to 0}{Lt}\ \frac{\tan\theta}{\theta} = 1\ (\theta\ in\ radians)(\text{Re}\ sults\ only)$ **4.2 DIFFERENTIATION** The derivative of a function - Differentiation of constant, $X^n, \sin x, \cos x, \tan x, \sec x, \cos ecx, \cot x, \log x, e^x, a^x, \sin^{-1}x, \cos^{-1}x, \tan^{-1}x, \cot^{-1}x, \sec^{-1}x$ $and\ \cos ec^{-1}x$ (Formulae only) - Differentiation rules: $u \pm v, uv, uvw, u/v$ - simple problems. **4.3 DIFFERENTIATION METHODS** Chain rule - Differentiation of Implicit functions - Differentiation of parametric functions - simple problems.	**5** **5** **5**
V	**DIFFERENTIAL CALCULUS - II** **5.1 SUCCESSIVE DIFFERENTIATION** Successive differentiation up to second order (parametric form not included). Definition of differential equation, order and degree, formation of differential equation - simple problems. **5.2 PARTIAL DIFFERENTIATION** Definition - Partial differentiation of two variables up to second order only - simple problems.	**7** **7**

Reference Books:

1. Higher Secondary +1 Mathematics volume I & II. Tamil Nadu Text Book Corporation.
2. Higher Secondary +2 Mathematics Volume I & II. Tamil Nadu Text Book Corporation.
3. Engineering Mathematics V. Sundaram, R. Balasubramanian.
4. Engineering Mathematics - I C.B.Gupta ,A.K.Malik, New age international Pub., 1st ed, - 2008.
5. Differential Calculus S. Balachandra Rao, CK Shantha New age Publishers
6. Probability Theory and Stochastic Process B.Prabhakara Rao, TSR Murthy, BS Publishers.

QUESTION PAPER PATTERN: General Pattern

6013 ENGINEERING PHYSICS - I

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
6013 ENGINEERING PHYSICS - I	5 Hrs	80 Hrs	Internal Assessment	External Exam*	Total	3 Hrs
			25	75	100	

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

Unit	Name of the Topics	Hrs
I	**SI UNITS AND STATICS** **1.1 UNITS AND MEASUREMENTS** Unit - Definition - Fundamental Quantities - Definition - Seven fundamental quantities - SI units and symbols for the seven fundamental quantities - Dimensional formula for length, mass and time - Supplementary quantities -	**6**

	Plane angle and Solid angle - SI units and symbols for the supplementary quantities - Derived quantities - Definition - SI units, symbols and derivation of dimensional formula for the derived quantities (area, volume, density, velocity, momentum, acceleration, force, impulse, work or energy and power) - Uses of Dimensional formula - Different types of measurement systems - Conventions to be followed while writing SI units - Multiples and sub-multiples of units and their prefixes - Unit conversions (Horse power to Watt and Calorie to Joule) - Applications of the method of dimensional analysis. **1.2 STATICS** Scalar and vector quantities - Definition and examples - Concurrent forces and coplanar forces - Definition - Resolution of a vector into two perpendicular components - Resultant and equilibrant - Definition - Parallelogram law of forces - Statement - Expressions for magnitude and direction of the resultant of two forces acting at a point with an acute angle between them - Lami's theorem - Statement and explanation - Experimental verification of parallelogram law of forces & Lami's theorem-Simple problems based on expressions for magnitude and direction of resultant - Moment of a force - Clockwise and anti-clockwise moments-Principle of moments-Couple-Torque acting due to a couple – Experimental determination of mass of the given body using principle of moments.	**9**
II	**DYNAMICS - I** **2.1 STRAIGHT LINE MOTION** Introduction - Distance - Displacement - Speed - Velocity - Acceleration - Acceleration due to gravity - Definitions - Difference between mass and weight - Newton's laws of motion - Fundamental Equations of motion for objects - in horizontal motion - Falling freely - Thrown vertically upwards.	**3**
	2.2 PROJECTILE MOTION Projectile motion - Angle of projection - Trajectory - Maximum height - Time of flight - Horizontal range - Definitions - Expressions for maximum height, time of flight and horizontal range - Condition for getting the maximum range of the projectile - Path of the projectile is a Parabola - Simple problems based on expressions for maximum height, time of flight and horizontal range - Examples of projectile motion.	**5**
	2.3 CIRCULAR MOTION Circular motion - Angular velocity - Period - Frequency - Definitions - Relation between linear velocity and angular velocity - Introduction to Degrees and radians - Relation between angular velocity, period and frequency - Normal acceleration - Centripetal force - Centrifugal force - Definitions - Expressions for normal acceleration and centripetal force - Banking of curved paths - Angle of banking - Definition - Expression for the angle of banking of a curved path - Simple harmonic motion - Amplitude, frequency and period - Definitions - Simple problems based on the expressions for centripetal force and angle of banking - Applications of centripetal force and centrifugal force.	**7**
III	**DYNAMICS - II** **3.1 ROTATIONAL MOTION OF RIGID BODIES** Rigid body - Definition - Moment of inertia of a particle about an axis - Moment of inertia of a rigid body about an axis - Radius of gyration - Definition - Expression for the kinetic energy of a rotating rigid body about an axis - Angular momentum - Definition - Expression for the angular momentum of a rotating rigid body about an axis - Law of conservation of angular momentum - Examples.	**5**
	3.2 GRAVITATION Newton's laws of gravitation - Acceleration due to gravity on the surface of earth - Expression for variation of acceleration due to gravity with altitude.	**4**
	3.3 SATELLITES Satellites - Natural and artificial - Escape velocity and orbital velocity - Definitions - Expression for escape velocity and orbital velocity - Polar and Geostationary satellites - Uses of artificial satellites - Simple problems based on escape velocity and orbital velocity.	**5**
IV	**PROPERTIES OF MATTER**	

	4.1 ELASTICITY Elastic & plastic bodies - Definition - Stress - Strain - Definitions - Hooke's law - Statement - Types of strain - Elastic and plastic limit - Young's modulus - Bulk modulus - Rigidity modulus - Definitions - Uniform and non-uniform bending of beams - Experimental determination of the Young's modulus of the material of a beam by uniform bending method - Poisson's ratio - Simple problems based on stress, strain and Young's modulus - Applications of elasticity.	**4**
	4.2 FLUID STATICS Introduction - Pressure - Definition - Pressure due to fluid column at rest - Pascal's law and its applications - Hydraulic lift and hydraulic brake - Buoyancy - Archimede's Principle - Law of floatation.	**3**
	4.3 VISCOSITY Viscous force-Viscosity-Coefficient of viscosity-Definitions-SI unit & dimensional formula for coefficient of viscosity - Streamline flow - Turbulent flow - Critical velocity - Reynolds number-Definition - Experimental comparison of coefficient of viscosity of two low viscous liquids-Terminal velocity - Definition - Experimental determination of coefficient of viscosity of a highly viscous liquid by Stoke's method - Practical applications of viscosity - Practical applications of Stoke's law.	**4**
	4.4 SURFACE TENSION Surface tension-Angle of contact-Definitions - Expression for surface tension of a liquid by capillary rise method-Experimental determination of surface tension of water by capillary rise method-Practical applications of capillarity - Problems based on expression for surface tension-Applications of surface tension.	**4**
V	**SOUND AND MAGNETISM** **5.1 SOUND** Wave motion - Introduction and definition - Audible range - Infrasonic - Ultrasonics - Progressive waves, longitudinal and transverse waves - Examples - Amplitude, Wave length, period and frequency of a wave - Definitions - Relation between wavelength, frequency and velocity of a wave - Stationary or standing waves - Vibrations - Free vibrations, forced vibrations and resonance - Definitions and examples - Laws of transverse vibration of a stretched string - Sonometer - Experimental determination of frequency of a tuning fork - Simple problems based on expression for frequency of vibration - Doppler effect - Definition and applications - Ultrasonic and its uses - SONAR.	**6**
	5.2 ACOUSTICS OF BUILDINGS Acoustics of buildings - Echo - Reverberation - Reverberation time - Sabine's formula for reverberation time - Coefficient of sound absorption - Noise pollution.	**3**
	5.3 MAGNETISM Pole strength - Definitions - Magnetic moment, intensity of magnetisation, magnetising field intensity, magnetic induction, Permeability, hysteresis, saturation, retentivity & coercivity-Definitions-Method of drawing hysteresis loop of a specimen using a solenoid-Uses of hysteresis loop-Simple problems based on intensity of magnetization-Types of magnetic materials and their applications.	**5**

Reference Books:

1. Fundamentals of Physics - Halliday & Resnick - Wiley India Pvt. Ltd. - Sixth Edition.
2. Physics for Higher Secondary - First & Second year - Volume I & II - Tamilnadu Textbook and Educational Services Corporation, 2018.
3. Engineering Physics - B.L.Theraja - S. Chand & Company Ltd. - Fourth Edition.
4. A text book of sound - R.L. Saighal - S. Chand Publishing - 2005.
5. A textbook of Applied Mechanics - R. S. Khurmi - S. Chand & Company Ltd. - Twelfth Edition.

QUESTION PAPER PATTERN: General Pattern

6014 ENGINEERING CHEMISTRY - I

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION	
6014	Hrs / Week	Hrs / Sem	Marks	Duration

ENGINEERING CHEMISTRY - I	5 Hrs	80 Hrs	Internal Assessment	External Exam*	Total	
			25	75	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

Unit	Name of the Topics	Hrs
I	**TECHNOLOGY OF WATER AND ACIDS AND BASES** **1.1 TECHNOLOGY OF WATER** Sources of water - Reasons for depletion of underground water - Rainwater harvesting (basic concepts) - Advantages - Hard water and soft water - Hardness of water - Carbonate and non-carbonate hardness - Disadvantages of hard water - Methods of expressing hardness - mg/lit and ppm - Simple problems - Softening of hard water - Ion-exchange method and Reverse osmosis method - Municipal water supply - Purification of drinking water (sedimentation, filtration and sterilization) - Disadvantages of using hard water in boilers - Scale formation - Corrosion of boiler metal - Caustic Embrittlement - Priming & foaming. **1.2 ACIDS AND BASES** Theories of acids and bases - Arrhenius theory - Lowry-Bronsted theory - Lewis theory - Advantages of Lewis theory - pH and pOH - Definition - Numerical problems - Indicator - Definition - Buffer solution - Definition - Types of buffer solution with examples - Application of pH in industries.	**9** **6**
II	**ATOMIC STRUCTURE & CHEMICAL BONDING, NUCLEAR CHEMISTRY** **2.1 ATOMIC STRUCTURE AND CHEMICAL BONDING** Fundamental particles - Proton - Electron - Neutron - Atomic number - Mass number - Extra nuclear part - Filling up of electrons - Aufbau principle - s-p-d-f orbital's - Electronic configuration - Definition of atomic mass, molecular mass, equivalent mass, valency (definitions only) - Octet rule - Electrovalent bond - Sodium chloride formation - Covalent bond - Formation of ammonia. **2.2 NUCLEAR CHEMISTRY** Natural radio activity - Definition - Alpha, beta, gamma rays - Comparison of alpha, beta, gamma particles - Atomic theory - Isotopes, Isobars and Isotones - Definition - Examples - Radioactive decay - Alpha and beta decay with example - Group displacement law - Half life period - Definition - Simple problems - Artificial radioactivity - Definition - Example - Nuclear fission and Nuclear fusion - Definition - Fission of U235 - Fusion reaction in the Sun - Nuclear reactor - Definition - Types of nuclear reactors - Components nuclear reactor - Reactor core, reflector, pressure vessel, shielding, heat exchanger and turbine - Application of radioactive isotopes.	**6** **8**
III	**SOLUTION, COLLOIDS AND CATALYSIS** **3.1 SOLUTION** Definition-Methods of expressing concentration of solutions- Percentage by mass, normality, molarity, & mole fraction-Simple problems. **3.2 COLLOIDS** True solution and colloidal solution - Definition - Differences - Types of Colloids - Lyophilic and lyophobic colloids - Differences - Properties - Tyndall effect, Brownian movement, Electrophoresis and Coagulation - Industrial applications of colloids - Smoke precipitation by Cottrell's method - Purification of water - Cleansing action of soap - Tanning of leather and sewage disposal. **3.3 CATALYSIS** Catalyst - Definition - Types of catalyst - Positive catalyst - Negative catalyst - Catalysis - Definition - Types of catalysis - Homogeneous and heterogeneous - Promoter - Catalyst poison - Definition - Characteristics of a catalyst - Industrial applications of catalysts.	**4** **6** **4**
IV	**ELECTROCHEMISTRY, ELECTROCHEMICAL CELL AND ENERGY SOURCES** **4.1 ELECTROCHEMISTRY** Electrolyte - Definition - Strong and weak electrolytes – non-electrolytes -	**5**

	Examples - Electrolysis - Definition - Mechanism - Industrial application of electrolysis - Electroplating - Chrome plating - Preparation of surface process - Factors affecting the stability of the coating - Electroless plating - Definition - Advantages of electroless plating over electroplating - Applications of electroless plating. **4.2 ELECTROCHEMICAL CELL** Electrochemical cell - Definition - Single electrode potential - Definition - Galvanic cell - Formation of Daniel cell - Electrochemical series - Definition and significance - Concentration cell - Definition - Types of concentration cell - Electrode concentration cell and Electrolyte concentration cell. **4.3 ENERGY SOURCES** Primary Battery - Definition and example - Construction, working and uses of dry cell - Secondary battery - Definition and example - Construction, working and uses of lead acid storage battery - Nickel Cadmium battery - Solar cell - Definition - Principle, construction, working and uses.	**5** **5**
V	**GLASS, CERAMICS, ABRASIVES AND LUBRICANTS** **5.1 GLASS** Composition of glass-Manufacture of glass Soda lime glass-Annealing of glass-Varieties of glass-Optical glass, wind shield glass & photo chromatic glass. **5.2 CERAMICS** Ceramics-White pottery-Definition-Manufacture of white pottery-Uses-Definition of glazing-Purpose-Methods of glazing- Salt glazing - liquid glazing. **5.3 ABRASIVES** Definition - Classification - Hardness in Moh's scale - Natural abrasives - Diamond, corundum, emery and garnet - Synthetic abrasives - Carborundum - Boron carbide - Manufacture - Properties and uses. **5.4 LUBRICANTS** Definition - Characteristics of lubricant - Types of lubricants - Solid, semi-solid and liquid lubricants.	**4** **4** **4** **3**

Reference Books:

1. Introduction to Engineering Chemistry, Shradha Sinha, S. S Dara & Sudha Jain, S. Chand Publishers, 2004.
2. Engineering Chemistry, S S Dara, Sudha Jain & Shradha Sinha, S. Chand Publishers 2005.
3. A Textbook of Engineering Chemistry, Dr. Uday Kumar, 2013.
4. Chemistry - Higher Secondary - 1st and 2nd year, Vol. I & II, Tamil Nadu Text Book Corporation, 2018.
5. Engineering Chemistry Fundamentals and Applications - Shikha Agarwal, Cambridge University Press, 2019.
6. Electrochemistry and Corrosion Science - Nestor Perez.

QUESTION PAPER PATTERN: General Pattern

6015 ENGINEERING GRAPHICS - I

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6015 ENGINEERING GRAPHICS - I	6 Hrs	96 Hrs	25	75	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

Note: While practicing, usage of drawing instruments like drawing board, mini drafter, compass, divider, drawing clips, H, 2H and HB grade drawing pencils, eraser etc., are mandatory for class work and examinations. Size of drawing sheet recommended: A2 size (420 x 594 mm).Use both sides of drawing sheets for practice.

Unit	Name of the Topics	Hrs

I	**DRAWING OFFICE PRACTICE AND DIMENSIONING** **1.1 DRAWING OFFICE PRACTICE** Importance of engineering drawing as a graphic communication - drawing practice as per BIS code - drawing instruments: drawing board, mini drafter, compass, divider, protractor, drawing sheets, drawing pencils, set squares etc., - title block - layout and folding of drawing sheets. Lettering and numbering as per BIS - importance of legible lettering and numbering - single stroke letters - upper case and lower case letters - slanting / inclind letters - general procedures for lettering and numbering - height of letters - guidelines - practices. Scales-full size scale, reducing scale and enlarging scales (Description only). **1.2 DIMENSIONING** Dimensioning - need for dimensioning - dimensioning terms and notations as per BIS - dimension line, extension line and leader line - dimensioning systems - methods of placement of dimensions - uni-directional and aligned systems - important dimensioning rules - dimensioning of common features - diameters, radii, holes, chamfers - addition of letters and symbols - parallel, chain and progressive dimensioning - practice of dimensioning the given drawing as per BIS code (one view of the object).	**6** **13**
II	**GEOMETRIC CONSTRUCTIONS & CONSTRUCTION OF CONICS** **2.1 GEOMETRIC CONSTRUCTIONS** Bisect a straight line - bisect an arc - bisect an angle - divide a straight line into any number of equal parts - divide the circle into number of equal divisions - construct an arc touching two lines at any angle - construct an arc touching two arcs. **2.2 CONSTRUCTION OF CONICS** Conic sections - definition of locus, focus, directrix, axis, vertex and eccentricity - practical applications of ellipse, parabola and hyperbola. Ellipse: Construction of ellipse by concentric circle method, rectangular method when major and minor axis are given and eccentricity method when focus and directrix are given - exercises in practical applications. Parabola: Construction of parabola by rectangular method, parallelogram method when major and minor axis are given and eccentricity method when focus and directrix are given - exercises in practical applications. Hyperbola: Construction of hyperbola by eccentricity method when focus and directrix are given - exercises in practical applications.	**6** **13**
III	**PROJECTION OF POINTS & STRAIGHT LINES AND CONSTRUCTION OF SPECIAL CURVES** **3.1 PROJECTION OF POINTS AND STRAIGHT LINES** Projection of points - position of a point on four quadrants and on the reference planes - system of notation - Place a point on four quadrants with different distances - exercises. Projection of straight lines - line in the first quadrant and on the reference planes - parallel to one plane and perpendicular to other plane - inclined to one plane and parallel to the other plane - inclind to both the planes - simple exercises. **3.2 CONSTRUCTION OF SPECIAL CURVES** Definition and construction of cycloid - epicycloid - hypocycloid - involute of a circle - Archimedean spiral for one revolution - helix - practical applications - exercises.	**11** **8**
IV	**ORTHOGRAPHIC PROJECTIONS** **4.1 FIRST ANGLE & THIRD ANGLE PROJECTION: SIMPLE COMPONENTS** Introduction - projection terms - orthographic projection - planes of projection - principal orthographic views - designation of views - four quadrants - first angle projection - third angle projection - symbols and arrangement of views for first angle and third angle projections - comparison - Simple exercises in first angle projection with minimum two views of simple components (Without curves and circles).	**11**

	4.2 FIRST ANGLE PROJECTIONS ONLY: **ENGINEERING COMPONENTS** Draw the projections of the simple engineering components using first angle projection - exercises in drawing orthographic views - three views - front view, top view and right / left side views. (For Exam any two views can be asked.)	**21**

Reference Books:

1. Bhatt N.D, "Engineering Drawing", Charotar Publishing House Pvt. Ltd.
2. Gill P.S, "Engineering drawing", S.K.Kataria & Sons.
3. Gopalakrishna.K.R., "Engineering Drawing", (Vol 1 & 2 combined), Subhas Publications.
4. Venugopal.K, Prabhu Raja V, "Engineering Graphics", New Age International Publishers.
5. Natarajan K V "A Text Book of Engineering Drawing and Graphics" Publisher: N Dhanalakshmi.
6. Shah M B, Rana B C, "Engineering Drawing", Pearson.
7. Basant Agrawal, Agrawal C M "Engineering Drawing", McGraw hill HED.
8. Parkinson A C, "First Year Engineering Drawing", Sir Isaac Pitman & Sons Ltd.
9.Thomas E. French, Charles J. Vierck, "The Fundamentals of Engineering Drawing", McGraw Hill.

QUESTION PAPER PATTERN

PART – A (4 x 5 = 20)

Note: Five questions will be asked (Sl. No: 1 to 5). Answer any four questions.
Each question carries five marks.
Minimum one question should be asked from each unit first chapter.
(Chapters: 1.1, 2.1, 3.1, 4.1)

PART – B (4 x 20 = 80)

Note: Six questions will be asked (Sl. No: 6 to11). Answer any four questions.
Each question carries twenty marks.
Minimum one question should be asked from each unit second chapter. (Chapters: 1.2, 2.2, 3.2, 4.2)

Internal Assessment Marks:

Class work assignment drawings	10
Average of two continuous assessment tests	05
Model examination	05
Attendance	05
Total	**25**

6016 ENGINEERING PHYSICS PRACTICAL - I

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6016 ENGINEERING PHYSICS PRACTICAL - I	2 Hrs	32 Hrs	25	75	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

LIST OF EXPERIMENTS WITH OBJECTIVES:

1. SCREW GAUGE - To measure the thickness of the given irregular glass plate using screw gauge and to determine the area of the glass plate using a graph sheet and to calculate the volume of the glass plate.
2. VERNIER CALIPER - To measure the length, inner and outer diameters of the given hollow cylinder using Vernier caliper and to calculate the volume of the hollow cylinder.
3. VERIFICATION OF PARALLELOGRAM LAW OF FORCES - To verify Parallelogram law of forces using Concurrent forces apparatus.
4. VERIFICATION OF LAMI'S THEOREM - To verify Lami's theorem using Concurrent forces apparatus.
5. SIMPLE PENDULUM - To determine the acceleration due to gravity using simple pendulum apparatus.
6. TORSION PENDULUM - To determine the moment of inertia of the disc and rigidity modulus of the given wire using torsion pendulum.
7. STOKE'S METHOD - To determine the coefficient of viscosity of high viscous liquid by Stokes

method.

8. SURFACE TENSION - To determine the surface tension of water by capillary rise method.
9. DEFLECTION MAGNETOMETER - To compare the magnetic moments of the given two bar magnets using deflection magnetometer in tan A position by equal distance method.
10. SONOMETER - To determine the frequency of given tuning fork using sonometer.

QUESTION PAPER PATTERN

Answer any one of the above experiment chosen by random method. The marks will be awarded as per the scheme of valuation given below.

SCHEME OF VALUATION

S. No	Category	Marks
1	Formula and diagram	20
2	Tabulation	10
3	Observation	40
4	Calculation	15
5	Result	10
6	Viva voce	05
	Total	**100**

6017 ENGINEERING CHEMISTRY PRACTICAL - I

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6017 ENGINEERING CHEMISTRY PRACTICAL - I	2 Hrs	32 Hrs	25	75	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

VOLUMETRIC ANALYSIS EXPERIMENTS:

Acidimetry and Alkalimetry:

1. Estimation of sulphuric acid using a standard solution of hydrochloric acid and sodium hydroxide as link solution - phenolphthalein indicator.
2. Estimation of sodium hydroxide using standard solution of sodium carbonate using sulphuric acid as a link solution - methyl orange indicator.
3. Comparison of strength of two hydrochloric acid solutions using a link solution of sodium hydroxide - phenolphthalein indicator.
4. Comparison of strength of two sodium hydroxide solutions using Oxalic acid link solution phenolphthalein indicator.

Permanganametry:

5. Estimation of Mohr's salt solution using standard solution of ferrous sulphate and link solution of potassium permanganate.
6. Estimation of ferrous sulphate using standard solution of Mohr's salt solution and link solution of potassium permanganate.
7. Comparison of two Mohr's salt solutions with a link solution of potassium permanganate.
8. Comparison of two potassium permanganate solutions with a link solution of ferrous sulphate.

6018 WORKSHOP PRACTICAL - I

No. of weeks per semester: 16

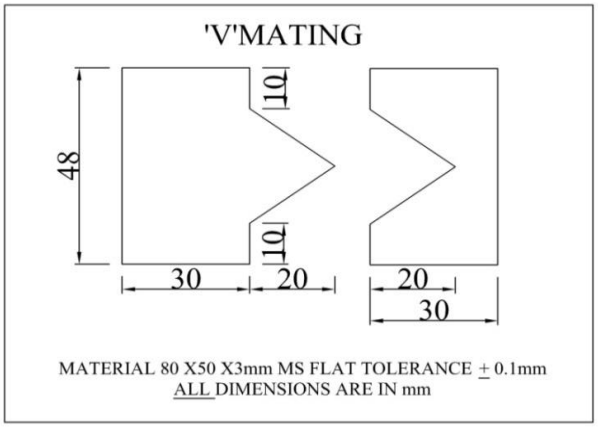
SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6018EI WORKSHOP PRACTICAL - I	3 Hrs	48 Hrs	25	75	100	3 Hrs

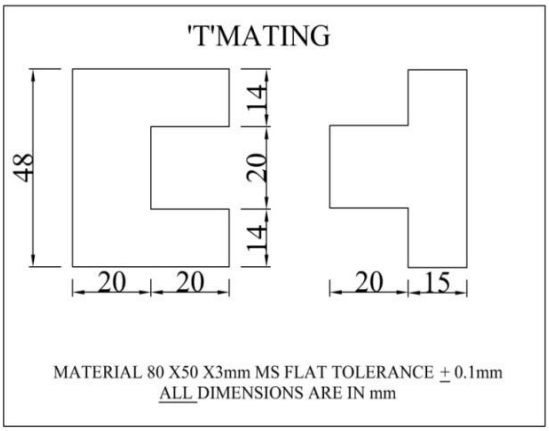
*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

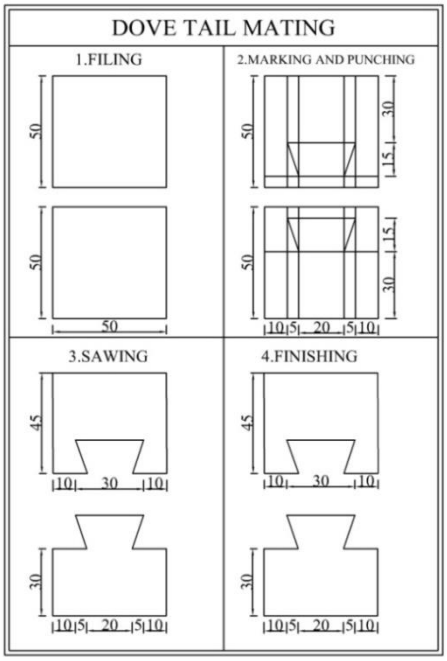
I. FITTING Introduction of fitting tools 04 Hrs

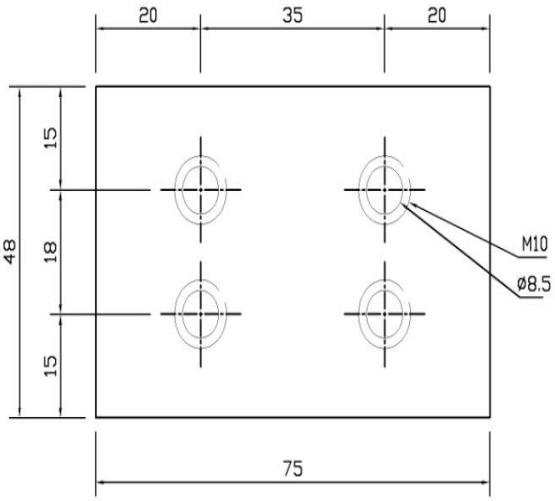
Exercises: **12 Hrs**

1. 'V' Mating 2. 'T' Mating 3. Dovetail Mating 4. Drilling & Tapping









DRILLING AND TAPPING

All dimensions are in 'mm'

Material: 80x50x10mm MS Flat, Tolerance: ±0.1 mm

Raw material: Use 3 mm thick MS flat for filing and 10 mm MS flat for drilling & tapping.

II. PLUMBING

Introduction of plumbing tools 04 Hrs

Exercises: **12 Hrs**

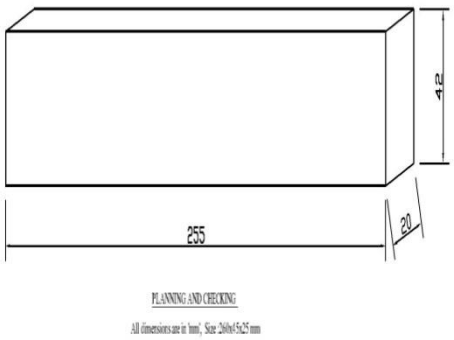
1. Cutting, bending and external threading of GI pipes using Die.
2. Install a sink and tap using different PVC pipe accessories such as bend, tee, socket and valve.
3. Install a washbasin and tap using different PVC pipe accessories such as bend, tee, socket and valve.
4. To Repair and replace all kinds of leaks.

III. CARPENTRY

Introduction of carpentry tools 04 Hrs

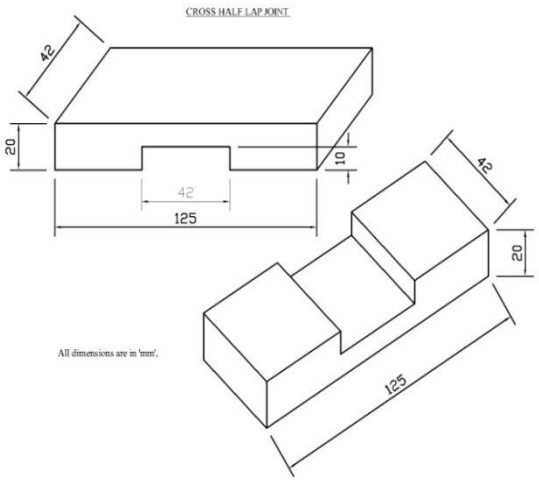
Exercises: **12 Hrs**

1. Planning & check up 2. Cross lap joint 3. Mortise and Tenon joint 4. Dovetail joint



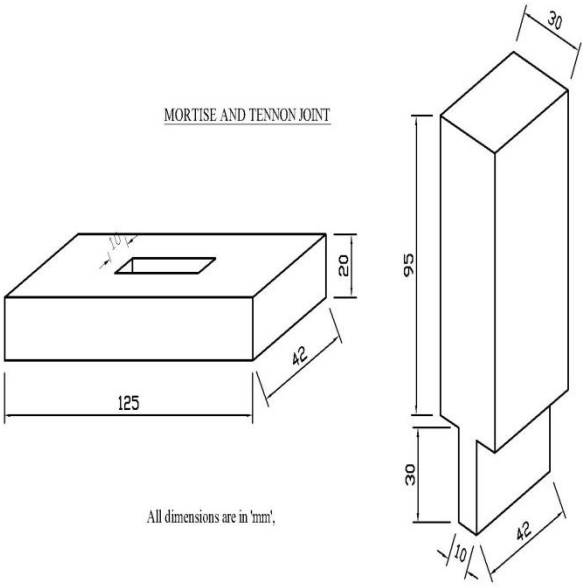
PLANNING AND CHECKING

All dimensions are in 'mm', Size 260x45x25 mm



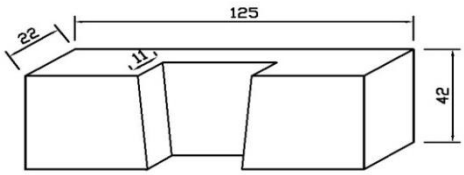
All dimensions are in 'mm',

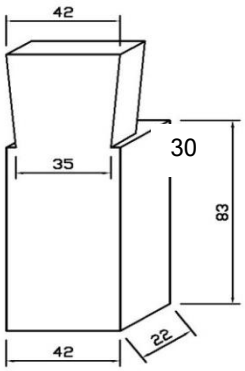
MORTISE AND TENNON JOINT



All dimensions are in 'mm',

LAP DOVE TAIL JOINT





QUESTION PAPER PATTERN

Fitting Exercise	50 marks
Plumbing or Carpentry (Any one) Exercise	45 marks
Viva voce	05 marks
Total	**100 marks**

6002 COMPUTER APPLICATIONS PRACTICAL

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
6002 COMPUTER APPLICATIONS PRACTICAL	2 Hrs	32 Hrs	Internal Assessment	External Exam*	Total	3 Hrs
			25	75	100	

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

Unit	Name of the Topics	Hrs
I	**Basics of Computer:** Computer basics - Hardware & software - General understanding of various computer hardware components - CPU - Memory - Display - Keyboard - Mouse - HDD & Other peripheral devices - Types of	5

	software - Application software & system software.	
II	**Word Processing:** Creating new document - Opening an existing document - Edit & save a document - Typing a text - Deleting a text - Inserting a text - Finding a text - Replacing a text - Copying & moving a text - Selecting font & font size - Justifying texts - Bold - Italic - Underline - Strike - Double strike - Coloring text - Spell check - Ruler - Formatting page - Line spacing - Margins - Page size - Page border - Page color - Page columns - Watermark - Page break - Section break - Portrait - Landscape - Inserting symbols, equations & shapes - Text Box - Word art - Hyperlink - Inserting pictures - Picture arrangement - Align objects - Bullets & numbering - Working with tables - Header & footer - Table of contents - Inserting page number - Changing character width & line spacing - Printing the document - Print preview - Shortcuts for various activities in word - Exercises.	**9**
III	**Spread sheet:** Creating a new worksheet - Opening an existing worksheet - Editing and saving a worksheet - Creating, renaming and deleting worksheets in a workbook - Types of data like numeric, text etc. - Entering in a cell - Manipulation of a cell, row and column (deleting, inserting, finding, replacing, copying and moving) - Justifying in a cell, Merging cells and columns - Addition, subtraction and using formula - Selecting font and font sizes - Using and manipulating tables, inserting / deleting of rows and columns – Sorting columns- Using header and footer, Inserting page number - Border and shading of cells, rows and columns - Formatting page, margins, page size, portrait and landscape - Selecting area for printing - Printing of a worksheet and workbooks - Using print preview - Copy / moving text between two different worksheets and workbooks - Using chart wizard - Creation of different types of charts - Protect sheet using password - Shortcuts for various activities in spreadsheet - Exercises.	**9**
IV	**Presentations:** Creating new presentations - Opening presentations - Saving presentation - Inserting new slides - Slide layout - Slide design - Presentation view - Adding text - Font formatting - Paragraph formatting - Inserting clipart & pictures - Inserting and manipulating smart art - Running a slide show - Insert slide number - Slide header & footer - Applying slide animation - Custom animation - Inserting shapes - Insert Video & sound - Insert action - Hyperlinks - Charts - Tables - Page setup - Print preview - Printing - Shortcuts of various activities in presentations - Exercises.	**9**

Theory & Instruction Classes	08 Hours
Practical Experiments	20 Hours
Revision / Repetition	04 Hours
Total	**32 Hours**

EXERCISES

EXERCISE 1 (WORD PROCESSING)

Prepare a report from the given printed document of minimum 250 words. (Use text formatting tools, header & footer, page number, line spacing, font & images)

- **Page Setup:** Set Margin: Left - 1.5, Right - 1.5, Top - 1.5 & Bottom - 1.5 / Orientation: Portrait / Paper Size: A4 / No. of Columns: 2.
- **Page Background Settings**: Watermark / Page Color / Page Borders
- **Text & Paragraph Settings:** Title: Font size: 16 - Centered - Bold - Suitable font - Heading: Font size: 14 - Left aligned - Underlined - Set the suitable font face - Body text: Font size: 12 - Justified - 1.5 Line spacing - Set the suitable font face.
- **Header & Footer:** Header - Seminar name, Name of the student, Reg. No. & Branch Footer - Page No., Date and Time
- **Insert:** Picture / Clipart / Shapes / Table.
- **Minimum No. of words:** 250 words

EXERCISE 2 (WORD PROCESSING)

Create a resume for placement from the given printed template with your personal details. Publish a copy of the resume as PDF.

- **Page Setup:** Margin: Left, Right, Top & Bottom - 0.5 / Orientation: Portrait / Paper size: A4 /

No. of columns: As per resume format.

- **Page Borders:** Insert page border if required.
- **Font & Paragraph:** Heading: Font size: 12 - Bold - Underlined - Set the suitable font - Face body text - Font size: 12 - Justified - 1 Line spacing - Set the suitable font - Insert bullets & numberings wherever required.

- **Insert:** Photo for your resume / tables.
- **Save as PDF:** Publish a copy of the resume as PDF using any PDF converting tools.

EXERCISE 3 (WORD PROCESSING)

Create a standard covering letter and use mail merge to generate the customized letters for applying to a job in various organizations. Also, create a database and generate labels for the applying organizations.

- **Page Setup:** Mar**gi**n: Left - 1.5, Right - 1.5, Top - 1.5 & Bottom - 1.5 / Orientation: Portrait / Paper Size: A4
- **Page Background:** Add page border for the letter.
- **Font & Paragraph:** Title: Font size: 16 - Centered - Bold - Suitable font - Heading: Font size: 14 - Left Aligned - Underlined - Set the suitable font face , Body text: Font size: 12 - Justified - 1.5 Line spacing - Set the suitable font face.
- **Mailings:** Select recipients and add a new List of HR database. Start mail merge through step by step mail merge wizard

EXERCISE 4 (SPREAD SHEET)

Create a worksheet for the given relational data (minimum ten records) and show the data in the Line chart, Bar chart and Pie chart.

- **10 Records:** Add data to spreadsheet to the various fields require to analyze the data in chart.
- **Font & Alignment:** Font face - Font size - Font color.
- **Formulae:** Use formulae for the selected data for calculation.
- **Insert:** Charts - Line chart, Bar chart & Pie chart.

EXERCISE 5 (SPREAD SHEET)

Create a worksheet for the given data with various functions like sum, average, count, min, max & logical functions [IF, AND].

- **Data:** Create a worksheet and insert the various records to the cells.
- **Formatting:** Set the font using font name, font size and with various alignment tools.
- **Formulas and Functions:** Use some functions like sum, average, count, min, max and logical functions. [IF, AND]

EXERCISE 6 (SPREAD SHEET)

Create a worksheet for the given data and analysis the data with various filters and conditional formatting.

- **Data**
- **Formatting** Text: Font Face - Font Size - Font Color - Alignment
- **Functions**
- **Conditional Formatting**
- **Filters**

EXERCISE 7 (PRESENTATION)

Create a presentation of minimum 10 slides from engineering related topic.

- **Design & Layout:** Add a suitable theme & layout according to the content of all 10 slides.
- **Header & Footer: H:** Insert the title & author; **F**: Insert the date & slide number
- **Font & Paragraph:** Font Face, Size & Color - Alignment - Bullets & Numberings
- **Insert:** Images & Tables

EXERCISE 8 (PRESENTATION)

Create a presentation of 10 slides about your college with Slide & Custom Animation, Shapes, Header & Footer, Slide number, Video, Audio, Picture, Tables and Hyperlink between slides.

- **Design & Layout:** Add a suitable theme & layout according to the content of all 10 slides.
- **Header & Footer:** Header: Insert the Title & Author; Footer : Insert the Date & Slide Number
- **Font & Paragraph:** Font Face - Font Size - Font Color - Alignment - Bullets & Numberings
- **Insert:** Video / Audio / Tables / Shapes

- **Hyperlink:** Use hyperlink to link between slides.
- **Animation:** Custom Animation for individual Objects / Slide Transition to all slides.

Note:

1. The student should be given proper training in all the exercises. All the exercises should be completed before examination.
2. The student should maintain observation note book / manual and record notebook. The record note book should be submitted during the Practical Examinations. Individual output for every exercise should be kept in the record note book.
3. During examination, the students are allowed to select any one exercise by lot. All exercises should be given for examination.

ALLOCATION OF MARKS

Description		Marks
1	Aim & Procedure	20
2	Execution	50
3	Output printout / Handout	20
4	Viva voce	10
Total		**100**

SECOND SEMESTER

6021 COMMUNICATIVE ENGLISH - II

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6021 COMMUNICATIVE ENGLISH - II	4 Hrs	64 Hrs	25	75	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

Unit	Name of the Topics	Hrs
I	**Functional Grammar and Usage** Application of Modal Verbs Negative Formation (No, Never, Nothing, Hardly, Seldom, No longer,None, Nowhere, Neither … nor) Use of Subordinating ConjunctionsUse of Conditionals Reported Speech (Dialogue to Indirect Speech)Punctuation Synthesis of three or more sentences	13
II	**English for Enrichment** The Language Game: Unscramble Phrases (Noun, Verb, Prepositional Phrases etc.)Cause and Effect Writing Suitable Responses to the Given Questions Giving Instructions Character sketch	11
III	**Situational English** Email for Official CommunicationSocial Media Language Reacting to Situations Correction of Sentences Proverbs for Everyday Situations	11
IV	**Creative English** The Language Game: Word Puzzle GridNotice Writing for the Given Situations Slogan Writing Technical Words Info graphics Comprehension Story completion	11

V	**English for Scholarly Presentation / Fluency** "The Lost Child" by Mulk Raj Anand "My Vision for India" by Abdul Kalam "From Lover's Gift" by Rabindranath Tagore"The Flower" by Tennyson	**11**

Reference Books:

Glossaries

https://www.engineering-dictionary.com/ https://techterms.com/definition/ http://dictionary.tamilcube.com/ https://www.lexilogos.com/english/tamil_dictionary.htm

Grammar

1. Just Enough English Grammar Illustrated, Gabriele Stobbe, McGraw-HillOsborne Media, 2008
2. Visual Guide to Grammar and Punctuation, DK Publishing, 2017
3. English Grammar in Use, Raymond Murphy, Cambridge University Press, 2019
4. Intermediate English Grammar, Raymond Murphy, Cambridge University Press,Second Edition.
5. Essential English Grammar, Raymond Murphy, Cambridge University Press,New edition.

Enrichment of Study

1. Enrich Your Vocabulary: Vocabulary for General, Placement & Competitive Exams by Edin Brow

Motivation

1. An Autobiography; Or, The Story of My Experiments with Truth, Mahatma Gandhi, Penguin Books, 2001
2. You Can Win, Shiv Khera, New Dawn Press, 2004
3. Chicken Soup for the Soul, Jack Canfield, Mark Victor Hansen, 2001
4. How to Win Friends and Influence People by Dale Carnegie

QUESTION PAPER PATTERN

Autonomous Examination

Time: 3 Hrs. Max. Marks: 100

Sl. No	Questions	Portions	Marks
1	Answer any TEN out of 12 questions	Unit I & II - Grammar items	10 x 4 = 40
2	Answer any FOUR out of 6 questions	Unit III - Composition items	4 x 5 = 20
3	Answer any FOUR out of 6 questions	Unit IV - Composition items	4 x 5 = 20
4	Answer any FOUR out of 6 questions	Unit V - Prose & Poetry	4 x 5 = 20
		TOTAL	**100**

6022 ENGINEERING MATHEMATICS - II

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6022 ENGINEERING MATHEMATICS - II	5 Hrs	80 Hrs	25	75	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

Unit	Name of the Topics	Hrs
I	**ANALYTICAL GEOMETRY** **1.1 ANALYTICAL GEOMETRY** Circles - General equation of a circle - Family of circles - Concentric circles - Orthogonal circles (condition only) - contact of circles - simple problems. **1.2 CONICS** Definition of a conic, Focus, Directrix and Eccentricity - General equation of a conic $ax^2+2hxy+by^2+2gx+2fy+c=0$.(Statement only) - Condition for conic (i) For circle $a=b$ and $h=0$ (ii) For pair of straight line : $\begin{vmatrix} a & h & g \\ h & b & f \\ g & f & c \end{vmatrix}=0$ (iii) For parabola : $h^2-ab=0$ (iv) For ellipse : $h^2-ab<0$ and (v) For hyperbola : $h^2-ab>0$ - simple problems.	6 8

II	**VECTOR ALGEBRA - I** **2.1 VECTOR – INTRODUCTION** Definition of vector - types, addition, subtraction and scalar multiplication of vector, properties of addition and subtraction - Position vector - Resolution of vector in three dimensions - Distance between two points - Direction cosines and direction ratios - simple problems. **2.2 PRODUCT OF TWO VECTORS** Scalar product - Vector product - condition for parallel and perpendicular vectors - properties - angle between two vectors - Unit vector perpendicular to two vectors - Application of Scalar and Vector product - simple problems.	**7** **7**
III	**INTEGRAL CALCULUS - I** **3.1 INTEGRATION - DECOMPOSITON METHOD** Historical approach for integration - Anti derivative - Definition of the integral as an anti-derivative - Fundamental rules for integration - Integration using decomposition method - simple problems based on Engineering applications. **3.2 METHODS OF INTEGRATION - INTEGRATION BY SUBSTITUION** Integrals of the form $\int [f(x)]^n f'(x)dx$, Where $n \neq -1 \int \frac{f'(x)}{f(x)}dx$ and $\int F[f(x)]f'(x)dx$ - simple problems. **3.3 STANDARD INTEGRALS** Integrals of the form, $\int \frac{dx}{a^2 \pm x^2}$, $\int \frac{dx}{x^2 - a^2}$, $\int \frac{dx}{\sqrt{a^2 - x^2}}$, $\int \sqrt{a^2 - x^2}dx$, $\int \sqrt{x^2 \pm a^2}dx$ - simple problems.	**5** **5** **5**
IV	**INTEGRAL CALCULUS - II** **4.1 METHODS OF INTEGRATION - INTEGRATION BY PARTS** Integrals of the form $\int x \sin nxdx, \int x \cos nxdx, \int xe^{nx}dx, \int x^n \log xdx,$ and $\int \log xdx$ - simple problems. **4.2 BERNOULLI'S FORMULA** Evaluation for the integrals $\int x^m \sin nxdx, \int x^m \cos nxdx, \int x^m e^{nx}dx,$ where $m \leq 3$ using Bernoulli's formula - simple problems. **4.3 DEFINITE INTEGRALS** Definition of definite integral - Properties of definite integrals - simple problems.	**4** **5** **6**
V	**APPLICATIONS OF INTEGRATION** **5.1 AREA AND VOLUME** Area & volume :Area of circle-Volume of sphere & cone-simple problems **5.2 FIRST ORDER DIFFERENTIAL EQUATIONS** Solution of first order variable separable type differential equations - Solution of linear type differential equations - simple problems. **5.3 SECOND ORDER DIFFERENTIAL EQUATIONS** Solution of second order differential equations with constant co- efficients $(i)\ a\frac{d^2y}{dx^2} + b\frac{dy}{dx} + cy = 0$ $(ii)\ a\frac{d^2y}{dx^2} + b\frac{dy}{dx} + cy = f(x)$, *where* $f(x) = e^{ax}$ - simple problems.	**5** **5** **5**

Reference Books:

1. Higher Secondary +1 Mathematics volume I & II. Tamil Nadu Text Book Corporation.
2. Higher Secondary +2 Mathematics Volume I & II. Tamil Nadu Text Book Corporation.
3. Engineering Mathematics V. Sundaram, R. Balasubramanian.
4. Engineering Mathematics - I C.B.Gupta ,A.K.Malik, New age international Pub., 1st ed, - 2008.
5. Differential Calculus S. Balachandra Rao, CK Shantha New age Publishers
6. Probability Theory and Stochastic Process B.Prabhakara Rao, TSR Murthy, BS Publishers.
7. Vectors and Geometry GS. Pandey, RR Sharma, New age international publishers.

QUESTION PAPER PATTERN: General Pattern

6023 ENGINEERING PHYSICS - II

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
6023 ENGINEERING PHYSICS - II	5 Hrs	80 Hrs	Internal Assessment	External Exam*	Total	3 Hrs
			25	75	100	

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

Unit	Name of the Topics	Hrs
I	**HEAT** **1.1 TRANSFER OF HEAT** Concept of Heat and temperature - Celsius, Fahrenheit and Kelvin scales of temperature - Conduction, convection and radiation - Definitions and explanations - Good and poor thermal conductors - Examples - Coefficient of thermal conductivity - Definition and its SI unit - Properties of thermal radiation - Heat conversions.	**5**
	1.2 KINETIC THEORY OF GASES Postulates of kinetic theory of gases - Mean square velocity and Root Mean Square (RMS) velocity of molecules - Definitions and expressions - Expression for the pressure of a gas on the basis of postulates of kinetic theory of gases - Relation between pressure and kinetic energy of the gas - Relation between kinetic energy and absolute temperature of the gas - Simple problems based on the expression for the pressure of a gas.	**5**
	1.3 SPECIFIC HEAT CAPACITY Specific heat capacity of a substance (solids and liquids) - Definition - Specific heat capacity of a gas at constant pressure - Specific heat capacity of a gas at constant volume - Ratio of specific heat capacities - Explanation for C_p is greater than C_v - Derivation of Mayer's relation - Calculation of Universal gas constant R from the gas equation (PV = RT) - Simple problems based on Mayer's relation.	**5**
II	**THERMODYNAMICS, LIQUEFACTION OF GASES AND NON-CONVENTIONAL ENERGY** **2.1 THERMODYNAMICS** Concept of internal energy - First law of thermodynamics - Statement - Concept of indicator diagram (PV Diagram) - Isothermal and adiabatic change - Explanation - Equation for isothermal and adiabatic change (No derivation) - Simple problems based on equations $P_1V_1 = P_2V_2$ and $P_1V_1^{\gamma} = P_2V_2^{\gamma}$ - Second law of thermodynamics - Clausius statement and Kelvin's statement - Working of Carnot engine with PV diagram - Efficiency of Carnot engine - Applications of heat and thermodynamics.	**6**
	2.2 LIQUEFACTION OF GASES Difference between gas and vapour - Critical temperature, critical pressure and critical volume - Definitions - Principle used in Cascade process - Cascade process of liquefaction of oxygen - Disadvantages of Cascade process - Joule Thomson effect - Temperature of inversion - Liquefaction of air by Linde's process.	**4**
	2.3 NON-CONVENTIONAL ENERGY Introduction - Non-renewable and Renewable (Alternate) energy sources - Examples - Solar energy - Wind energy - Tidal energy – Advantages and disadvantages of renewable energy.	**4**
III	**LIGHT** **3.1 OPTICS** Reflection - Laws of reflection - Refraction - Laws of refraction - Refractive index of a medium - Definitions - Derivation of refractive index of glass prism using minimum deviation - Spectrometer - Experimental determination of refractive index using spectrometer - Phenomenon of total internal reflection - Applications of total internal reflection - Fiber optics - Introduction - Optical Fiber Cable as a	**6**

	wave guide - Advantages of OFC - Problems based on refractive index. **3.2 LASER** LASER - Characteristics of LASER - Principle of LASER - Spontaneous emission - Stimulated emission - Population inversion - Ruby Laser - Construction and working - Uses of LASER. **3.3 REMOTE SENSING** Introduction - Active & passive remote sensing - Explanation & examples - Components of remote sensing - Data acquisition and data analysis - Reference data - RADAR - Principle and working with block diagram.	**4** **4**
IV	**ELECTRICITY** **4.1 ELECTRICAL CIRCUITS** Ohm's law - Laws of resistances - Resistivity, conductivity, super conductivity and Meissner effect - Definitions - Kirchhoff's current and voltage laws - Condition for balancing the Wheatstone's bridge - Simple problems based on expression for resistivity - Capacitance of a capacitor - Definition - 'farad' - Definition - Expressions for effective capacitance when capacitors are connected in series and in parallel - Simple problems based on effective capacitance of capacitors connected in series and in parallel - Applications of capacitors. **4.2 EFFECTS OF CURRENT** Joule's law of heating - Experimental determination of specific heat capacity of a liquid using Joule's calorimeter - Faraday's laws on electrolysis - Electro chemical equivalent (e.c.e) of an element - Definition - Experimental determination of e.c.e. of copper - Simple problems based on expressions for e.c.e - Applications of heating effect of electric current. **4.3 ELECTROMAGNETIC INDUCTION** Introduction - Magnetic flux - Faraday's experiments on electromagnetic induction - Lenz's law - Fleming's right hand rule - Self induction and mutual induction (definitions) - Applications of electromagnetic induction. **4.4 MEASURING INSTRUMENTS** Expression for the force acting on a current carrying straight conductor placed in a uniform magnetic field - Fleming's Left Hand rule - Expression for the torque experienced by a rectangular current carrying coil placed inside a uniform magnetic field - Working of a moving coil galvanometer and its merits - Conversion of galvanometer into an ammeter and voltmeter - Simple problems based on conversion of galvanometer into ammeter and voltmeter.	**5** **4** **2** **4**
V	**ELECTRONICS** **5.1 SEMICONDUCTORS** Introduction - Energy bands in solids - Energy band diagram of good conductors, insulators and semiconductors - Concept of Fermi level - Types of semiconductors - Intrinsic semiconductors - Concept of holes - Doping - Extrinsic semiconductors - P type and N type semiconductors. **5.2 DIODES AND TRANSISTORS** PN junction diode - Forward bias and reverse bias - Rectification action of diode - Working of full wave bridge rectifier using PN junction diodes - PNP and NPN transistors - Three different configurations - Working of NPN and PNP transistor in common base configuration. **5.3 DIGITAL ELECTRONICS** Digital electronics - Introduction - Logic levels - Basic logic gates - OR, AND, NOT gates - Universal logic gates - NAND and NOR gates - Symbolic representation, Boolean expression and truth table for all the above logic gates - Integrated circuits - Levels of integration - SSI, MSI, LSI and VLSI – Adv. of ICs - Applications of transistors, gates and ICs.	**5** **5** **5**

Reference Books:

1. Fundamentals of Physics - Halliday & Resnick - Wiley India Pvt. Ltd. - Sixth Edition
2. Fundamentals of Magnetism and Electricity - D.N. Vasudeva - S. Chand Publishing - 5th Ed.
3. Physics for Higher Secondary - First & Second year - Volume I & II - Tamilnadu Textbook and

Educational Services Corporation 2018
4. Non-conventional energy sources - G.D. Rai - Khanna Publishers - Sixth Edition
5. Textbook of Remote Sensing and Geographical Information Systems - M. Anji Reddy - BS Publications - Fourth Edition.

QUESTION PAPER PATTERN: General Pattern

6024 ENGINEERING CHEMISTRY - II

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
6024 ENGINEERING CHEMISTRY - II	Hrs / Week	Hrs / Sem	Marks			Duration
	5 Hrs	80 Hrs	Internal Assessment	External Exam*	Total	
			25	75	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

Unit	Name of the Topics	Hrs
I	**ENVIRONMENTAL CHEMISTRY** **1.1 AIR POLLUTION** Pollution and air pollution – Definition - Air pollutants (SO_2, H_2S, HF, CO and dust) - Harmful effects - Formation of acid rain - Harmful effects - Green house effect - Causes - Global warming - Harmful effects - Ozone layer - Importance - Causes for depletion of ozone layer (No equations) - Harmful effects of Ozone layer depletion - Control of air pollution. **1.2 WATER POLLUTION** Causes of water pollution - (Sewage, Effluents, Algae and Micro-organisms) - Sewage - Definition - Problems and disposal of sewage - Industrial effluents - Harmful effects of heavy metal ions (Lead, Cadmium, Zinc and Copper) - Treatment of effluents - Eutrophication - Definition and harmful effects. **1.3 SOLID WASTE MANAGEMENT** Solid waste - Definition - Problems - Types of solid waste - Methods of disposal - Land fill and incineration. Recycling - Definition - Examples - Advantages of recycling (Basic concepts). **1.4 GREEN CHEMISTRY** Definition - Goals of Green Chemistry (Basic concepts)	**6** **5** **3** **1**
II	**POLYMER CHEMISTRY** **2.1 PLASTICS** Plastics - Definition - Types of polymerization - Addition polymerization - Formation of polythene - Condensation polymerization - Formation of Bakelite - Types of plastics - Thermoplastics and thermosetting plastics – Differences - Mechanical properties of plastics - Advantages of plastics over traditional materials (wood and metal) - Specific uses of some plastics (Bakelite, PVC, Nylon & Urea-formaldehyde) - Polymers in surgery - Biomaterials - Definition - Biomedical uses of polyurethane, PVC, Polypropylene and Polyethylene. **2.2 RUBBER** Rubber - Definition - Preparation of natural rubber from latex - Defects of natural rubber - Compounding of rubber - Ingredients and their functions - Vulcanization of rubber - Definition and purpose - Synthetic rubber - Buna-S, Thiokal, Neoprene - Reclaimed rubber - Definition - Process - Properties and uses.	**8** **6**
III	**FUELS, ROCKET PROPELLANTS AND REFRACTORY** **3.1 FUELS** Fuel - Definition - Calorific value of fuels - Classification - Solid fuels - Wood - Coal - Varieties of coal - Composition - Specific uses - Liquid fuels - Refining of petroleum - Fractional distillation - Cracking (concept only) - Liquid hydrogen - Gaseous fuels - Preparation, composition and specific uses of producer gas and water gas - Composition and uses of LPG -	**6**

	Advantages of gaseous fuels - comparison of solid, liquid and gaseous fuels. **3.2 ROCKET PROPELLANTS** Definition - Characteristics - Classification of propellants - brief account of solid and liquid propellants with example**.** **3.3 REFRACTORY** Definition - Requirements of a good refractory - Classification - Acidic, basic and neutral refractory - Examples and uses - Uses of fire clay bricks, Alumina bricks and Silica bricks.	**4** **4**
IV	**METALLURGY, EXTRACTION OF METALS, ALLOYS,LIME & CEMENT** **4.1 METALLURGY** General principles of metallurgy - Minerals, ores, gangue, flux, slag - Metallurgical processes - Concentration of the ore (gravity separation, froth floatation process and magnetic separation) - Chemical methods of purifying ore (roasting, calcination, smelting) - Refining - Electrolytic refining, Van Arkel method, Distillation method. **4.2 EXTRACTION OF METALS** Extraction and uses of tungsten and titanium. **4.3 ALLOYS** Definition - Purpose of alloying - Types - Ferrous alloys - Composition & uses of Stainless steel, Chromium steel & Vanadium steel - Non-ferrous alloys - Composition and uses of Brass, Dutch metal (German silver), Bronze (Gunmetal), Nickel alloys (Nichrome), Aluminium alloys (Duralumin). **4.4 LIME AND CEMENT** Lime - raw materials used for lime - Manufacture of hydraulic lime by continuous vertical kiln process - properties - slaking, plasticity and setting. Cement - Definition - Manufacture of portland cement - Wet process - Setting of cement	**5** **2** **4** **4**
V	**CORROSION AND PREVENTION OF CORROSION** **5.1 CORROSION** Definition - Types of corrosion - Theories of corrosion - Galvanic cell formation theory - Differential aeration theory - Factors influencing the rate of corrosion. **5.2 METHODS OF PREVENTION OF CORROSION** Control of environment - Alloying - Surface coatings - Metal coatings - Electroplating, galvanization and tinning - Inorganic coating - Anodisation and phosphate coating - Cathodic protection - Sacrificial anode method and impressed voltage method. **5.3 ORGANIC COATINGS** Paint - Definition - Components of paints - Varnish - Definition - Types - Preparation of oil varnish - Differences between paint and varnish - Special paints - Luminescent paint, fire retardant paint, aluminium paint and distemper.	**5** **5** **5**

Reference Books:

1. Introduction to Engineering Chemistry, Shradha Sinha , S S Dara & SudhaJain, S.Chand Publishers, 2004.
2. Engineering Chemistry, S S Dara, Sudha Jain & Shradha Sinha, S.Chand Publishers,2005.
3. A Textbook of Engineering Chemistry, Dr. Uday Kumar, 2013.
4. Chemistry - Higher Secondary - I & II year, Vol. I & II, Tamil Nadu Text Book Corporation 2018.
5. Engineering Chemistry Fundamentals and Applications, Shikha Agarwal, Cambridge University Press, 2019.
6. Electrochemistry and Corrosion Science, Nestor Perez.
7. Indian Minerals Year book 2011.

QUESTION PAPER PATTERN: General Pattern

6025 ENGINEERING GRAPHICS - II

COMPUTER AIDED DRAWING PRACTICAL

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
6025 ENGINEERING GRAPHICS - II (PRACTICAL)	5 Hrs	80 Hrs	Internal Assessment	External Exam*	Total	3 Hrs
			25	75	100	

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

INTRODUCTION TO AUTOCAD **10 Hrs**

History of AutoCAD - Applications - Advantages over manual drafting - Hardware requirements - Software requirements - Window desktop - AutoCAD screen interface - Menus - Toolbars - How to start AutoCAD - Command groups - How to execute command - Types of coordinate systems - Absolute - Relative - Polar.

EXERCISE:

I. ELECTRICAL SYMBOLS **15 Hrs**

Incandescent lamp - Fluorescent Lamp - Signal lamp - Push button - Fire alarm - Siren - Water heater - Ceiling fan - Exhaust fan.

Relays - Contactors - Fuses - Main switch - Electric bell - Earth - Aerial - DPST - DPDT - TPST - Network link - Ammeters - Voltmeters - Wattmeter - Energy meters - Frequency meters - Power factor meters - Timers - Buzzers - Transformers - Auto transformers - IGBT.

Draw symbols of DC armatures - Alternators - Squirrel and slip ring induction motors - Field winding - Shunt, series and compound DC motors.

II. ELECTRONICS SYMBOLS: **15 Hrs**

Draw symbols of resistors - Inductors - Capacitors - Diodes - Transistors - FET - SCR - UJT-DIAC-TRIAC-MOSFET'S-LOGIC GATES- AND - OR - NOT - NAND - NOR - EXOR.

III. ELECTRICAL CONNECTION DIAGRAMS: **40 Hrs**

1. Draw the panel wiring diagram of two shunt generators in parallel.
2. Draw the mush winding diagram of a three phase induction motor.
3. Draw the control circuit of automatic rotor starters.
4. Draw the connection diagram of on load tap changer.
5. Draw the circuit of three phase transformers in parallel.
6. Draw the connections of three point starter.
7. Draw the connections of direct on line starter.
8. Draw the line diagram of wiring of a drawing hall.
9. Draw the single line diagram of residential wiring.
10. Draw the single line diagram of substation.

QUESTION PAPER PATTERN

The marks will be awarded as per the scheme of valuation given below.

SCHEME OF VALUATION

Sl. No	Category	Marks
1	Drawing the symbols in Electrical and Electronics. Any 10 Symbols (10 questions x 3 marks)	30 marks
2	Electrical Connection Diagram (Any one)	60 marks
3	Viva-voce	10 marks
	TOTAL	**100 marks**

Reference Books:

1. Machine drawing with AutoCAD - Goutam Pohil
2. AutoCAD 2017 - Goutam Ghosh
3. AutoCAD 2008 for Engineers & Designers by Prof. Sham Tickoo published by dream Tech Press.
4. AutoCAD 2010 & AutoCAD LT 2010 by Ellen Finkelstein published by Wiley-India.
5. A Textbook for Electrical Estimating and Costing by Garg and Gupta – Tech India Publications.
6. Engineering Drawing (NCVT Group B) - Electrical Trade by A K Xavier and S Radhakrishnan

6026 ENGINEERING PHYSICS PRACTICAL - II

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6026 ENGINEERING PHYSICS PRACTICAL - II	2 Hrs	32 Hrs	25	75	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

LIST OF EXPERIMENTS WITH OBJECTIVES:

1. SOLAR CELL - To study the VI characteristics of the given solar cell.
2. REFRACTIVE INDEX - To determine the refractive index of water using travelling microscope.
3. LAWS OF RESISTANCES - To verify the laws of resistances using Ohm's law.
4. METRE BRIDGE - To determine the unknown resistance of the given wire
5. POTENTIOMETER - To compare the emfs of the given two cells.
6. JOULE'S CALORIMETER - To determine the specific heat capacity of water using Joule's calorimeter.
7. TANGENT GALVANOMETER -To determine the value of the horizontal component of the earth's magnetic field using tangent galvanometer.
8. PN JUNCTION DIODE - To study the voltage-current characteristics of the given PN junction diode in forward bias and to find its dynamic forward resistance.
9. TRANSISTOR CHARACTERISTICS -To study the transfer characteristics of the given NPN transistor in common emitter configuration and to find its current gain.
10. LOGIC GATES - To find the output conditions for different combinations of the input for NOT gate and 2 inputs AND, OR, NAND & NOR logic gates using IC chips.

QUESTION PAPER PATTERN

Answer any one of the above experiment chosen by random method. The marks will be awarded as per the scheme of valuation given below.

SCHEME OF VALUATION

S. No	Category	Marks
1	Formula and diagram	20
2	Tabulation	10
3	Observation	40
4	Calculation	15
5	Result	10
6	Viva voce	05
Total		**100**

6027 ENGINEERING CHEMISTRY PRACTICAL - II

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6027 ENGINEERING CHEMISTRY PRACTICAL - II	2 Hrs	32 Hrs	25	75	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

INTELLECTUAL SKILLS

1. Studying the effect of heating on substances and reagents.
2. Study of the reactions of the following radicals leading to qualitative analysis of the given Inorganic simple salt soluble in water or dilute acids.

MOTOR SKILLS

1. Handle the apparatus carefully
2. Awareness on Industrial safety.

QUALITATIVE ANALYSIS;

ACID RADICALS:

1. Carbonate 2. Chloride 3. Nitrate 4. Sulphate

BASIC RADICALS: 1. Lead 2. Copper 3. Aluminium 4. Zinc 5. Barium 6. Calcium 7. Magnesium 8. Ammonium

ANALYSIS OF INORGANIC SIMPLE SALT:

Analysis of eight inorganic simple salts containing any one acid radical and basic radical without omitting any of the above mentioned radicals

QUESTION PAPER PATTERN

Answer any one of the above Inorganic simple salt chosen by random method. The marks will be awarded as per the scheme of evaluation.

SCHEME OF VALUATION

Description	Marks
Identification procedure of acid radical with systematic procedure	**45**
Identification procedure of basic radical with systematic procedure	**45**
Viva voce	**10**
Total	**100**
Without systematic procedure	
Identification of acid radical with confirmatory test only	**45**
Identification of basic radical with confirmatory test only	**45**
Mere spotting of acid radical and basic radical (5+5)	**10**
Writing systematic procedure without correct radicals	**20**

6028 BASICS OF INDUSTRIES AND WORKSHOP PRACTICAL - II

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam**	Total	
6028 BASICS OF INDUSTRIES AND WORKSHOP PRACTICAL - II	Theory *: 2 Practical: 3	80 Hrs	25	75	100	3 Hrs

*** Theory Portion common for all branches.**

**** Examination will be conducted for 100 marks (45 Marks Theory and 55 Marks Practical) and the marks obtained will be converted into 75 marks.**

BASICS OF INDUSTRIES: (Common for All Branches)

Unit	Name of the Topics	Hrs
I	**BASICS OF INDUSTRIES** Industry - Need of Industrialization - Classification - Factors influences the location of the Industries - Types of Industries: Small scale, Medium scale and Large scale industries - Procedure to start up an Industry. Manufacturing Industry - Overviews - Global manufacture. Engineering Industry: Introduction - Engineering materials – Products of various engineering sectors.	**6**

II	**INDUSTRIAL SAFETY MEASURES AND MAINTENANCE** Industrial safety - Importance - Safety activities - Safety equipment - Health and safety procedure - Personnel protective devices - Safe working practices - Structural collapse - Safety signs. Accident - Causes - Prevention of accidents - Electric shock- Safety precautions against electric shock - Significance of first aid. Plant Maintenance: Introduction - Objectives - Importance. Maintenance practices: Breakdown maintenance - Preventive maintenance - Scheduled maintenance - Predictive maintenance -Standard data for maintenance. TPM: Introduction - Objectives - Steps of TPM process.	**6**
III	**QUALITY AND STANDARDS** Definition of quality - Quality control - Quality assurance - Modern management techniques - Just In Time (JIT) - Total Quality Management (TQM) - Introduction - PDSA cycle - Kaizen - TQM Tools -Bench marking - Quality circle - Zero Defect Concept - 5S principle - Sort, Set in order, Shine, Standardise and Sustain - Necessity of 5S - Six Sigma - Essential elements - Methodologies - Six sigma belt - SWOT analysis. BIS for construction - National Building Code - ISO standards - ISI Standards - Intellectual property rights - Engineering Ethics -.Brief description only.	**6**
IV	**BASICS OF ENGINEERING** Tolerance - Limits - Deviation - Allowance - Definitions only - Types of tolerances: Unilateral, Bilateral - Fits - Types of fits. Types of structures - List of materials used for building construction - Requirements of water for construction. Mortar: Types and its properties. Concrete: Constituents – Requirements - Types of grouting materials - Types of roofing - Types of foundation - requirements of good foundation - Standard sizes of doors and windows. Weathering course: Purpose - Materials required. Earthquake: Types of earth quake and its remedial measures. Rain water harvesting - Types - Importance. EMF - Current - Potential difference - Electric power - Definitions only. Wiring - Types of wires - Internal wiring - Cleat wiring - Surface conduit wiring - Concealed conduit.	**8**
V	**INDUSTRY 4.0** Industrial revolution - Definition – History - Industry 4.0 - Definition - Design principles and goals - Industry 4.0 technologies - Big data - Cloud computing - Internet of Things (IoT) - Simulation - Autonomous robots - Augmented reality - Cyber security - System integration - Additive manufacturing. Evolution of Industry 4.0 - Global readiness - Global trend - Initiative by Industries and Government - Importance of Industry 4.0.	**6**

Reference Books:

1. Industrial Organisation and Engineering Economics - "T.R.Banga, S.C. Sharma"-Khanna Publishers
2. Industrial Engineering and Management "O.P. Khana" - Dhanbat Rai Publications.
3. Machine Drawing - K.L.Narayana, P.Kannaiah, K.Venkata reddy - New Age International Publishers.
4. Elements of Civil Engineering - Bhavikatti
5. A Text Book of Electrical Technology - B.L. Theraja, A.K. Theraja - S.Chand & Company Ltd.
6. Testing, Commissioning, Operation & Maint.of Electrical Equipments - S.Rao - Khanna Publishers.
7. A Course in Electrical Power by Soni & Gupta - Dhanbat Rai & Sons, New Delhi.

INTERNAL ASSESSMENT

Assignment (Theory portion)*	10 marks
Practical (Observation (5) and Record work (5))	10 marks
Attendance	05 marks
Total	**25 marks**

Note: Three assignments will be given and the marks will be converted to 10 marks.

- First assignment - Unit I & II Second assignment - Unit III & IVThird assignment - All Units

Each assignment should have five two marks questions and two five marks questions.

END SEMESTER EXAMINATION

1. The students should maintain theory assignment, observation note book / manual and record notebook. The assignment and record note book should be submitted during the Practical Examinations.
2. The question paper consists of theory and practical portions. All students should write the answers for theory portions (45 Marks) and practical portion (55 Marks).
3. For theory portions:
   Ten questions (2 from each unit) will be asked for 2 marks each. (10 x 2 = 20)
   Five questions (2 from each unit) will be asked for 5 marks each. (5 x 5 = 25)

6028E WORKSHOP PRACTICAL - II

I. ELECTRICAL WIRING

Introduction of Electrical wiring 04 Hrs

Exercises: **20 Hrs**

1. One LED lamp controlled by one switch.
2. Two LED lamps controlled by one-way switch in series connection.
3. Two LED lamps controlled by one-way switch in parallel connection.
4. Two LED lamps controlled by two individual switches.
5. Draw the circuit and execute stair case wiring.
6. Draw the circuit and connect the LED Lamp, Fluorescent lamp and one plug point socket with individual switch control in a board.

II. BASICS OF COMPUTER HARDWARE

Introduction of Computer Hardware 04 Hrs

Exercises: **20 Hrs**

1. Identification & testing of front panel & rear panel connectors available in Computer system.
2. Marking the positions of SMPS, Motherboard, HDD and add-on cards.
3. Draw the layout of a Pentium Motherboards.
4. Assemble internal drives with respective cables.
5. Configuring CMOS - setup program.
6. Installation of Printer.

QUESTION PAPER PATTERN

A. Theory Question and Answer (5x9=45 Marks)	45 Marks
B. Electrical Exercise	25 marks
C. Computer Hardware Exercise	25 marks
Viva voce	05 marks
Total	**100 marks**

6001 COMMUNICATION SKILL PRACTICAL

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
6001 COMMUNICATION SKILL PRACTICAL	2 Hrs	32 Hrs	Internal Assessment	External Exam*	Total	
			25	75	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

Unit	Name of the Topics	Hrs
I	**LISTENING SKILL** Listening to speeches by Great speakers / TV News (Assessment through note taking) Listening to short stories (Assessment by vocabulary check) Listening to Indian / British / American English (Assessmentby cloze)	10
II	**READING SKILL** Stress & Intonation Tongue twisters / Tongue modulators frequently	6

	Mispronounced words Reading Newspaper - (Skimming & Scanning)	
III	**SPEAKING SKILL** Polite expressions (Greeting, Requesting, Thanking, Apologizing,Opinions, Suggestions) Introducing Yourself / Friends / Family Recite - quotes of Leaders / Scholars / Scientists Face to face conversation	**10**
IV	**WRITING SKILL** Thought fillers Completing an Incomplete story How to prepare PPT Non-verbal communication	**6**

Note:

1. The students should be given proper practice in all the exercises. All theexercises should be completed before the examinations.
2. The students should maintain a record note book. The record note book should be submitted during the semester practical examinations.

PART A - LISTENING (No. of Exercises: 3, Duration: 45 min.)

Exercise	ulars
1	The examiner shall play either the audio of the speech of a Great speaker or that of TV news running from 3 to 5 min. The audio can be played twice. The candidates may be given 10 minutes to take notes as directed in the question paper.
2	A short story selected by the external examiner shall be played only once without transcript. The objective of this exercise is to test the listening ability of the candidate and therefore questions should be framed accordingly in the pattern of question and answer. The time to complete this exercise is 5 minutes.
3	Any one of the audios (British English, American English or Indian English) may be selected by the external examiner and the same shall be played only once. Maximum of 5 questions for filling in the blanks may be given and the candidates may be provided maximum of 10 minutes to answer the questions.

This part shall be completed within 45 minutes including the time used for playinglistening audios.

PART B - READING (No. of Exercises: 3, Duration: 45 min.)

Each batch may be divided into two groups. Both examiners may engage all the students.

Exercise	Particulars
1	Readout the tongue twister.
2	A passage from newspaper can be given for reading.
3	Pronounce the words correctly.

This part shall be completed within 45 minutes.

PART C - SPEAKING (No. of Exercises: 4, Duration: 45 min.)

Divide the students to make it convenient for conversations in English by a pair.Both examiners can handle.

Exercise	Particulars
1	Polite expressions for the context provided.
2	Self-introduction for the interview.
3	Any five quotes can be recited from the given list of quotes of Leaders, Scholars and Scientists.
4	The candidates have to speak as directed by the concerned examiner. All the questions are mandatory.

This part shall be completed within 45 minutes.

PART D - WRITING (No. of Exercises: 3, Duration: 45 min.)

All students should appear for this part.

Exercise	Particulars
1	Five questions with blanks shall be asked based on a list of 25 frequently used thought fillers already trained during lab classes.
2	Shall consist of an unknown incomplete story providing scope for further development and application of imagination. (Minimum 3 lines for completion with suitable title and moral)
3	Questions can be taken from a list of fifteen important questions covering the core areas of non-verbal communication. (Five out of eight questions to be answered)

This part shall be completed within 30 minutes.

ALLOCATION OF MARKS

Description		Marks
A	Listening	30
B	Reading	20
C	Speaking	30
D	Writing	20
Total		**100**

Guidelines for Conduct of Practical Classes and Writing Record Note:

There are 13 experiments in total equally distributed to each skill as follows:

Sl. No	Name of the exercise	Min. Exercises to be practiced / written in Record Note
Listening Skill		
1	Listening to Speeches by Great Speakers/ TV News	Each One exercise
2	Listening to Short Stories	Minimum of two exercises
3	Listening to Indian / British / American English	Minimum of two exercises
Reading Skill		
4	Reading Tongue Twisters	A list of 25 tongue twisters
5	Reading English Newspapers	Minimum 2 passages from any English Newspaper
6	Frequently mispronounced words	List of 25 words
Speaking Skill		
7	Making Polite Expressions	Polite expressions - Greeting, Requesting, Thanking, Apologizing, Opinions, Suggestions
8	Introducing oneself / friends/family	Minimum two exercises for introducing oneself and introducing others
9	Reciting quotes	Quotes of Leaders / Scholars / Scientists (List of 25 quotes)
10	Face to face conversation	Minimum two exercises
Writing Skill		
11	Use of Thought Fillers	A list of 25 frequently used thought fillers
12	Completing an Incomplete Story	Minimum of two exercises. (conclusion - minimum 3 lines, title & moral)
13	Non-Verbal Communication	A list of 10 questions and answers relating to non- verbal communication.

Notes:

1. Each experiment shall be awarded 20 marks and the total marks secured in all experiments shall be averaged to 20 marks.
2. Attendance mark shall be calculated for 5 marks as per the given norms.
3. Total internal mark is 25 (Record 20 marks + Attendance 5 marks).
4. Observation note is not applicable for this practical.
5. Listening skill exercises: For each exercise under Listening Skill, minimum exercise should be provided for practice and should be recorded in the record note.(as per the tabular column)

Open sources available online on the sites such aswww.youtube.com, www.letstalk.co.in, http://www.bbc.co.uk/learningenglish/english/features/6-minute-english, and https://esl-lab.com/, can be utilized for sessions on improving listening skill.

THIRD SEMESTER

6331 - ELECTRONIC DEVICES AND CIRCUITS

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
6331 ELECTRONIC DEVICES AND CIRCUITS	6 Hrs	96 Hrs	Internal Assessment	External Exam*	Total	
			25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

UNIT - I

FILTERS, ZENER DIODES AND OPTO-ELECTRONIC DEVICES

Chapter 1.1: Filters **6 Hrs**

Definition - types - capacitor filter - inductor filter - L section filter - Pi section and RC filter - comparison and applications of filters.

Chapter 1.2: Zener Diode **6 Hrs**

Construction, working principle and characteristics of zener diodes - zener breakdown - avalanche breakdown - zener diode as a voltage regulator.

Chapter 1.3: Opto-Electronic Devices **6 Hrs**

Definition - types - symbol, working, characteristics and applications of LED, 7 segment LED - photo diode, photo transistor and opto-coupler.

UNIT - II

BIPOLAR JUNCTION TRANSISTOR (BJT), FIELD EFFECT TRANSISTOR (FET) AND UNI JUNCTION TRANSISTOR (UJT)

Chapter 2.1: Bipolar Junction Transistor (BJT) **7 Hrs**

Transistor biasing: need for biasing - types - fixed bias, collector to base bias and self bias (operation only, no derivation of circuit elements and parameters) - definition of stability factor - operation of common emitter transistor as an amplifier and as a switch.

Chapter 2.2 : Field Effect Transistor (FET) **6 Hrs**

Construction - working principle - classification - drain and transfer characteristics -applications - comparison between FET and BJT - FET amplifier (common source amplifier).

Chapter 2.3 : Uni Junction Transistor (UJT) **5 Hrs**

Construction - equivalent circuit - operation - characteristics - UJT as a relaxation oscillator.

UNIT - III

FEEDBACK, AMPLIFIERS AND OSCILLATORS

Chapter 3.1: Feedback **6 Hrs**

Concept - effects of negative feedback - types of negative feedback connections -Applications

Chapter 3.2: Amplifiers **7 Hrs**

Transistor amplifiers - types - RC coupled amplifier - working and frequency response characteristics - working of common collector amplifier (emitter follower).

Chapter 3.3: Oscillators **5 Hrs**

Transistor oscillators - conditions for oscillation (Barkhausen criterion) - classifications - Hartley oscillator - Colpitts oscillator - RC phase shift oscillator.

UNIT - IV

SPECIAL SEMICONDUCTING DEVICES (SCR, DIAC AND TRIAC)

Chapter 4.1: Silicon Controlled Rectifier (SCR) **5 Hrs**

symbol - layered structure - transistor analogy - working - VI characteristics - applications - comparison between SCR and transistor.

Chapter: 4.2 : Diode for Alternating Current (DIAC) **4 Hrs**
Symbol - layered structure - working - VI characteristics - applications.
Chapter 4.3 : Triode for Alternating Current (TRIAC) **5 Hrs**
Symbol - layered structure - working - VI characteristics - applications.
Chapter 4.4: Metal Oxide Semiconductor FET (MOSFET) **4 Hrs**
Symbol - layered structure - working - VI characteristics - applications

UNIT - V
WAVE SHAPING CIRCUITS
Chapter 5.1: Clippers and Clampers **6 Hrs**
Construction and working of positive, negative and biased clippers - construction and working of positive and negative clamper.
Chapter 5.2: Voltage Multipliers **5 Hrs**
Construction and working of voltage doubler and tripler .
Chapter 5.3: Multivibrator and Schmitt Trigger **6 Hrs**
Construction - working - waveform of astable, monostable and bistable multivibrator using transistors and schmitt trigger using transistors.

Text Books:

1. Electronics Devices & Circuits by Salivahanan S,N.Suresh Kumar, A.Vallavaraj, 2nd Edition, Tata McGraw Hill Publication, 2016
2. Electronics Devices & Circuits by Jacob Millman and Halkias, 2nd Edition, , Tata McGraw -Hill publication, 2010

Reference Books:

1. Electronics Devices & Circuits by Salivahanan S,N.Suresh Kumar, A.Vallavaraj Tata McGraw Publication 4thEdition 2016
2. Electronics Devices and circuit theory by Boyestad & Nashelsky, PHI, New Delhi 2009
3. Electronic Principles by Malvino, -Tata McGraw Hill Publication 2010.
4. Optical Fiber Communication by Gerd Keiser 2nd Edition, Tata McGraw-Hill.

*** Pattern of End Semester Exam Question Paper - General Pattern (Theory)**

6332 - ELECTRICAL CIRCUIT THEORY

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
6332 ELECTRICAL CIRCUIT THEORY	7 Hrs	112 Hrs	Internal Assessment	External Exam*	Total	
			25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

UNIT - I
DC CIRCUITS **21 Hrs**
Basic concepts of current, EMF, potential difference, resistance and resistivity - Ohm's law - work, power, energy - resistance in series, parallel and series - parallel circuits - Kirchhoff's laws - concept of capacitance - capacitors in series and in parallel - problems in the above topics. basic definitions : active and passive elements linear & non-linear elements - lumped & distributed elements - bilateral and unilateral circuit elements.

UNIT - II
CIRCUIT THEOREMS **21 Hrs**
Basic definitions: ideal current source and practical current source, ideal voltage source and practical voltage source - node, branch and network - mesh equations - nodal equations - superposition theorem - Thevenin's theorem - Norton's theorem - maximum power transfer theorem. (problems in DC circuits only)

UNIT - III
SINGLE PHASE CIRCUITS AND RESONANCE
Chapter 3.1: Single Phase Circuits **12 Hrs**
Definitions of sinusoidal voltage and current-instantaneous, peak, average and effective values -

form factor and peak factor (derivation for sine wave) - pure resistive, inductive and capacitive circuits - RL, RC, RLC series circuits - impedance - phase angle - power and power factor - use of 'J' notations - rectangular and polar coordinates - phasor diagram - power triangle - apparent power, active and reactive power - parallel circuits (two branches only) - conductance, susceptance and admittance - problems in all above topics.

Chapter 3.2: Resonance **9 Hrs**

Concept of series resonance - parallel resonance (R, L & C) - applications (no problems)

UNIT - IV

THREE PHASE AC CIRCUITS **21 Hrs**

Three phase AC systems - phase sequence - necessity of three phase system - concept of balanced and unbalanced load - balanced star & delta connected loads - relation between line and phase voltages and currents - phasor diagram three phase power - power factor - three phase power and power factor measurement by single wattmeter and two wattmeter methods - star / delta transformations - problems in all topics.

UNIT - V

STORAGE BATTERIES **21 Hrs**

Classification of cells - construction, chemical action and physical changes during charging and discharging of lead acid, nickel iron and nickel cadmium cells - advantages and disadvantages of nickel ion and nickel cadmium cells over lead acid cell - indication of fully charged and discharged battery - defects and their remedies - capacity - Ah efficiency and Wh efficiency (no problems) - methods of charging - care and maintenance - applications - maintenance free batteries - lithium cells, lithium - ion cells and mercury cells - concept of recharged cell.

Text Book:

1. Electric Circuit Theory, Dr.M.Arumugam, Khanna Publishers

Reference Books:

1. Circuits and Networks, A Sudhakar Shyammohan, Tata McGraw Analysis and Synthesis S Palli Hill Education Private.
2. Electric Circuits, Mahamood Nahvi Schaum Joseph A Edminister Publishing Company, Newyork

*** Pattern of End Semester Exam Question Paper - General Pattern (Theory)**

6333 - ELECTRICAL MACHINES - I

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6333 ELECTRICAL MACHINES - I	6 Hrs	96 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

UNIT - I

DC GENERATORS **18 Hrs**

Review of electromagnetic induction - Faraday's laws - Lenz's law - Fleming's right hand rule - principle of operation of DC generator - construction of DC generator - types of armature windings(no winding diagram) - EMF equation(simple problems) - types of DC generators - no load and load characteristics of DC generators - causes of failure to build - up voltage and remedy - armature reaction - methods of compensating armature reaction - process of commutation - methods of improving commutation. load characteristics of DC generators - applications of DC generators

UNIT - II

DC MOTORS **18 Hrs**

Principle of operation of DC Motor - Fleming's left-hand rule – construction - back emf -torque equation - types of DC motors - torque-current, speed - current, speed - torque characteristics of different DC motors - speed control of DC motors - field control and armature control - necessity

of starters - 3 point and 4 point starters - losses in DC machines - testing of DC machines - predetermination of efficiency of motor and generator by Swinburne's test - problems in the above topics - applications of DC motors.

UNIT - III

SINGLE PHASE TRANSFORMER **18 Hrs**

Principle of operation - constructional details of core and shell type transformers - EMF equation - voltage ratio - transformer on no load - transformer full load - current ratio - phasor diagram on no load and full load at different power factors. OC test, SC test - determination of equivalent circuit constants - determination of voltage regulation and efficiency - condition for maximum efficiency - all day efficiency - problems on the above topics - polarity test - parallel operation of single phase transformers - auto transformer - principle - applications of transformers - energy efficient transformer - dry type transformer and amorphous core transformer

UNIT - IV

THREE PHASE TRANSFORMER **18 Hrs**

Three phase transformer - construction, types of connections of transformer. parallel operation of three phase transformers - grouping of transformers - pairing of transformers - load sharing of transformers with equal and unequal ratings - cooling of transformers - various cooling arrangements - transformer accessories - conservator, breather, explosion vent, Buchholz relay - ON load and OFF load tap changer - scott connection.

UNIT - V

MAINTENANCE OF DC MACHINES AND TRANSFORMERS **17 Hrs**

Maintenance - importance, preventive and breakdown maintenance - advantages of preventive maintenance - causes of sparking in commutators - defects in commutators and remedies - resurfacing of commutators and brushes - maintenance of brush holder - staggering of brushes, brush pressure - defects in DC armature winding - maintenance of earthing of DC machines. maintenance of transformer oil - transformer oil tester - acidity test, BDV test - drying out of transformer - earthing - measurement of earth resistance.

Text Books:

1. A Textbook of Electrical Technology Volume II, B.L. Theraja, S. Chand & Co. New Delhi.
2. Electrical Technology, Edward Hughes Addision, Wesley International Student Edition

Reference Books:

1. Elements of Electrical Engineering, Maria Louis, Prentice Hall of India
2. Electrical Machines, Nagarath, TMH Publications.
3. Electrical Machines, Bhattacharya, TMH Publications.

*** Pattern of End Semester Exam Question Paper - General Pattern (Theory)**

6334 - ELECTRONIC DEVICES AND CIRCUITS PRACTICAL

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
6334 ELECTRONIC DEVICES AND CIRCUITS PRACTICAL	4 Hrs	64 Hrs	Internal Assessment	External Exam*	Total	3 Hrs
			25	100	100	

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

EXPERIMENTS: **64 Hrs**

Note: At least 5 experiments should be done using bread board

1. Construct a circuit to test the forward and reverse bias characteristics of a PN junction silicon diode. Find the value of its cut-in voltage.
2. Construct a circuit to test the forward and reverse bias characteristics of a Zener diode. Find the value of its reverse breakdown voltage.
3. Construct a full wave (center tapped) rectifier and test its input and output waveforms with and without capacitor filter. Find its maximum voltage.

4. Construct a bridge rectifier and test its input and output waveforms with and without capacitor filter. Find its maximum voltage.
5. Construct a common emitter transistor circuit and test its input and output characteristic curves.
6. Construct the positive clamper and negative clamper circuit and trace their output waveform.
7. Construct the positive clipper and negative clipper circuit and trace their output waveform.
8. Construct a circuit to test the turning on and turning off characteristics of SCR and find out the forward break over voltage, the value of latching and holding currents.
9. Construct a circuit to test the bidirectional characteristics of DIAC and plot its switching characteristics.
10. Construct a circuit to test the bidirectional characteristics of TRIAC and plot its switching characteristics.
11. Construct a circuit and VI characteristics for LED and LDR.
12. Construct a circuit to test the switching characteristics of astable multivibrator.
13. Construct a circuit to test the negative resistance characteristics of UJT.
14. Soldering and Desoldering of DC power supply board.

AUTONOMOUS EXAMINATION

Note: All the exercises have to be completed. Any one exercise will be given for examination. All the exercises should be given in the question paper and students are allowed to select question by a lot. All students should submit record notebook for the practical examination.

DETAILED ALLOCATION OF MARKS

Sl. No.	Name of the activity	Max. Marks
1	Circuit Diagram	25
2	Connections	25
3	Execution and Handling of Equipment	25
4	Output / Result	15
5	Viva-voce	10
Total		**100**

6335 - ELECTRICAL CIRCUITS AND MACHINES PRACTICAL

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6335 ELECTRICAL CIRCUITS AND MACHINES PRACTICAL	4 Hrs	64 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

EXPERIMENTS:

CIRCUITS: 16 Hrs

1. Verification of super position theorem with two different DC voltages for a common load.
2. Verification of thevenin's theorem with DC supply.
3. Verification of maximum power transfer theorem.
4. Measurement of power
   a. Using ammeter and voltmeter
   b. Using wattmeter for single phase resistive load

MACHINES: 48 Hrs

5. No load and full load characteristics of self excited DC shunt generator.
6. Load test on DC Shunt motor and draw the performance curve.
7. Load test on DC Series motor and draw the performance curve.
8. Predetermine the efficiency of DC machines by swinburne's test.
9. Speed control of DC shunt motor by
   a. Armature control method

b. Field control method

10. Load test on single phase transformer.
11. Load test on three phase transformer.
12. Predetermine the efficiency and regulation of single-phase transformer by conducting O.C and S.C tests.
13. Find the equivalent circuit constants of single phase transformer by conducting O.C and S.C tests.
14. Connect two single phase transformers for parallel operation.
15. Conduct acidity test on transformer oil.

AUTONOMOUS EXAMINATION

Note: All the exercises have to be completed. Any one exercise will be given for examination. All the exercises should be given in the question paper and students are allowed to select question by a lot. All students should submit record notebook for the practical examination.

DETAILED ALLOCATION OF MARKS

Sl. No.	Name of the activity	Max. Marks
1	Circuit Diagram	35
2	Connections and Proceeding the Experiment	30
3	Reading / Calculation / Graph / Result	30
4	Viva-voce	05
Total		**100**

6336 - ELECTRICAL WORKSHOP AND WINDING PRACTICAL

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6336 ELECTRICAL WORKSHOP AND WINDING PRACTICAL	4 Hrs	64 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

EXPERIMENTS: 64 Hrs

1. Familiarization of tools used for electrical repair works and personal protection equipments.
2. Dismantling of electrical iron box, identifying the parts, checking the conditions, assembling, and testing.
3. Dismantling of mixer grinder, identifying the parts, checking the conditions, assembling and testing.
4. Dismantling of wet grinder, identifying the parts, checking the conditions, assembling, and testing.
5. Assembling the accessories of ceiling fan, test the connections of winding & capacitor and run the fan with speed regulator.
6. Connect the battery and inverter to supply partial load in a domestic wiring during mains failure.
7. Assembling and testing of 15 Watts LED light.
8. Battery charging through solar panel. Connect solar panel to charge battery through charge controller.
9. Wiring, testing and servicing of Mercury Vapor lamp.
10. Design and wind a No Volt coil of electric bell.
11. Design and wind 230/12-0-12 V, 500 mA of transformer.

AUTONOMOUS EXAMINATION

Note: All the exercises have to be completed. Any one exercise will be given for examination. All the exercises should be given in the question paper and students are allowed to select question by a lot. All

students should submit record notebook for the practical examination.

DETAILED ALLOCATION OF MARKS

Sl. No.	Name of the activity	Max. Marks
1.	Connection Diagram	25
2.	Tools Required	20
3.	Dismantling and Assembling Procedure	30
4.	Testing	20
5.	Viva-voce	05
Total		**100**

6337 - SIMULATION - I PRACTICAL

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6337 SIMULATION - I PRACTICAL	4 Hrs	64 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

EXPERIMENTS: 64 Hrs

1. Generate the following waveforms
   (i) Sinusoidal waveform of fundamental frequency (50Hz)
   (ii) 3rd order, 5th order and 7th order harmonics for the fundamental frequency.
2. Simulation of RLC series and RLC parallel response circuits.
3. Step response of RL and RC series circuit.
4. Simulation of mesh and nodal analysis for DC circuits.
5. Verification of superposition theorem.
6. Verification of Thevenin's and Norton's theorem.
7. Verification of maximum power transfer theorem.
8. Simulation of full wave rectifier (center tapped and bridge) with RL load.
9. Simulation of single phase half wave controlled converter with RL load and free wheeling diode.
10. Simulation of single phase full wave controlled converter with RL load and free wheeling diode.
11. Simulation of three phase star connected balanced and unbalanced load.
12. Simulation of three phase delta connected balanced and unbalanced load
13. Simulation of three phase non-linear star connected load with three phase 3 wire system.
14. Simulation of three phase non-linear star connected load with three phase 4 wire system.
15. Simulation basic logic gates, universal logic gates and realization of logic gates using universal logic gates.
16. Simulation of half adder and full adder.

AUTONOMOUS EXAMINATION

Note: All the exercises have to be completed. Any one exercise will be given for examination. All the exercises should be given in the question paper and students are allowed to select question by a lot. All students should submit record notebook for the practical examination.

DETAILED ALLOCATION OF MARKS

Sl. No.	Name of the activity	Max. Marks
1	Circuit Diagram (Manual Diagram)	30

2	Development of Circuit Diagram	30
3	Simulation Performance & Print out	35
4	Viva-voce	05
Total		**100**

FOURTH SEMESTER

6341 - ELECTRICAL MACHINES - II

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6341 ELECTRICAL MACHINES - II	6 Hrs	96 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

UNIT - I

ALTERNATOR PRINCIPLE AND CONSTRUCTION 18 Hrs

Basic principle of alternators - types of alternators - stationary armature rotating field - advantages of rotating field - construction details of alternator - salient pole rotor - cylindrical type rotor - types of A.C. armature windings - types of slots - full pitch and short pitched windings - phase spread angle and effect of distribution factor - pitch factor - relation between frequency, speed and number of poles - EMF equation - problems - methods of obtaining sine wave - critical speed of rotor - ventilation of turbo alternators - advantages of hydrogen cooling and its precaution - excitation and exciters**.**

UNIT - II

ALTERNATOR PERFORMANCE AND TESTING 18 Hrs

Load characteristics of alternators - reason for change in terminal voltage - qualitative treatment of armature reaction for various power factor loads - effective resistance - leakage reactance - synchronous reactance, synchronous impedance - voltage regulation - determination of voltage regulation of alternator by direct load test - pre-determination of regulation of alternator by indirect method (EMF, MMF, and ZPF) - necessity and conditions for parallel operation of alternators - synchronizing by dark lamp method, bright lamp method, dark-bright lamp method and synchroscope method - synchronizing current, synchronizing power and synchronizing torque - load sharing of alternators - infinite bus bar.

UNIT - III

THREE PHASE INDUCTION MOTOR 18 Hrs

Rotating magnetic field - principle of operation of three phase induction motors - slip and slip frequency - comparison between cage and slip ring induction motors - development of phasor diagram - expression for torque in synchronous watts - slip-torque characteristics - stable and unstable region - no load test and blocked rotor test - development of approximate equivalent circuit - problems on the above topics - simplified circle diagram - determination of maximum torque, slip (problems not required) - starting torque and starting current expression - relationship between starting torque and full load torque - speed control of induction motors. starters of induction motors - direct online starter and its merits for cage motors - star delta starter - auto transformer starter - rotor resistance starter - cogging - crawling in induction motor - double cage induction motor - induction generator.

UNIT - IV

SINGLE PHASE INDUCTION MOTOR AND SYNCHRONOUS MOTOR

Chapter 4.1: Single Phase Induction Motor 09 Hrs

Single phase induction motors - not self starting - methods of making itself starting - construction, working principle - phasor diagram - slip-torque characteristics - split phase motor - capacitor motor - shaded pole motor - repulsion motor - universal motor - operation of three phase motor

with single phase supply.

Chapter 4.2: Synchronous Motor **09 Hrs**

Principle of operation - not self starting - methods of starting - effects of excitation on armature current and power factor - vector diagram - 'V' curve and inverted 'V" curve of synchronous motor - the phenomenon of hunting and prevention of hunting by damper winding - comparison between synchronous motor and three phase induction motor - applications - problems on power factor improvement.

UNIT - V

MAINTENANCE OF INDUCTION MOTORS AND STARTERS **17 Hrs**

BIS publication dealing with the code of practice of induction motors and starters - classification of cage motor - continuous rating and intermittent rating - various types of enclosures - specifications of motors - selecting the cable rating - single phase prevention using current operated relay - commissioning - annual maintenance selection of starters of induction motor - common induction motor troubles and their remedies - causes of noise and vibration - care of bearings - static balancing - degreasing - vacuum impregnation - varnishing - effect of unbalanced supply on the performance of induction motor - drying out process of induction motor.

Text books:

1. A Textbook of Electrical Technology Volume II, B.L. Theraja, S.Chand& Co, New Delhi.
2. Electrical Technology, Edward Hughes, Addision - Wesley International Student, Edition.

Reference Books:

1. Performance and Design of AC Machines, M.G.Say, Pitman Publishing Ltd.
2. Electrical Machines, Nagarath, TMH Publications.
3. Electrical Machines, Bhattacharya,TMH Publications.

*** Pattern of End Semester Exam Question Paper - General Pattern (Theory)**

6342 - MEASUREMENTS, INSTRUMENTS AND TRANSDUCERS

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6342 MEASUREMENTS, INSTRUMENTS AND TRANSDUCERS	6 Hrs	96 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

UNIT - I

CLASSIFICATION AND CHARACTERISTICS OF INSTRUMENTS **18 Hrs**

General - definition of measurement - functions of measurement system (indicating, recording and controlling function) - applications of measurement systems - classification - absolute and secondary instruments - indicating recording and integrating instruments - analog and digital. definition of true value, accuracy, precision, error and error correction - instrument efficiency - effects used in instruments - operating forces - deflecting, controlling and damping forces.

UNIT - II

MEASUREMENT OF CURRENT, VOLTAGE AND RESISTANCE **18 Hrs**

Types of instruments - construction, working and torque equation of moving coil, moving iron, dynamometer type (shaded pole) instruments - extension of instrument range using shunts and multipliers. (calculation, requirements and simple problems). Tong tester - electrostatic voltmeter - rectifier type instruments - instruments transformers CT and PT - testing, errors and characteristics of CT and PT. Classification of resistance - measurement using conventional method - (ammeter - voltmeter method) measurement of low resistance using Kelvin's bridge

ohmmeter - measurement of medium resistance using Wheatstone bridge - high resistance using megger - earth resistance - earth tester - multimeters.

UNIT - III
MEASUREMENT OF POWER, POWER FACTOR AND FREQUENCY 18 Hrs

Power in DC and AC circuits - watt meters in power measurement - measurement of energy in AC circuits - single phase and three phase energy meters construction and operation - digital energy meter. power factor meters - single phase electro dynamometer type - construction and working - phase sequence indicator - phase difference measurement using synchro scope - trivector meter - Merz price maximum demand indicator. frequency measurement frequency meter - digital frequency meter (simplified block diagram) - definition of power quality analyzer.

UNIT - IV
MEASUREMENT OF L, C PARAMETERS, WAVEFORMS AND SIGNAL CONDITIONERS

Chapter 4.1: Measurement of L, C Parameters, Waveforms 14 Hrs
Inductance - Maxwell's inductance bridge - Andersons bridge - measurement of capacitance using Schering bridge. CRO - block diagram - CRT - applications - measurements of voltage, frequency and phase difference using CRO - digital storage oscilloscope - block diagram.
Chapter 4.2: SIGNAL CONDITIONER: 04 Hrs
Basic components of signal conditioning system - clipper, clamper using op-amp.

UNIT - V
SENSORS AND TRANSDUCERS
Chapter 5.1: Passive Transducers: 09 Hrs
Definition - types of transducers - Resistive transducer - strain gauge - capacitive transducer - inductive transducer - proximity sensor - construction and operation of LVDT and RVDT.
Chapter 5.2: Active Transducers: 06 Hrs
RTD - thermistor - thermocouple - synchro - piezoelectric transducer - measurement of pressure and vibration - hall effect transducer - photovoltaic transducer - photoconductive transducer - tachogenerator.
Chapter 5.3: Telemetry: Block diagram and its applications. **02 Hrs**

Text Books:

1. A Course in Electrical and Electronics Measurements and Instrumentation, A.K. Sawhney, Puneet Sawhney Dhanpat Rai & Co (P) Ltd., New Delhi 1993.

Reference Books:

1. Electronic instrumentation, HS Kalsi, Tata Mc Graw Hill Publishing Co., Delhi 2010.
2. Modern Electronic Instrumentation and Measurement techniques, Albert D. helfrick William David Copper, Prentic-Hall of India (P)Ltd., New Delhi 2010.
3. Electronic and Instrumentation, Dr. S.K.Battachariya, Dr. Renu Vig, S.K. Kataria & Sons, New Delhi.

*** Pattern of End Semester Exam Question Paper - General Pattern (Theory)**

6343 - ANALOG AND DIGITAL ELECTRONICS

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
6343 ANALOG AND DIGITAL ELECTRONICS	6 Hrs	96 Hrs	Internal Assessment	External Exam*	Total	
			25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

UNIT - I
LINEAR ICs AND OP-Amps
Chapter 1.1: Operational Amplifier 07 Hrs
Ideal op-amp - block diagram and characteristics - op-amp parameters CMRR - slew rate - concept of virtual ground.

Chapter 1.2: Applications of Op-Amp **07 Hrs**
Inverting amplifier - summing amplifier - non inverting amplifier - voltage follower -comparator - zero crossing detector - integrator - differentiator - waveform generation (schmitt trigger only) - RC low pass active filter.
Chapter 1.3: Op-Amp Specifications **04 Hrs**
Op-amp 741 - symbol - pin diagram - specifications.

UNIT - II
A/D, D/A, SPECIAL FUNCTION ICs AND IC VOLTAGE REGULATORS
Chapter 2.1: Sampling and Quantization **02 Hrs**
Sampling and hold circuit - quantization.
Chapter 2.2: A/D Converter **04 Hrs**
Analog to digital conversion using ramp method - successive approximation method - dual slope method - specifications of A/D converter.
Chapter 2.3: D/A Converter **04 Hrs**
Basic concepts - weighted resistor D/A converter - R-2R ladder D/A converter - specifications of DAC IC.

Chapter 2.4: Special Function ICs **05 Hrs**
2.4.1: IC 555 Timer - pin diagram - functional block diagram of IC 555 in astable and monostable multivibrator mode - schmitt trigger using IC 555.
2.4.2: IC 565 - PLL - pin diagram - functional block diagram of IC 565.
2.4.3: IC 566 - VCO - pin diagram - functional block diagram of IC 566.
Chapter 2.5.: IC VOLTAGE REGULATORS **03 Hrs**
Positive IC voltage regulators: 78XX - negative IC voltage regulators: 79XX and general - purpose IC voltage regulators using LM 723.

UNIT - III
BOOLEAN ALGEBRA AND ARITHMETIC OPERATIONS
Chapter 3.1: Number Systems **04 Hrs**
Decimal - binary - octal - hexadecimal - BCD - conversion from one number system to other - Boolean algebra - basic laws and demorgan's theorems.
Chapter 3.2: Universal Gates **03 Hrs**
Realization of basic logic gates using universal gates NAND and NOR - tristate buffer circuit.
Chapter 3.3: Problems Using 2, 3, and 4 Variables **04 Hrs**
Boolean expression for outputs - simplification of boolean expression using Karnaugh map (up to 4 variable) - constructing logic circuits for the boolean expressions.
Chapter 3.4: Arithmetic Operations **03 Hrs**
Binary addition - binary subtraction - 1's compliment and 2's compliment - signed binary numbers.
Chapter 3.5: Arithmetic Circuits **04 Hrs**
Half Adder - Full Adder - Half Subtractor - Full Subtractor.

UNIT - IV
COMBINATIONAL AND SEQUENTIAL LOGIC CIRCUITS
Chapter 4.1: Parity Generator and Checker **02 Hrs**
Parity Generator and Checker
Chapter 4.2: Decimal to BCD Encoder **02 Hrs**
Conversion of Decimal to BCD Encoder
Chapter 4.3: 3 to 8 Decoder **02 Hrs**
Conversion of 3 to 8 Decoder
Chapter 4.4: Multiplexer:
Conversion of 4 to 1 Multiplexer **01 Hrs**
Chapter 4.5: Demultiplexer :. **01 Hrs**
Conversion of 1 to 4 Demultiplexer
Chapter 4.6: Flip-Flops (FF) **04 Hrs**
RS FF- JK FF: master slave FF and edge triggered FF - D and T FF.
Chapter 4.7: Counters **03 Hrs**
4-bit Asynchronous Up Counter - Mod N counter - Decade counter - 4-bit Synchronous up

counter.

Chapter 4.8: Shift Register **03 Hrs**

4-bit shift register - serial in serial out - parallel in parallel out - serial in parallel out - parallel in serial out.

UNIT - V

MEMORIES

Chapter 5.1: Classification of Memories **03 Hrs**

Classification of memories

Chapter 5.2:RAM **07 Hrs**

RAM organization - address lines and memory size - read/write operations - static RAM - bipolar RAM cell - dynamic RAM - SD RAM - DDR RAM.

Chapter 5.3:ROM **07 Hrs**

ROM organization - expanding memory - PROM - EPROM - and EEPROM - flash memory - anti fuse technologies.

Text Books:

1. Digital Electronics, Roger L. Tokheim Macmillan, McGraw - Hill -1994.
2. Linear Integrated Circuits, D.Roychoudhury & shail. B.Jain, New age International pub. - II Ed -2004.

Reference Books:

1. Digital Principles and Applications, Albert Paul Malvino and Donold P. Leach.
2. Linear Integrated Circuits, B.Suseela & T.R.Ganesh babu, Scitech publications-2018
3. Integrated circuits, K.R.Botkar-Khanna publisher's-1996.
4. Modern Digital Electronics, R.P.Jain, TMH 2003

*** Pattern of End Semester Exam Question Paper - General Pattern (Theory)**

6344 - E-VEHICLE TECHNOLOGY AND POLICY

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
6344 E-VEHICLE TECHNOLOGY AND POLICY	5 Hrs	80 Hrs	Internal Assessment	External Exam*	Total	
			25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

UNIT - I

ENVIRONMENTAL IMPACT AND HISTORY, TYPES OF ELECTRIC VEHICLES

Chapter 1.1 : Environmental Impact & History **07 Hrs**

Environmental impact of conventional vehicle - air pollution - petroleum resources - history of electric vehicles & hybrid electric vehicles - conventional drive train system - rear wheel, front wheel and all wheel - parts of drive train system.

Chapter 1.2 : Types of Electric Vehicles **08 Hrs**

Introduction to battery electric vehicle (BEV) - definition BEV - necessity BEV - different between BEV and conventional vehicle - advantages of BEV - block diagram of BEV - hybrid electric vehicle (HEV) - plug-in hybrid electric vehicle (PHEV) - fuel cell electric vehicle (FCEV) - description.

UNIT - II

ELECTRIC VEHICLES, ELECTRIC PROPULSION SYSTEMS

Chapter 2.1: Electric Vehicles **07 Hrs**

Configurations of electric vehicle - performance of electric vehicles - tractive effort in normal driving - energy consumption. hybrid electric vehicles: concept of hybrid electric drive trains - architecture of hybrid electric drive trains - series, parallel and series and parallel.

Chapter 2.2: Electric Propulsion Systems **08 Hrs**

Types of EV motors - DC motor drives - permanent magnetic brush less DC motor drives (BLDC) - principles, Construction and working - hub motor drive system - merits and demerits of DC

motor drive, BLDC motor drive.

UNIT - III

ENERGY STORAGES, CHARGING SYSTEM, EFFECTS AND IMPACTS

Chapter 3.1: Energy Storages **06 Hrs**

Electrochemical batteries - battery technologies - construction and working of lead acid batteries, Nickel based batteries and lithium based batteries - role of battery management system (BMS) - battery pack development technology - cell series and parallel connection to develop battery pack.

Chapter 3.2: Charging **06 Hrs**

Battery charging techniques - constant current and constant voltage, trickle charging - battery swapping techniques - DC charging - Wireless charging - Maintenance of Battery pack - Latest development in battery chemistry.

Chapter 3.3: Effects and Impacts **03 Hrs**

Effects of EV - impacts on power grid - impacts on environment - impacts on economy.

UNIT - IV

ELECTRIC MOBILITY POLICY FRAME WORK **14 Hrs**

Government of India electric mobility policy frame work - global scenario of EV adoption - electric mobility in India - national electric mobility mission plan 2020 - action led by original equipment manufacturers - need of EV policy - advantage of EV eco system - scope and applicability of EV policy - ARAI standards for electric vehicle - AIS 038, AIS 039 &AIS 123 - key performance indicator - global impact - trends and future developments

UNIT - V

TAMIL NADU E-VEHICLE POLICY 2019 **14 Hrs**

Tamil Nadu e-vehicle policy 2019: vehicle population in Tamil Nadu - objectives of EV policy - policy measures - demand side incentives - supply side incentives to promote EV manufacturing - revision of transport regulation of EV - city building codes - capacity building and skilling - charging structure - implementing agencies - research & development and business incubation - recycling ecosystem - battery and EVs

Text Books:

1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles, Mehrdad Ehsani, Yimin Gao, Sebastien E.Gay, Ali Emadi, CR Press, London, New York.
2. Comparison of Electric and Conventional Vehicles in Indian Market: Total Cost of Ownership, Consumer Preference and Best Segment for Electric Vehicle (IJSR),Akshat Bansal, Akriti Agarwal

Reference books:

1. A Comprehensive Study of Key Electric Vehicle (EV) Components, Technologies, Challenges, Impacts, and Future Direction of Development (MDPI), Fuad Un-Noor, Sanjeevi kumar Padmanaban, Lucian Mihet-Popa, Mohammad NurunnabiMollah and Eklas Hossain.
2. Electric Vehicles: A future Projection CII October 2020 report.
3. Design and analysis of aluminum/air battery system for electric vehicles, Shaohua Yang,Harold Knickle, Elsevier.
4. Propelling Electric Vehicles in India, Technical study of Electric Vehicles and ChargingInfrastructure
5. Zero Emission Vehicles (Zevs): Towards A Policy Framework - Niti Aayog.
6. Faster Adoption of Electric Vehicles in India: Perspective of Consumers and Industry, TheEnergy and Resources Institute, New Delhi.
7. India EV Story: Emerging Opportunities by Innovation Norway.

*** Pattern of End Semester Exam Question Paper - General Pattern (Theory)**

6345 - ELECTRICAL MACHINES AND INSTRUMENTATION PRACTICAL

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6345 ELECTRICAL MACHINES AND INSTRUMENTATION PRACTICAL	4 Hrs	64 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

EXPERIMENTS: **64 Hrs**

1. Predetermine the regulation of alternator.
2. Load test on 3 phase alternator.
3. Synchronous of 3 phase alternator.
4. Variable speed characteristics of induction motor by pole changing method.
5. Load test on single phase induction motor.
6. Load test on 3 phase induction motor.
7. Determine the equivalent circuit constants of 3 phase induction motor.
8. Predetermine the performance of a 3 phase induction motor.
9. Improvement of power factor of an induction motor with load.
10. Calibration of given ammeter and voltmeter.
11. Calibration of given wattmeter.
12. Calibration of single phase energy meter.
13. Measurement of alternator winding resistance using Wheatstone bridge
14. Measure the intensity of light using LDR, photo diode and photo transistor and plot their outputs with luminous intensity.
15. Displacement measurement using LVDT.
16. Measure the speed of motor by digital and analog methods.

AUTONOMOUS EXAMINATION

Note: All the exercises have to be completed. Any one exercise will be given for examination. All the exercises should be given in the question paper and students are allowed to select the question by lot. All students should submit record notebook for the practical examination.

DETAILED ALLOCATION OF MARKS

Sl. No.	Name of the Activity	Max. Marks
1	Circuit Diagram	30
2	Connections And Conduction of the Experiment	30
3	Reading/Calculation	20
4	Graph/Result	15
5	Viva-voce	05
TOTAL		**100**

6346 - ANALOG AND DIGITAL ELECTRONICS PRACTICAL

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6346 ANALOG AND DIGITAL ELECTRONICS PRACTICAL	4 Hrs	64 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

EXPERIMENTS: **64 Hrs**

1. Realization of basic gates using NAND & NOR gates.
2. Realization of logic circuit for Demorgan's theorems.
3. Test the performance of half adder and full adder.
4. Test the performance of half subtractor and full subtractor.
5. Test the performance of decoder.
6. Test the performance of encoder.
7. Test the performance of RS, D, T & JK flip-flops.
8. Test the performance of parity generator and checker using parity checker / generator IC's.
9. Test the performance of multiplexer using IC 4051.
10. Test the performance of De-multiplexer using IC 4051 .

11. Test the performance of inverting amplifier and non-inverting amplifier using Op-amp IC 741.
12. Test the performance of summing amplifier, difference amplifier.
13. Test the performance of zero crossing detector and voltage comparator using Op-amp IC 741.
14. Test the performance of integrator and differentiator using Op-amp IC 741.
15. Test the performance of astable multivibrator using IC 555.
16. Test the performance of IC voltage regulator power supplies using IC 7805, IC 7912.

AUTONOMOUS EXAMINATION

Note: All the exercises have to be completed. Any one exercise will be given for examination. All the exercises should be given in the question paper and students are allowed to select the question by lot. All students should submit record notebook for the practical examination

DETAILED ALLOCATION OF MARKS

Sl. No.	Name of the Activity	Max. Marks
1	Circuit Diagram	25
2	Connection	30
3	Execution & Handling of Equipment	20
4	Output / Result	15
5	Viva-voce	10
TOTAL		**100**

6347 - SIMULATION - II PRACTICAL

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6347 SIMULATION - II PRACTICAL	4 Hrs	64 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

EXPERIMENTS: 64 Hrs

1. Generate a signal using function generator and measure frequency and amplitude with CRO using simulation.
2. Construct the circuit for addition and subtraction of two numbers using simulation.
3. Construct the circuit for adding two waveforms using simulation.
4. Construct the circuit to perform multiplication of two arrays using simulation.
5. Construct the circuit to plot random set of data using three different charts (strip, scope and sweep) using simulation.
6. Construct the circuit to find factorial of the given number using simulation.
7. Construct the circuit to create username and password for login purpose using simulation.
8. Construct the circuit to develop sub VI for arithmetic calculator using simulation.
9. Construct the multiplexer circuit and verify its output with truth table using simulation
10. Construct the demultiplexer circuit and verify its output with truth table using simulation
11. Construct the encoder circuit and verify its output with truth table using simulation.
12. Construct the decoder circuit and verify its output with truth table using simulation.
13. Solving Boolean equation.

AUTONOMOUS EXAMINATION

Note: All the exercises have to be completed. Any one exercise will be given for examination. All the exercises should be given in the question paper and students are allowed to select the question by lot. All students should submit record notebook for the practical examination.

DETAILED ALLOCATION OF MARKS

Sl. No.	Name of the Activity	Max. Marks
1	Circuit Diagram (Manual Diagram)	30

2	Development of Circuit Diagram	30
3	Simulation Performance & Print out	35
4	Viva-voce	05
	Total	**100**

FIFTH SEMESTER

6351 - GENERATION, TRANSMISSION AND SWITCHGEAR

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6351 GENERATION, TRANSMISSION AND SWITCHGEAR	6 Hrs	96 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

UNIT - I

GENERATION OF ELECTRICAL POWER **18 Hrs**

Introduction- conventional methods of power generations - schematic arrangement and choice of site for hydro, thermal, nuclear power plants - advantages and disadvantages - comparison of these power plants - principle and types of co-generation. schematic arrangement of diesel, gas, pumped storage schemes - advantages and disadvantages - grid or inter connected system - advantages of inter connected systems - load transfer through inter connector - load curves and load duration curves - connected load-average load - maximum demand factor - plant capacity factor - load factor and its significance - diversity factor - simple problems - load sharing between base load and peak load plants. renewable energy sources - basic principle of solar energy, wind power - generation - hybrid renewable energy systems.

UNIT - II

AC AND HVDC TRANSMISSION

Chapter 2.1: AC Transmission **12 Hrs**

Introduction - typical layout of AC power supply scheme - advantages and disadvantages of AC transmission - high transmission voltage - advantages - economic choice of transmission voltage - elements of a transmission line - over head line -conductor materials and their properties - line supports - properties - types of supports and their applications - spacing between conductors - length of span - sag in overhead lines - calculation of sag - when the supports are at equal and unequal levels - problems - effect of wind and ice loading over the line conductor (qualitative treatment only) - constants of a transmission line - transposition of transmission lines - skin effect - ferranti effect - corona formation and corona loss - factors affecting corona - advantages and disadvantages - classification of OH transmission lines - performance of single phase short transmission line - voltage regulation and transmission efficiency - problems.

Chapter 2.2: HVDC Transmission **06 Hrs**

Advantages and disadvantages of DC transmission - layout scheme and principle of high voltage DC transmission - DC link configurations (monopolar, bipolar and homopolar) - HVDC convertor station (schematic diagram only).

UNIT - III

FACTS, LINE INSULATORS AND UNDERGROUND CABLES

Chapter 3.1: FACTS **04 Hrs**

Definition - need for FACTS controllers- types of FACTS controllers - SVS - STATCOM -UPFC (block diagram explanation only).

Chapter 3.2: Line Insulators **07 Hrs**

Introduction - line insulator materials - properties of insulators - types and causes of failure of insulators - testing of insulators - potential distribution over suspension insulator string - string efficiency - methods of improving string efficiency - problems.

Chapter 3.3: Underground cables **07 Hrs**

Introduction - advantages and requirement of cables - construction of a three - core cable - insulating materials for cables - properties of insulating materials used in cables -classification of cables - cables for three phase service - construction of belted cable, screened cable, pressure cables - laying of underground cables - direct laying, drawing system, advantages and disadvantages.

UNIT - IV

CIRCUIT BREAKERS AND OVER VOLTAGE PROTECTION

Chapter 4.1: Circuit Breakers **09 Hrs**

Switch gear - essential features of switch gear-faults in a power system (definition only). basic principle of circuit breaker - arc phenomenon - methods of arc extinction-arc voltage - re-striking voltage and recovery voltage - rate of rise of re-striking voltage C.B ratings - breaking capacity, making capacity, short time rating - auto reclosing in circuit breakers - classification of circuit breakers - construction and working principle of air circuit breakers, E.L.C.B, residual current circuit breaker SF6 and vacuum circuit breaker maintenance of circuit breakers - rupturing capacity of circuit breaker - conditions to trip - auto reclose breaker - fault clearance time - inverse time overload relay - maintenance requirement for oil circuit breakers - SF6 circuit breakers - miniature circuit breaker.

Chapter 4.2: Fuses **04 Hrs**

L.V fuses - rewireable fuse, HRC fuse - H.V. fuses & cartridge type, liquid type and metal clad fuses.

Chapter 4.3: Over Voltage Protection **05 Hrs**

Voltage surge - causes of over voltage - lightning - types of lightning strokes - direct stroke, indirect stroke - harmful effects of lightning - protection against lighting - earthing screen, overhead ground wires, lighting arresters - expulsion type, gapless arrester.

UNIT - V

PROTECTIVE RELAYS, GROUNDING AND EARTHING

Chapter 5.1: Protective Relays and Grounding **11 Hrs**

Basic principle - fundamental requirements of protective relaying - primary and back up protection - relay characteristics - relay timing - instantaneous relay - inverse time relay and definite time lag relay - inverse definite minimum time relay - classification of relays - construction, principle of operation and applications of induction type over current relay (directional and non-directional), differential relay - static relays - basic elements of static relay - over current - distance relay (block diagram explanation only).

Chapter 5.2: Grounding and Earthing **06 Hrs**

Introduction - equipment grounding - system grounding - ungrounded neutral system - necessity of neutral grounding - methods - solid grounding, resistance grounding, reactance grounding and resonant grounding - earthing - definition - necessity - types - pipe, plate.

Text Books:

1. Principles of Power System, V.K.Metha, S.Chand & Company, NewDelhi, 4th Edition Reprint 2007.
2. Electrical Power System, CLWadhawa, New Age International, New Delhi, Sixth Edition.

Reference Books:

1. Course in Electrical Power, Soni, Gupta, DhanpathRai&Co (P) Ltd, New Delhi.
2. Electrical Power, S.L Uppal, Khanna Delhi Publishers.
3. A Course in Electrical Power, J.B. Gupta, Kaison Publishing House, Reprint 2004.
4. HVDC Power Transmission System & Technology, KR. Padiyar New Age Int., New Delhi, Reprint 2005.
5. Power System Protection and Switchgear, B Ram & DN Viswakarma, TMH 1995, Reprint 2000.
6. Thyristor-Based Facts Controllers for Electrical Transmission Systems, Mohan Mathur.R., Rajiv. K.Varma, IEEE press and John Wiley & Sons, Inc., New, 2005.

*** Pattern of End Semester Exam Question Paper - General Pattern (Theory)**

6352 - MICROCONTROLLER AND ITS APPLICATIONS

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION	EXAMINATION

6352 MICROCONTROLLER AND ITS APPLICATIONS	Hrs / Week	Hrs / Sem	Marks			Duration
	7 Hrs	112 Hrs	Internal Assessment	External Exam*	Total	
			25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

UNIT - I

ARCHITECTURE OF 8051 MICROCONTROLLER **21 Hrs**

Microprocessor - microcontroller - comparison of microprocessor and microcontroller - architecture diagram of microcontroller 8051 - functions of each block - pin details of 8051 - ALU - ROM - RAM - memory organization of 8051 - special function registers -program counter - PSW register - stack - I/O ports - timer - interrupt - serial port - external memory - oscillator and clock - reset - power on reset - clock cycle - machine cycle - instruction cycle - overview of 8051 family.

UNIT - II

8051 INSTRUCTION SET AND PROGRAMMING

Chapter 2.1: Instruction Set of 8051 **11 Hrs**

Instruction set of 8051 - classification of 8051 instructions - data transfer instructions - arithmetic instructions - logical instructions - branching instructions - bit manipulation instructions - assembling and running an 8051 program - structure of assembly language-assembler directives - different addressing modes of 8051 - time delay routines.

Chapter 2.2: Assembly language Programs **10 Hrs**

16 bit addition and 16 bit subtraction - 8 bit multiplication and 8 bit divisions - BCD to HEX code conversion - HEX to BCD code conversion. - smallest number/ biggest number.

UNIT - III

PERIPHERALS OF 8051

Chapter 3.1: I/O Ports **05 Hrs**

Bit addresses for I/O ports - I/O port programming - I/O bit manipulation programming.

Chapter 3.2: Timer/Counter **05 Hrs**

SFRS for Timer - Modes of Timers/counters - Programming 8051 Timer (simple programs).

Chapter 3.3: Serial Communication **06 Hrs**

Basics of serial communication - SFRs for serial communication - RS232 standard - 8051 connection to RS 232 - 8051 serial port programming.

Chapter 3.4: Interrupts **05 Hrs**

8051 interrupts - SFRs for interrupt - interrupt priority.

UNIT - IV

INTERFACING TECHNIQUES

Chapter 4.1: IC 8255 **05 Hrs**

IC 8255 - block diagram - modes of 8255 - 8051 interfacing with 8255

Chapter 4.2: Interfacing **16 Hrs**

Interfacing external memory to 8051 - relay interfacing - sensor interfacing - seven segment LED display interfacing - keyboard interfacing - stepper motor interfacing - ADC interfacing - DAC interfacing - DC motor interfacing using PWM - LCD interfacing - external memory Interfacing.

UNIT - V

ADVANCED MICROCONTROLLERS

Chapter 5.1: Types of microcontrollers **15 Hrs**

PIC microcontroller - general block diagram - features - applications - arduino - general block diagram - pin diagram - variants - features - applications - raspberry pi-general block diagram - features - applications - comparison of microcontrollers.

Chapter 5.2: IoT **06 Hrs**

Introduction to IoT - block diagram of home automation using IoT.

Text books:

1. Microcontrollers Principles and Applications, Ajit pal, PHI Ltd,2011.
2. 8051 Microcontroller and Embedded Systems using Assembly and C, Mazidi,Mazidi and D.MacKinlay" 2006 Pearson Education Low Price Edition.

Reference Books:

1. Microprocessor and Microcontroller, R. Thyagarajan, Sci Tech Publication, Chennai.
2. Design with PIC microcontrollers, J.B. Peatman.

*** Pattern of End Semester Exam Question Paper - General Pattern (Theory)**

6353.1 ELECTIVE THEORY - I: CONTROL OF ELECTRICAL MACHINES

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
6353.1 CONTROL OF ELECTRICAL MACHINES	6 Hrs	96 Hrs	Internal Assessment	External Exam*	Total	
			25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

UNIT - I

CONTROL CIRCUIT COMPONENTS **18 Hrs**

Switches - push button, selector, drum, limit, pressure, temperature (thermostat), float, zero speed and proximity switches - relays - voltage relay, DC series current relay, frequency response relay, latching relay and phase failure relay (single phasing preventer) - over current relay - bimetallic thermal over load relay and magnetic dash pot oil filled relay - timer - thermal pneumatic and electronic timer - solenoid valve, solenoid type contactor (air break contactor), solid state relay, simple ON-OFF motor control circuit, remote control operation and interlocking of drives.

UNIT - II

MOTOR CONTROL CIRCUITS

Chapter 2.1: DC Motor Control Circuits **04 Hrs**

Series relay and counter EMF starters - field failure protection - jogging control, dynamic braking.

Chapter 2.2: AC Motor Control Circuits **14 Hrs**

Motor current at start and during acceleration - no load speed and final speed of motor DOL starter - automatic auto transformer starter (open circuit and closed circuit transition) – star / delta starter (semi-automatic and automatic) - starter for two speed two winding motor - reversing the direction of rotation of induction motor - dynamic braking - plugging of induction motor - three step rotor resistance starter for wound induction motor - secondary frequency acceleration starter.

UNIT - III

INDUSTRIAL CONTROL CIRCUITS **18 Hrs**

Planner machine control - skip hoist control - automatic control of a water pump - control of electric oven - control of air compressor - control of over head crane - control of battery - operated truck - control of conveyor system - control of elevator - trouble spots in control circuits - general procedure for trouble shooting.

UNIT - IV

PROGRAMMABLE LOGIC CONTROLLER **18 Hrs**

Automation - types of automation (manufacturing and non - manufacturing) - advantages of automation - PLC introduction - block diagram of PLC - principle of operation - modes of operation - PLC scan - memory organization - input module (schematic and wiring diagram) - output module (schematic and wiring diagram). types of programming devices - comparison between hardwire control system and PLC system - PLC types (fixed and modular) - input types - output types - criteria for selection of suitable PLC - list of various PLCs available.

UNIT - V

PLC PROGRAMMING AND SCADA **17 Hrs**

Different programming languages - ladder diagram - relay type instruction - timer instruction - ON Delay and OFF Delay timer - retentive timer instruction - cascading timers - counter instruction UP counter - down counter - UP/DOWN Counter - ladder logic diagram for DOL starter, automatic star-delta starter - rotor resistance starter and EB to generator change over system - supervisory control data acquisition system (SCADA) - block diagram of SCADA, features and functions of SCADA - introduction to DCS.

Text Book:

1. Control of Electrical Machines, "S.K.Battacharya, New Age International Publishers, New Delhi.

Reference Books:

1. Exposing Programmable Logic Controllers with Application, Pradeep Kumar, Srivastava, BPB Publications.
2. Industrial Motor Control, Stephen Herman, 6th Edition, Cengage Learning.
3. Practical SCADA for Industry, David Bailey, Edwin Wright, Newnes Publishers.

*** Pattern of End Semester Exam Question Paper - General Pattern (Theory)**

6353.2 - ELECTIVE THEORY - I: PROGRAMMABLE LOGIC CONTROLLER

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
6353.2 PROGRAMMABLE LOGIC CONTROLLER	6 Hrs	96 Hrs	Internal Assessment	External Exam*	Total	
			25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

UNIT - I

INTRODUCTION TO PLC **18 Hrs**

Automation - types of automation (manufacturing and non- manufacturing) - advantages of automation - PLC introduction - definition - block diagram of PLC - principle of operation - modes of operating system - PLC scan - hardwire control system compared with PLC system - advantages and disadvantages of PLCs - criteria for selection of suitable PLC - memory organization - input types - discrete input - analog in/out - elements of power supply unit - PLC types (fixed I/O and Modular I/O) - list of various PLCs available - applications of PLC.

UNIT - II

INPUT/OUTPUT MODULES **18 Hrs**

The I/O section - discrete I/O modules (DC and AC) - analog I/O modules - special I/O modules - I/O module specification - typical discrete and analog I/O field devices -sensors - limit switch - reed switch - proximity sensor (inductive and capacitive) - types of photo electric sensor - sinking and sourcing I/O modules - TTL output module - relay output module - isolated output module - input /output addressing scheme in important commercial PLCs.

UNIT - III

PLC PROGRAMMING **18 Hrs**

Types of programming methods - types of programming devices - logic functions - AND Logic - OR logic - NOT logic - relay type instructions -timer instructions - ON delay and OFF delay timer - retentive timer instruction - cascading timers - counter instruction - UP counter - DOWN counter - UP/DOWN counter - cascading counters - program control instructions - data manipulation instruction - data compare instructions - math instructions - sequencer instructions - PID instruction - PWM function - simple programs using above instructions - develop ladder logic for: bottle filling system - automatic car parking system - EB to generator changeover system - batch process - elevator system - DOL starter - automatic star-delta starter - traffic light control.

UNIT - IV

NETWORKING **18 Hrs**

Levels of industrial network - network topology - network protocol - OSI reference model -

networking with TCP / IP protocol - I/O bus networks - block diagram of I/O bus networks - types of I/O bus networks - protocol standards - advantages of I/O bus networks - gateway - token passing - data highway - serial communication - device net - control net - ethernet - modbus - fieldbus - profibus - sub netting - subnet mask - file transfer protocol - PLC maintenance - Internal and external PLC fault.

UNIT - V

DATA ACQUISITION SYSTEMS **17 Hrs**

Computers in process control - types of processes - structure of control system - ON/OFF control - closed loop control - PID control - motion control - block diagram of direct digital control - supervisory control and data acquisition (SCADA) - block diagram of SCADA - features of SCADA - functions of SCADA - SCADA software - data loggers - tags - alarms - landlines for SCADA - use of modems in SCADA.

Text books:

1. Programmable Logic Controllers - Principle and Applications, John W. Webb, Prentice Hall.
2. Programmable Logic Controllers, W. Bolton, Newness.

Reference books:

1. Programmable Logic Controllers, Frank D.Petruzella, Tata McGraw Hill Edition-Fourth Edition 2011.
2. Practical SCADA for industry, David Bailey Edwin Wright, Newnes.

*** Pattern of End Semester Exam Question Paper - General Pattern (Theory)**

6353.3 - ELECTIVE THEORY - I: RENEWABLE ENERGY SOURCES

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6353.3 RENEWABLE ENERGY SOURCES	6 Hrs	96 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

UNIT - I

FUNDAMENTALS OF ENERGY SYSTEMS AND SOLARRADIATION

Chapter 1.1: Fundamentals of Energy Systems **09 Hrs**

Introduction to energy - energy consumption and standard of living - classification of energy resources - consumption trend of primary energy resources - importance of renewable energy sources - energy for sustainable development - various forms of renewable energy.

Chapter 1.2: Solar Radiation **09 Hrs**

Outside earth's atmosphere - earth surface - analysis of solar radiation data - geometry - measurement of solar radiation - solar radiation data in India.

UNIT - II

SOLAR THERMAL CONVERSION AND SOLAR PV SYSTEMS

Chapter 2.1: Solar Thermal Applications **09 Hrs**

Solar collectors - flat plate collectors - concentrating collectors - comparison of collectors - selection of collector for various applications - solar water heaters - solar industrial heating system - solar cookers - solar pond electric power plant.

Chapter 2.2: Solar PV systems **09 Hrs**

A brief history of PV, PV in silicon: basic principle, classification of PV Cells - equivalent circuit and electrical characteristics of silicon PV cells - series parallel connections of Solar cells - solar PV array and solar panel - solar panel applications - grid connected PV system - equipments required for grid connected system - stand alone solar PV power plant - hybrid solar PV system.

UNIT - III

WIND, TIDAL & WAVE ENERGY

Chapter 3.1: Wind Energy **12 Hrs**

Introduction - basic principles of wind energy conversion: nature of the wind, power in the wind, forces on the blades and wind energy conversion - wind data and energy estimation - site selection - classification of wind energy conversion systems - types of wind machines - horizontal axis wind turbine(HAWT) - vertical axis wind turbine(VAWT) - comparison between HAWT & VAWT - generating system - energy storage - applications of wind energy - power generation - pumping station - safety and environmental aspects.

Chapter 3.2: Tidal & Wave Energy **06 Hrs**

Basic principle of tidal power - components and operation of tidal power plant - wave energy - wave energy conversion devices.

UNIT - IV

BIO - ENERGY

Chapter 4.1: Biomass Resources **08 Hrs**

Introduction - photo synthesis - usable forms of bio mass, their composition and fuel properties - biomass resources.

Chapter 4.2: Biomass Energy Conversion **10 Hrs**

Biomass conversion technologies - urban waste to energy conversion - biomass gasification - biomass liquefaction - biomass to ethanol production - biogas production from waste biomass - types of bio gas plants - applications - bio diesel production - biomass energy scenario in India.

UNIT - V

GEOTHERMAL AND OCEANIC ENERGY

Chapter 5.1: Geo Thermal Energy **08 Hrs**

Energy inside the earth - uses of geothermal energy - geothermal wells - potential in India - types of geothermal heat pump systems - types of geothermal power plants.

Chapter 5.2: Oceanic Energy **09 Hrs**

Ocean energy resources - principle of ocean thermal energy conversion (OTEC) - method of ocean thermal electric power generation.

Text Book:

1. Non-Conventional Energy Sources, G.D. Rai, Khanna Publishers,New Delhi - 1999.

Reference Books:

1. Non-Conventional Energy Sources and Utilization, R.K. Rajput, S.Chand & Company Ltd. - 2012.
2. Renewable Energy Sources, Twidell J.W. and Weir A, EFN Spon Ltd. - 1986.
3. Non-Conventional Energy Resources, B.H.Khan, Tata Mc Graw Hill., New Delhi. - 2nd Edn, 2009.

*** Pattern of End Semester Exam Question Paper - General Pattern (Theory)**

6354 - MICROCONTROLLER PRACTICAL

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
6354 MICROCONTROLLER PRACTICAL	4 Hrs	64 Hrs	Internal Assessment	External Exam*	Total	
			25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

PART A **40 Hrs**

1. Write an assembly language program for adding two 8 bit numbers and execute it using 8051 microcontroller.
2. Write an assembly language program for subtracting two 8 bit numbers and execute it using 8051 microcontroller.
3. Write an assembly language program for multiplying two 8 bit numbers and execute it using 8051 microcontroller.
4. Write an assembly language program for dividing two 8 bit numbers and execute it using 8051 microcontroller.

5. Write an assembly language program for multi - byte addition of given numbers and execute it using 8051 microcontroller.
6. Write an assembly language program for converting BCD to HEX code and execute it using 8051 microcontroller.
7. Write an assembly language program for converting HEX to BCD code and execute it using 8051 microcontroller.
8. Write an assembly language program for converting HEX to ASCII code and execute it using 8051 microcontroller.
9. Write an assembly language program for finding maximum value in an array and execute it using 8051 microcontroller.

PART B (INTERFACING APPLICATION BOARDS) 24 Hrs

10. Write an assembly language program for interfacing ADC 0808 with 8051 and execute it.
11. Write an assembly language program for interfacing push to on switches and relays and execute it.
12. Write an assembly language program for interfacing the 4*4 key matrix with 8051 and execute it.
13. Write an assembly language program for interfacing stepper motor with 8051 and execute it.
14. Write an assembly language program for interfacing seven segment LED display or LCD with 8051 and execute it.
15. Write an assembly language program for interfacing DC motor with 8051 and execute it.

AUTONOMOUS EXAMINATION

Note: All the exercises have to be completed. Any one exercise will be given for examination. All the exercises should be given in the question paper and students are allowed to select the question by lot. All students should submit record notebook for the practical examination.

DETAILED ALLOCATION OF MARKS

Sl. No.	Name of the Activity	Max. Marks
1	Algorithm or Flow Chart	20
2	Program	30
3	Execution	30
4	Result	10
5	Viva-voce	10
Total		**100**

6355 - COMPUTER AIDED ELECTRICAL DRAWING PRACTICAL

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6355 COMPUTER AIDED ELECTRICAL DRAWING PRACTICAL	4 Hrs	64 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

EXPERIMENTS: 64 Hrs

1. Draw the single line diagram of single phase MCB distribution board.
2. Draw the single line diagram of three phase MCB distribution board.
3. Draw the single line diagram of typical MV panel.
4. Draw the single line diagram of motor control centre (MCC) panel.
5. Draw the single line diagram of fire alarm riser arrangement in multi - storey building.
6. Draw the single line diagram of intercom arrangement in multi - storey building.
7. Draw the front-end schematic diagram of typical sub switch board (SSB).
8. Draw the winding diagram of lap connected DC armature with commutators connections and brush positions
9. Draw the control and main circuit of automatic star delta starter.

10. Draw the single line diagram of 4 point starter.
11. Draw the single line diagram for OFF load tap changer
12. Draw the mush winding diagram of a three phase induction motor.
13. Draw the concentric winding diagram of a single-phase induction motor.

AUTONOMOUS EXAMINATION

Note: All the exercises have to be completed. Any one exercise will be given for examination. All the exercises should be given in the question paper and students are allowed to select the question by lot. All students should submit record notebook for the practical examination.

DETAILED ALLOCATION OF MARKS

Sl. No.	Name of the Activity	Max. Marks
1	Manual Drawing of Electrical Connection diagram	30
2	Electrical Connection Diagram in CAD	40
3	Print Out	20
4	Viva-voce	10
Total		**100**

6356.1 - ELECTIVE PRACTICAL - I: CONTROL OF ELECTRICAL MACHINES PRACTICAL

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6356.1 CONTROL OF ELECTRICAL MACHINES PRACTICAL	4 Hrs	64 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

EXPERIMENTS: **64 Hrs**

1. Wire and test the control circuit for jogging in cage induction motor.
2. Wire and test the control circuit for semi-automatic star-delta starter.
3. Wire and test the control circuit for automatic star-delta starter.
4. Wire and test the control circuit for dynamic braking of cage motor.
5. Wire and test the control circuit for two speed pole changing motor.
6. Wire and test the control circuit for forward and reverse operation.
7. Wire and test the control circuit for automatic rotor resistance starter.
8. Wire and test the DOL starter with single phase preventer using PLC.
9. Wire and test the star-delta starter using PLC.
10. Wire and test the control circuit for automatic rotor resistance starter using PLC.
11. Develop and execute the ladder logic diagram in PLC for 3 stage lift operation.
12. Wire and test the sequential operation of solenoid valve and a motor for tank filling operation using PLC.
13. Develop and execute the ladder logic to interface PLC with conveyor model for counting the object moving in the conveyer.
14. Wire and test the control circuit for jog forward, jog reverse, forward and reverse operations using PLC.

AUTONOMOUS EXAMINATION

Note: All the exercises have to be completed. Any one exercise will be given for examination. All the exercises should be given in the question paper and students are allowed to select the question by lot. All students should submit record notebook for the practical examination.

DETAILED ALLOCATION OF MARKS

Sl. No.	Name of the Activity	Max. Marks
1	Drawing connection/ladder diagram and writing details of the components/equipment/machines used	25

2	Making the correct circuit connections	20
3	Conducting the Experiment - Following the correct procedure - Verifying the operation / appropriate readings - Following the appropriate safety procedure	30
4	Tabulation of readings / interpretation of results graphical representation (if required)	20
5	Viva-voce	05
Total		**100**

6356.2 - ELECTIVE PRACTICAL - I:
PROGRAMMABLE LOGIC CONTROLLER PRACTICAL

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6356.2 PROGRAMMABLE LOGIC CONTROLLER PRACTICAL	4 Hrs	64 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

EXPERIMENTS: 64 Hrs

1. Develop the ladder diagram for the truth table of logic gates. (OR, AND, NOT, NOR, NAND Gates) and verify its output in PLC.
2. Develop the ladder logic diagram for the jogging control of an induction motor and execute it in the PLC.
3. Develop the ladder logic diagram for the forward and reverse of an induction motor using PLC.
4. Develop the ladder logic diagram for on-delay timer and off delay timer using PLC.
5. Develop the ladder logic diagram for retentive timer using PLC.
6. Develop the ladder logic diagram for fully automatic star / delta starter and execute it in the PLC.
7. Develop and test the ladder logic diagram for traffic light system using PLC.
8. Develop the ladder logic diagram for the two speed pole changing motor using PLC.
9. Develop the ladder logic diagram for the comparison instructions (equal, less than, less than or equal, greater than, greater than or equal).
10. Develop the ladder logic diagram for the arithmetic instructions (addition, subtraction, multiplication and division).
11. Develop the ladder logic diagram for the car-parking using counter in PLC.
12. Develop ladder logic diagram for three floor lift control.

AUTONOMOUS EXAMINATION

Note: All the exercises have to be completed. Any one exercise will be given for examination. All the exercises should be given in the question paper and students are allowed to select the question by lot. All students should submit record notebook for the practical examination.

DETAILED ALLOCATION OF MARKS

Sl. No.	Name of the Activity	Max. Marks
1	Drawing Connection/Ladder Diagram and Writing Details of the Components/Equipment/Machines used	25
2	Making the correct circuit connections	20
3	Conducting the Experiment - Following the correct procedure - Verifying the operation / appropriate readings - Following the appropriate safety procedure	30

4	Tabulation of Readings / Interpretation of Results Graphical Representation (If required)	20
5	Viva-voce	05
Total		**100**

6356.3 - ELECTIVE PRACTICAL - I: RENEWABLE ENERGY SOURCES PRACTICAL

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6356.3 RENEWABLE ENERGY SOURCES PRACTICAL	4 Hrs	64 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

EXPERIMENTS: **64 Hrs**

Solar PV Module

1. Measurement of solar radiation.
2. I-V and P-V characteristics of PV module.
3. I-V and P-V characteristics of PV modules in series.
4. I-V and P-V characteristics of PV modules in parallel.
5. Effect of tilt angle on PV module power.
6. Effect of shading on output of solar panel.
7. Working of blocking diode.

Power flow calculation

8. Power flow calculation of standalone PV system for AC load.
9. Power flow calculation of standalone PV system for DC load.
10. Calculation of maximum power point.

Solar Thermal conversion

11. Direct type solar dryer.
12. Indirect type solar dryer.
13. Solar water heater.
14. Solar cooker.
15. Solar air heater.

Wind mill

16. Demo model of wind mill.

AUTONOMOUS EXAMINATION

Note: All the exercises have to be completed. Any one exercise will be given for examination. All the exercises should be given in the question paper and students are allowed to select the question by lot. All students should submit record notebook for the practical examination.

DETAILED ALLOCATION OF MARKS

Sl. No.	Name of the Activity	Max. Marks
1	Procedure	25
2	Sketches/Circuit diagram	25
3	Tabulation	15
4	Calculation/graph	15
5	Result	15
6	Viva - voce	05
Total		**100**

6357 - ENTREPRENERUSHIP AND STARTUPS

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
6357 ENTREPRENERUSHIP AND STARTUPS	4 Hrs	64 Hrs	Internal Assessment	External Exam*	Total	
			25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

UNIT - I

ENTREPRENEURSHIP - INTRODUCTION AND PROCESS — 10 Hrs

- Concept, functions and importance.
- Myths about entrepreneurship.
- Pros and cons of entrepreneurship.
- Process of entrepreneurship.
- Benefits of entrepreneur.
- Competencies and characteristics.
- Ethical entrepreneurship.
- Entrepreneurial values and attitudes.
- Motivation.
- Creativity.
- Innovation.
- Entrepreneurs - as problem solvers.
- Mindset of an employee and an entrepreneur.
- Business failure - causes and remedies.
- Role of networking in entrepreneurship.

UNIT - II

BUSINESS IDEA AND BANKING — 10 Hrs

- Types of business: manufacturing, trading and services.
- Stakeholders: sellers, vendors and consumers.
- E- commerce business models.
- Types of resources - human, capital and entrepreneurial tools.
- Goals of business and goal setting.
- Patent, copyright and intellectual property rights.
- Negotiations - importance and methods.
- Customer relations and vendor management.
- Size and capital based classification of business enterprises.
- Role of financial institutions.
- Role of Government policy.
- Entrepreneurial support systems.
- Incentive schemes for state Government.
- Incentive schemes for central Government.

UNIT - III

STARTUPS, E-CELL AND SUCCESS STORIES — 10 Hrs

- Concept of incubation center's.
- Activities of DIC, financial institutions and other relevance institutions.
- Success stories of Indian and global business legends.
- Field visit to MSME's.
- Various sources of information.
- Learn to earn.

- Startup and its stages.
- Role of technology - E-commerce and social media.
- Role of E-cell.
- E-cell to entrepreneurship.

UNIT - IV

PRICING AND COST ANALYSIS **10 Hrs**

- Calculation of unit of sale, unit price and unit cost.
- Types of costs - variable and fixed, operational costs.
- Break even analysis.
- Understand the meaning and concept of the term cash inflow and cash outflow.
- Prepare a cash flow projection, Pricing and factors affecting pricing.
- Understand the importance and preparation of income statement.
- Launch strategies after pricing and proof of concept.
- Branding - business name, logo, tag line.
- Promotion strategy.

UNIT - V

BUSINESS PLAN PREPARATION **10 Hrs**

- Generation of ideas.
- Business ideas vs. business opportunities.
- Selecting the right opportunity and Product selection.
- New product development and analysis.
- Feasibility study report - technical analysis, financial analysis and commercial analysis.
- Market research - concept, importance and process.
- Marketing and sales strategy and Digital marketing.
- Social entrepreneurship.
- Risk taking-concept and Types of business risks.

FIELD VISITS AND PREPARATION OF CASE STUDY REPORT **14 Hrs**

Text Books:

1. Dr. G.K. Varshney, Fundamentals of Entrepreneurship, Sahitya Bhawan Publications, Agra – 28,2002
2. Dr. G.K. Varshney, Business Regulatory Framework, Sahitya Bhawan Publications, Agra – 28,2002

Reference Books:

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Entrepreneurship , McGraw Hill (India) Private Limited, Noida – 201301.
2. M.Scarborough, R.Cornwell, Essentials of Entrepreneurship and small business management, Pearson Education India, Noida – 201301.
3. Charantimath Poornima M. Entrepreneurship Development and Small Business Enterprises, Pearson Education, Noida – 201301.
4. Trott, Innovation Management and New Product Development, Pearson Education, Noida – 201301.
5. M N Arora, A Textbook of Cost and Management Accounting, Vikas Publishing House Pvt. Ltd., New Delhi-110044.
6. Prasanna Chandra, Financial Management, Tata McGraw Hill education private limited, New Delhi
7. I. V. Trivedi, Renu Jatana, Indian Banking System, RBSA Publishers, Rajasthan.

Evaluation Pattern (Internal Mark Allocation)

Assignment (Theory portion)*	10 marks
Seminar Presentation	10 marks
Attendance	05 marks
Total	**25 marks**

Note: * Two assignments should be given. The same must be evaluated and converted to 10 marks. Each assignment should have five three mark questions and two five mark questions.

AUTONOMOUS EXAMINATION

Note:

The students should be taught all units and proper exposure and field visit also arranged. All the portions should be completed before examinations. The students should maintain theory assignments and seminar presentation and should submit during the Practical Examinations. The question paper consists of theory and practical portions. All students should write the answers for theory questions (45 Marks) and practical portions (55 Marks). All exercises should be given in the question paper and students are allowed to select by lot.

For Written Examination: Theory question and answers: 45 Marks

Ten questions will be asked for 3 marks each. Five questions from Unit 1 & Five questions from Unit 2. (10 x 3 = 30).

Three questions will be asked for 5 marks each. One question from Unit 1, One question from Unit 2 & One question from Unit 3. (3 x 5 = 15)

For Practical Examination:

The business plan / feasibility report or report on unit 4 & unit 5 should be submitted during the practical examinations. The same have to be evaluated for the report submission (40 marks).

DETAILED ALLOCATION OF MARKS

Sl. No	Description	Marks
Part A	Written Examination - theory question and answer 10 questions x 3 marks = 30 marks 03 questions x 5 marks = 15 marks	45
Part B	Practical Examination - submission on business plan / feasibility report or report	40
Part C	Viva-voce	15
	Total	**100**

SIXTH SEMESTER

6361 - DISTRIBUTION AND UTILIZATION

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6361 DISTRIBUTION AND UTILIZATION	6 Hrs	96 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

UNIT - I

DISTRIBUTION

Chapter 1.1: Substation **07 Hrs**

Introduction - sub stations - classification of sub stations - indoor and outdoor sub stations - gas insulated sub stations - comparisons - layout 110v / 11kv substation and 11kv / 400v distribution substation - substation equipments - bus bar - types of bus bar arrangement - advantages and disadvantages.

Chapter 1.2: Distribution **11 Hrs**

Distribution system - requirements of a distribution system - part of distribution system - classification of distribution systems - comparison of different distribution systems (AC and DC) - AC Distribution - types - connection schemes of distribution system - AC distribution calculations - calculation of voltage at load points on single phase distribution systems (with concentrated load only) - distribution fed at one end, both ends and ring mains - problems - three phase, four wire, star connected unbalanced load circuit - problems - consequence of disconnection of neutral in three phase four wire system (illustration with an example)

UNIT - II

INDUSTRIAL DRIVES **18 Hrs**

Introduction to electric drive - advantages of electric drives - transmission of power -types of electric drives - individual, group and multi motor drives - advantages and disadvantages of

individual and group drive - factors governing the selection of motors-nature and classification of load torque - matching of speed torque characteristics of load and motor - standard ratings of motor - classes of load duty cycles - selection of motors for different duty cycles - selection of motors for specific application - braking - features of good braking system - types of braking - advantages of electric braking - plugging, dynamic and regenerative braking - as applied to various motors.

UNIT - III

ELECTRIC TRACTION **09 Hrs**

Chapter 3.1: System of Track Electrification

Introduction to traction systems - advantages and disadvantages of electric traction - system of track electrification - methods of supplying power - rail connected system and over head system - OH equipments - contact wire, catenary and droppers - current collection gear for OHE - bow and pantograph collector - different systems of track electrification - advantages of single phase low frequency AC system - booster transformer - necessity - methods of connecting BT - neutral sectioning.

Chapter 3.2: Traction Mechanics: **09 Hrs**

Units and notations used in traction mechanics - speed time curve for different services - simplified speed time curve - derivation of maximum speed - crest speed, average speed, schedule speed (definitions only) - tractive effort and power requirement - specific energy output - specific energy consumption - traction motors and control: desirable characteristics of traction motors - motors used for traction purpose - methods of starting and speed control of DC Traction motors - rheostatic control - energy saving with plain rheostatic control series - parallel control - energy saving with series parallel starting - shunt transition - bridge - transition - multiple unit control - regenerative braking. recent trends in electric traction - magnetic levitation (MEGLEV) - suspension systems.

UNIT - IV

ILLUMINATION **09 Hrs**

Chapter 4.1: Lighting System

Introduction - definition and units of different terms used in illumination - plane angle, solids angle, light, luminous flux, luminous intensity, luminous efficacy candle power, lumen, illumination, MSCP, MHCP, MHSCP - reduction factor, luminance, glare lamp efficiency. space - height ratio, depreciation factor utilization factor, waste light factor, absorption factor, beam factor, reflection factor - requirements of good lighting system - laws of illumination - problems. types of lighting scheme - factors to be considered while designing lighting scheme - design of lighting scheme (indoor and outdoor) - problems - lighting systems - factory lighting, flood lighting, street lighting.

Chapter 4.2: Sources of Light **06 Hrs**

Arc lamp, incandescent lamp, halogen lamp, sodium vapor lamp, high pressure mercury vapor lamp, fluorescent tube - induction lamp - metal halide lamp - energy saving lamps (CFL and LED lamps) - limitation and disposal of CFL - benefits of led lamps - comparison of lumen output for LED, CFL and incandescent lamp.

Chapter 4.3: Earthing and Maintenance of Lighting **03 Hrs**

Fluorescent lamp disposal - precautions in erecting lighting installations - symptoms to identify the end of the useful life of lamp - causes for lowering the illumination level.

UNIT - V

ELECTRIC HEATING AND WELDING

Chapter: 5.1 Electric Heating **05 Hrs**

Introduction - advantages of electric heating - modes of heat transfer - classification of electric heating - power frequency electric heating - direct and indirect resistance heating - infrared heating - arc heating - high frequency electric heating - induction heating - induction stove - eddy current heating and dielectric heating.

Chapter: 5.2 Electric Furnaces **06 Hrs**

Resistance furnace - requirements of heating elements -commonly used heating element materials - resistance furnace for special purposes -temperature control of resistance furnace - arc furnace - direct and indirect arc furnace - temperature control of arc furnace - reasons for

employing low voltage and high current supply - induction furnace - direct and indirect core type induction furnace - coreless induction furnace - power supply for coreless induction furnace.

Chapter: 5.3 Electric Welding **06 Hrs**

Introduction - types of electric welding - requirements of good weld - preparation of work - resistance welding - butt welding, spot welding, seam welding, projection welding and flash welding - arc welding - carbon arc welding, metal arc welding, atomic hydrogen arc welding, inert gas metal arc welding - friction welding - comparison between resistance and arc welding. Radiation welding - ultrasonic welding, electron beam welding, laser beam welding - electric welding equipments (AC and DC).

Text Books:

1 A Course in Electrical Power, Soni&Gupta, Dhanpat Rai& Sons, New Delhi

Reference Books:

1 Electric Power, SL Uppal, Khanna Publishers, New Delhi
2 Modern Electric Traction, H Partab Dhanpat Rai & sons, New Delhi
3 Electrical Power , Distribution System AS Pabla Tata McGraw Hill Publishing Co, New Delhi

*** Pattern of End Semester Exam Question Paper - General Pattern (Theory)**

6362 - POWER ELECTRONICS

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
6362 POWER ELECTRONICS	6 Hrs	96 Hrs	Internal Assessment	External Exam*	Total	
			25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

UNIT - I

THYRISTOR FAMILY, TRIGGER AND COMMUTATION CIRCUITS

Chapter 1.1: Thyristor Family and Trigger Circuits **10 Hrs**

Thyristor family (review) - SCS, SUS, SBS, LASCR and GTO - symbol, circuit, working, characteristics and applications - UJT, SCR, DIAC, TRIAC, IGBT, GTO and MOSFET - gate triggering circuits - requirements, types. circuit, working of - R, RC, synchronized UJT triggering circuits - pulse transformer in trigger circuits - IC based advance triggering circuits for SCR & TRIAC (using IC TCA 785) - driver and power circuits for thyristor.

Chapter 1.2: Commutation Circuits **08 Hrs**

Commutation circuits - SCR turn off methods - natural commutation - forced commutation - class A, class B, class C, class D, class E and class F - SCR rating and their importance.

UNIT - II

PHASE CONTROLLED RECTIFIERS **18 Hrs**

Introduction - phase controlled rectifiers - circuit diagram, working, waveform and application - half wave, full wave controlled rectifier with resistive, inductive loads and free wheeling diode - single phase fully controlled bridge, single phase dual converter with R load, RL load - single phase semi converter with continuous and discontinuous load current. AC-AC converter - three phase half controlled bridge, fully controlled bridge with RL load - complete protection of thyristors against surge current, surge voltage, dv/dt, di/dt protection.

UNIT - III

CHOPPERS AND INVERTERS

Chapter 3.1: Choppers **09 Hrs**

Introduction, principle of chopper operation - control strategies - constant frequency system and variable frequency system - chopper circuit classification - step up chopper, step down chopper, voltage, current, load commutated chopper, fist quadrant, second quadrant, two quadrant and four quadrant choppers - circuit diagram, working and waveform - step up chopper, Morgan

chopper, Jones chopper - applications of choppers – SMPS

Chapter 3.2: Inverters **09 Hrs**

Introduction, classification of inverter - circuit diagram, working and waveform parallel inverter, half bridge inverter, full bridge inverter, modified mc Murray full bridge inverter, mc Murray Bedford full bridge inverter - three phase bridge inverter under 180° mode,120° mode operations - pulse width modulated inverters, (single pulse, multiple pulse, sinusoidal pulse) applications of inverters - UPS - online, offline.

UNIT - IV

CONTROL OF DC DRIVES **18 Hrs**

Introduction - DC drive - basic DC motor speed equation - operating region, armature voltage control, field current control, constant torque and constant HP regions - circuit diagram, output waveforms and output equation of - separately excited DC motor in - a) single phase full converter drives b) single phase dual converter drives c) three phase semi converter drives - power factor improvement in phase controlled converter - DC chopper for series motor drive - four quadrant control of DC motor - DC to DC converter using MOSFET and IGBT - block diagram, explanations of closed loop control of DC drives, phase locked loop control of DC drives - microprocessor based closed loop control of DC drives.

UNIT - V

CONTROL OF AC DRIVES **17 Hrs**

Introduction AC drive - torque speed characteristics of three phase induction motor, speed control of induction motor, stator voltage control, variable frequency control, necessity of maintaining v/f ratio - rotor resistance control inverters for variable voltage and variable frequency control - static var compensation. speed control by rotor resistance for slip ring induction motors - static scherbius drive (slip power recovery scheme) - closed loop control of AC drive block diagram - micro computer based pwm control of induction motor - introduction to cycloconverter with simple circuit - single phase and three phase - space vector control scheme.

Text Book:

1. Power Electronics, MD Singh, KB Khanchandani, McGraw Hill Publishing Company, New Delhi, Third reprint 2008

Reference books:

1. Power Electronics , Mohammed H.Rashid, New Age Publication, Third Edition,2004
2. Power Electronics , Mohan, Undeland, Robbins, Wiley India Edition, Media Enhanced Third Edition
3. Power Electronics, Dr.P.S.Bimbhra, Khanna Publishers, Fourth Edition, 2011.

*** Pattern of End Semester Exam Question Paper - General Pattern (Theory)**

6363.1 - ELECTIVE THEORY - II: ENERGY CONSERVATION AND AUDIT

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
6363.1 ENERGY CONSERVATION AND AUDIT	5 Hrs	80 Hrs	Internal Assessment	External Exam*	Total	
			25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

UNIT - I

ENERGY CONSERVATION AND ITS IMPORTANCE **15 Hrs**

Definition - need for and importance of energy conservation - primary and secondary energy - energy demand and supply - energy conservation in household, industries and community level - energy for sustainable development - energy conservation in India - energy conservation approaches - safe working of electrical equipments and electrical safety. energy conservation techniques - principles of energy conservation methods - difference between energy conservation and energy audit - relevant clauses of energy conservation - BEE and its roles - MEDA and its roles - energy audit in energy conservation star labelling: need and its benefits -

role of Tamil Nadu energy development agency (TEDA) - introduction to ISO 50001 - energy audit certificate.

UNIT - II

ENERGY CONSERVATION IN ELECTRICAL MACHINES 15 Hrs

Need for energy conservation in induction motor and transformer - methods of energy conservation in induction motor - energy saving opportunities with energy efficient motors - energy conservation techniques in induction motor by: improving power quality - variation in efficiency and power factor with loading motor survey matching motor rating with load - minimizing the idle and redundant running of motor operating in star mode - rewinding of motor - replacement by energy efficient motor periodic maintenance energy conservation techniques in transformer - loading sharing parallel operation isolating techniques - replacement by energy efficient transformers - periodic maintenance - energy conservation equipment: soft starters, automatic star delta convertor, variable frequency drives, automatic P.F. controller (APFC), intelligent P.F. controller (IPFC)energy efficient motor; significant features, advantages, applications and limitations.

UNIT - III

ENERGY CONSERVATION IN ELECTRICAL INSTALLATION SYSTEMS 15 Hrs

Aggregated technical and commercial losses (ATC); power system at state, regional, national and global level. technical losses; causes and measures to reduce by - controlling I^2R losses - optimizing distribution voltage - balancing phase currents compensating reactive power flow commercial losses: pilferage causes and remedies - energy conservation equipment: maximum demand controller, KVAR Controller, automatic power factor controller (APFC) energy conservation in lighting system replacing lamp sources - using energy efficient luminaries - using light - controlled gears - installation of separate transformer / servo stabilizer for lighting - periodic survey and adequate maintenance programs - energy conservation techniques in fans - electronic regulators.

UNIT - IV

ENERGY AUDIT AND INSTRUMENTS 14 Hrs

Definition, objective and principles of energy management, need of energy audit and management, types of energy audit, audit process, energy audit of building system, lighting system, HVAC system, water heating system, heat recovery opportunities during energy audit, industrial audit opportunities - energy flow diagram (sankey diagram) simple payback period, energy audit procedure (walk through audit and detailed audit) instruments for audit and monitoring energy and energy savings energy audit instruments - basic measurements - electrical measurements, light, pressure, temperature and heat flux, velocity and flow rate, vibrations, etc. instruments used in energy systems: load and power factor measuring equipments, wattmeter, flue gas analysis, temperature and thermal loss measurements, air quality analysis etc.

UNIT - V

ENERGY COSTS AND ENERGY AUDIT REPORT 14 Hrs

Understanding energy costs energy cost in Indian scenario - co-generation and tariff - concept, significance for energy conservation - co-generation - types of cogenerations on basis of sequence of energy use (topping cycle, bottoming cycle) - types of co-generation basis of technology (steam turbine co-generation, gas turbine co-generation, reciprocating engine co-generation) factors governing the selection of co-generation system. advantages of co-generation - tariff: types of tariff structure: special tariffs; time - off - day tariff, peak - off - day tariff, power factor tariff, maximum demand tariff, load factor tariff - application of tariff system to reduce energy bill. Benchmarking and energy performance - energy audit report format - guidelines for writing energy audit report - data presentation in report.

Text books:

1. Energy Conservation & Audit, M A Chaudhari, S M Chaudhari & S A Asarkar, Nirali Prakashan" Publication.
2. Energy Conservation and Audit, Y.B.Mandake, Pankaj Mohan, Dr.D.B. Talange, Tech - Neo Publications.

Reference Books:

1. Electrical Energy Conservation & Auditing, Er. Udit Mamodiya, Ashirwad Publication.

2. Energy Technology, O.P. Gupta, Khanna Publishing House, New Delhi

*** Pattern of End Semester Exam Question Paper - General Pattern (Theory)**

6363.2 - ELECTIVE THEORY - II: BIO MEDICAL INSTRUMENTATION

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
6363.2 BIO MEDICAL INSTRUMENTATION	5 Hrs	80 Hrs	Internal Assessment	External Exam*	Total	3 Hrs
			25	100	100	

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

UNIT - I

BIO-ELECTRIC SIGNALS, ELECTRODES AND CLINICAL MEASUREMENT

Chapter 1.1 : Bio-Electric Signals and Electrodes **04 Hrs**

Bio - potential and their generation - resting and action potential - propagation of action potential. electrodes - micro - skin surface - needle electrodes.

Chapter 1.2 : Clinical Measurement **11 Hrs**

Measurement of blood pressure (direct, indirect) - blood flow meter (electromagnetic and ultrasonic blood flow meter) - blood pH measurement - measurement of respiration rate - measurement of lung volume - heart rate measurement - measurement of body and skin temperature - chromatography, photometry, flurometry.

UNIT - II

BIO - MEDICAL RECORDERS **15 Hrs**

Electro cardiograph (ECG) - lead system - ECG electrodes - ECG amplifiers - ECG recording units - analysis of ECG curves. electroencephalograph (EEG) - 10-20 lead system - EEG recording units - EEG wave types - clinical use of EEG - (EMG) - EMG waves - measurement of conduction velocity - EMG recording units - electro retino graph (ERG)- ERG recording units, audiometer - principle - types - basics audiometer working.

UNIT - III

THERAPEUTIC INSTRUMENTS **15 Hrs**

Cardiac pacemaker - classification - external pace makers - implantable pacemaker - programmable pacemaker - cardiac defibrillators - types - ac and dc defibrillators - heart lung machine with block diagram - dialysis hemo dialysis - peritoneal dialysis. endoscopes endoscopic laser coagulator and applications - physiotherapy equipment - short wave diathermy - micro wave diathermy - ultrasonic therapy unit (block / circuit) - ventilators - types - modern ventilator block diagram.

UNIT - IV

BIOTELEMETRY AND PATIENT SAFETY

Chapter 4.1: Biotelemetry **07 Hrs**

Introduction to biotelemetry - physiological - adaptable to biotelemetry - components of a biotelemetry system - application of telemetry - tele-medicine - introduction, working, applications.

Chapter 4.2: Patient Safety **07 Hrs**

Patient Safety: physiological effects of electric current - micro and macro shock - leakage current - shock hazards from electrical equipment - methods of accident prevention - grounding - double insulation - protection by low voltage - ground fault circuit interrupter - isolation of patient connected parts - isolated power distribution system - safety aspects in electro surgical units - burns, high frequency current hazards, explosion hazards.

UNIT - V

MODERN IMAGING TECHNIQUES **14 Hrs**

LASER beam properties - block diagram - operation of Co2 and nd:YAG LASER - applications of LASER in medicine. X-ray apparatus - block diagram - operation - special techniques in X-ray Imaging - tomogram - computerized axial tomography, CT scanner - ultrasonic imaging techniques - echo cardiograph - angiography - magnetic resonance imaging techniques.

Text Book:

1. Biomedical Instrumentation, Dr.M. Arumugam,Anuradha, Publications, Chennai.

Reference Books:

1. Bio Medical Instrumentation and Measurements, Leslie Cromwell, Fred j. Wibell, Erich A.P Feither, II Edition.
2. Medicine and Clinical Engineering, Jacobson and Webstar .
3. Hand book of Bio -Medical Instrumentation, R.S .Khandpur.
4. Medical Electronics - Kumara doss.
5. Introduction to Medical Electronics. B.R. Klin.
6. Introduction to Biomedical Instrumentation, Mandeep Singh, Printice Hall India 2010.

*** Pattern of End Semester Exam Question Paper - General Pattern (Theory)**

6363.3 - ELECTIVE THEORY - II: COMPUTER HARDWARE AND NETWORKS

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
6363.3 COMPUTER HARDWARE AND NETWORKS	5 Hrs	80 Hrs	Internal Assessment	External Exam*	Total	3 Hrs
			25	100	100	

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

DETAILED SYLLABUS

UNIT - I

MOTHERBOARD COMPONENTS AND MEMORY STORAGE DEVICES

Chapter 1.1: Introduction **03 Hrs**

Parts - mother board, sockets, expansion slots, memory, power supply, drives and front panel and rear panel connectors - hardware, software and firmware.

Chapter 1.2: Processors **03 Hrs**

Architecture and block diagram of multi core processor (any one), features of new processor definition only chipsets (concepts only).

Chapter 1.3: Bus Standards **02 Hrs**

Overview and features of PCI, AGP, USB, PCMCIA, processor BUS - high.

Chapter 1.4: Primary Memory **02 Hrs**

Introduction - main memory, cache memory - DDR2 - DDR3, RAM versions - 1TB RAM - direct RDRAM.

Chapter 1.5: Secondary Storage **03 Hrs**

Hard disk - construction - working principle - specification of IDE, ultra ATA, serial ATA; HDD partition - formatting - troubleshooting hard disk drives.

Chapter 1.6: Removable Storage **02 Hrs**

CD&DVD construction - reading & writing operations; CD-R, CD-RW; DVD-ROM, DVD-RW; construction and working of DVD reader / writer - blue-ray: introduction - disc parameters - recording and playback principles - solid state memory devices.

UNIT II

I/O DEVICES AND INTERFACE

Chapter 2.1: Keyboard and Mouse **03 Hrs**

Keyboard: signals - operation of membrane and mechanical keyboards troubleshooting; wireless keyboard - mouse - types, connectors, operation of optical mouse and troubleshooting.

Chapter 2.2: Printers **04 Hrs**

Introduction - types of printers - dot matrix, laser, line printer, MFP (multi-function printer), thermal printer - operation - construction - features and troubleshooting.

Chapter 2.3: I/O Ports **03 Hrs**
Serial, parallel, USB, game port, bluetooth interface, IR connector, fire ware, signal specification problems with interfaces.
Chapter 2.4: Displays and Graphic Cards **03 Hrs**
Panel displays - principles of LED, LCD and TFT displays. SVGA port signals - common problems and solutions.
Chapter 2.5: Power Supply **02 Hrs**
SMPS: principles of operation and block diagram of ATX power supply, connector specifications

UNIT III
MAINTENANCE AND TROUBLE SHOOTING OF DESKTOP AND MOBILE PHONES
Chapter 3.1: BIOS **03 Hrs**
Standard CMOS setup, advanced BIOS setup, power management, advanced chipset features, PC BIOS communication - upgrading BIOS, Flash BIOS - setup.
Chapter 3.2: POST **02 Hrs**
Definition - IPL hardware - POST test sequence - beep codes and error messages.
Chapter 3.3: Mobile phone components **03 Hrs**
Basics of mobile communication - components - battery - antenna - ear piece - microphone - speaker - buzzer - LCD - keyboard - basic circuit board components - Names and functions of different ICs used in mobile phones.
Chapter 3.4: Tools & Instruments used in mobile servicing **02 Hrs**
Mobile servicing kit - soldering and de-soldering components using different soldering tools - use of multi - meter and battery booster.
Chapter 3.5: Installation & Troubleshooting **02 Hrs**
Assembling and disassembling of different types of mobile phones - installation of OS - fault finding & troubleshooting - jumpering techniques and solutions.
Chapter 3.6: Software and Antivirus **03 Hrs**
Flashing - formatting - unlocking - use of secret codes - downloading - routing; mobile viruses - precautions - antivirus software.

UNIT - IV
COMPUTER NETWORK DEVICES AND OSI LAYERS
Chapter 4.1: Data Communication **03 Hrs**
Components of a data communication - data flow: simplex - half duplex - full duplex; networks - definition - network criteria - types of connections: point to point - multipoint; topologies: star, bus, ring, mesh, hybrid - advantages and disadvantages of each topology.

Chapter 4.2: Types of Networks **03 Hrs**
LAN - MAN - WAN - CAN - HAN - internet - intranet - extranet, client-server, peer to peer networks.
Chapter 4.3: Transmission Media **03 Hrs**
Classification of transmission media - guided - twisted pair, coaxial, fiber optics; unguided - radio waves - infrared - LOS - VSAT - cabling and standards.
Chapter 4.4: Network devices **03 Hrs**
Features and concepts of switches - routers (wired and wireless) - gateways.
Chapter 4.5: Network Models **02 Hrs**
Protocol definition - standards - OSI model - layered architecture - functions of all layers.

UNIT V
802.X AND TCP/IP PROTOCOLS
Chapter 5.1: Overview of TCP / IP **03 Hrs**
OSI & TCP/IP - transport layers protocol - connection oriented and connectionless services - sockets - TCP & UDP.
Chapter 5.2: 802.X Protocols **03 Hrs**
Concepts and PDU format of CSMA/CD (802.3) - token bus (802.4) - token ring (802.5) - Ethernet - type of Ethernet (fast Ethernet, gigabit Ethernet) - comparison between 802.3, 802.4 and 802.5.
Chapter 5.3: Network Layers Protocol **03 Hrs**

IP - interior gateway protocols (IGMP, ICMP, ARP, RARP concept only).

Chapter 5.4: IP Addressing **03 Hrs**

Dotted decimal notation - sub netting & super netting - VLSM technique - IPv6 (concepts only).

Chapter 5.5: Application Layer Protocols **02 Hrs**

FTP - telnet - SMTP - HTTP - DNS - POP

Text Books:

1. Computer Installation and Servicing, D.Balasubramania, Arasan Ganesan, Institute of Technology 1993.
2. Computer Networks, Achyut Godbole, Tata Mc-Graw Hill, New Delhi.
3. Troubleshooting, Maintaining and Repairing PCs- Stephen J Bigelow, Tata MCGraw Hill Publication 2004.

Reference Books:

1. The complete PC upgrade and Maintenance, Mark Minasi - BPB Publication 1997.
2. Principles of Wireless Networks, A unified Approach, Kaveh Pahlavan and Prashant krishnamoorthy - Pearson Education 2002

*** Pattern of End Semester Exam Question Paper - General Pattern (Theory)**

6364 - POWER ELECTRONICS PRACTICAL

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6364 POWER ELECTRONICS PRACTICAL	6 Hrs	96 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

EXPERIMENTS: **96 Hrs**

1. Construct and verify the characteristics of IGBT for the various values of gate voltage.
2. Construct and observe the waveform of ramp and pedestal trigger circuit for ac load.
3. Construct lamp control circuit using DIAC – TRIAC to measure various output voltage for firing angles
4. Construct and test the SCR Commutation circuits (class B and class D)
5. Construct single phase half wave controlled rectifier circuits using thyristors and draw the input and output waveforms.
6. Construct single phase full wave controlled rectifier circuits using thyristors and draw the input and output waveforms.
7. Draw the input and output waveforms of single phase half controlled bridge rectifier with resistive load.
8. Draw the input and output waveforms of single phase full controlled bridge rectifier with resistive load.
9. Construct three phase half controlled bridge converter circuits using thyristors and draw the input and output waveforms
10. Construct three phase fully controlled bridge converter circuits using thyristors and draw the input and output waveforms
11. Construct and draw the input and output waveforms of basic series inverter by using thyristors.
12. Construct the IGBT based Single phase multiple pulse (PWM) inverter and draw the input and out wave form waveforms.
13. Construct and test the DC Chopper control circuit using thyristor (any class).
14. Construct and verify the MOSFET based PWM chopper.
15. Construct PWM IC based buck converter.
16. Construct and draw the input and output waveforms of 1ϕ to 1ϕ cycloconverter with center tapped transformer configuration.

AUTONOMOUS EXAMINATION

Note: All the exercises have to be completed. Any one exercise will be given for examination. All the exercises should be given in the question paper and students are allowed to select question by a lot. All students should submit record notebook for the practical examination.

DETAILED ALLOCATION OF MARKS

Sl. No.	Name of the activity	Max. Marks
1	Circuit Diagram	25
2	Connections	25
3	Procedure	20
4	Reading / Graph / Result	25
5	Viva-voce	05
Total		**100**

6365.1 - ELECTIVE PRACTICAL - II: ELECTRICAL ESTIMATION AND COSTING PRACTICAL

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6365.1 ELECTRICAL ESTIMATION AND COSTING PRACTICAL	6 Hrs	96 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

EXPERIMENTS: **96 Hrs**

1. To study the various electrical symbols, IE rules 28, IE rules 30, IE rules 31, IE rules 54, IE rules 56, IE rules 87.
2. To study the various types of earthing.
3. To study the various types of electrical wiring methods.
4. Estimate the quantity of material and cost required for residential building (1BHK).
5. Estimate the quantity of material and cost required for computer centre having 10 computers, AC unit, UPS, light and fan.
6. Estimate the quantity of material and cost required for industrial power wiring having 4 machines.
7. Estimate the quantity of material and cost required for street light service having 12 lamps light fitting.
8. Estimate the quantity of material and cost required for 3 phase Service connection to a building having 5KW Load.
9. Estimate the quantity of material and cost required for irrigation pump wiring (5HP).
10. Estimate the quantity of material and cost required for school building having 3 class rooms.
11. Estimate the quantity of material and cost required for erection of a 15HP Induction motor in a saw mill/flour mill.

Text Book:

1. Electrical Design Estimating and Costing, K.B.Raina & K.Battacharya, Khanna Publications.

Reference Books:

1. Electrical Installation Estimating and Costing, J.B.Gupta, S.K.Kataria and Sons
2. Electrical Wiring, Estimating and Costing, Dr.S.L.Uppal, New age international (p) limited
3. Electrical Estimating and Costing, Surjit Singh, DhanpatRai Company.
4. Electrical wiring, Estimating and costing, B.D.Arora, R.B Publication.

AUTONOMOUS EXAMINATION

Note: All the exercises have to be completed. Any one exercise will be given for examination. All the exercises should be given in the question paper and students are allowed to select question by a lot. All students should submit record notebook for the practical examination.

DETAILED ALLOCATION OF MARKS

Sl. No	Name of The Activity	Max. Marks
1	Layout / Details of Fitting	20
2	Load Calculation	20

3	Material Calculation	30
4	Material Schedule and Approximate Cost	25
5	Viva-voce	05
Total		**100**

6365.2 - ELECTIVE PRACTICAL - II: BIO-MEDICAL INSTRUMENTATION PRACTICAL

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6365.2 BIO-MEDICAL INSTRUMENTATION PRACTICAL	6 Hrs	96 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

EXPERIMENTS: **96 Hrs**

1. Construction and testing of differential amplifier.
2. Construction and testing of instrumentation amplifier.
3. Measurement of pH of given solution.
4. Measurement of blood pressure.
5. Measurement of ECG waveform.
6. Construction and verification of pacemaker circuit.
7. Construction and testing of high gain amplifier.
8. Measurement of body and skin temperature.
9. Study, handle and use the following instruments/equipments:
    a. Cardiac monitor.
    b. ECG stimulator.
    c. Muscle stimulator.
    d. Vascular doppler recorder.
    e. Pressure plethysmograph.
    f. Skin sympathetic response meter.

AUTONOMOUS EXAMINATION

Note: All the exercises have to be completed. Any one exercise will be given for examination. All the exercises should be given in the question paper and students are allowed to select question by a lot. All students should submit record notebook for the practical examination.

DETAILED ALLOCATION OF MARKS

Sl. No.	Name of the Activity	Max. Marks
1	Circuit Diagram / Connection Diagram / Block Diagram	35
2	Connections and Proceeding theExperiment	35
3	Reading/Calculation/Graph/Result	25
4	Viva-voce	05
Total		**100**

6365.3 - ELECTIVE PRACTICAL - II: COMPUTER HARDWARE AND NETWORKS PRACTICAL

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6365.3 COMPUTER HARDWARE AND NETWORKS PRACTICAL	6 Hrs	96 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

EXPERIMENTS:

PART A - COMPUTER SERVICING AND NETWORK PRACTICAL 48 Hrs

1. Identification of system layout (study exercise)
   a) Front panel indicators & switches and front side & rear side connectors.
   b) Familiarize the computer system layout: marking positions of SMPS, motherboard, HDD, DVD and add on cards.
   c) Configure bios setup program and troubleshoot the typical problems using BIOS utility.
2. HARD DISK
   a) Install hard disk.
   b) Configure CMOS-setup.
   c) Partition and format hard disk.
   d) Identify master /slave / IDE devices.
   e) Practice with scan disk, disk cleanup, disk de-fragmentation, virus detecting and rectifying software.
3. a) Install and configure a DVD Writer & blu-ray disc writer.
   b) Recording a blank DVD & blu-ray disc.
4. Assemble a system with add on cards and check the working condition of the system and install Dual OS.
5. Identification of mobile phone components (Study Exercise)
   a) Basic mobile phone components.
   b) Familiarizing the basic circuit board components: Marking position of different IC and switches in the network and power sections of the PCB.
6. Flashing, unlocking and formatting memory cards in mobile phones.
7. Do the following cabling works in a network
   a) Cable crimpling
   b) Standard cabling
   c) Cross cabling
   d) I/O connector crimping
   e) Testing the crimped cable using a cable tester
8. a) Configure host IP, subnet mask and default gateway in a system in LAN(TCP/IP Configuration).
   b) Configure Internet connection and use IPCONFIG, PING / tracert and net stat utilities to debug the network issues.
9. Transfer files between systems in LAN using FTP configuration. Install a printer in LAN and share it in the network.

PART B - SYSTEM ADMINISTRATION PRACTICAL 48 Hrs

10. Installation of windows 2008 / 2013 server.
11. Installation and configuration of DHCP server.
12. Installation and configuration of mail server.
13. a) Installation of red hat linux using graphical mode.
    b) Installation of red hat linux using vmware.
14. a) Creating a user in linux server and assigning rights.
    b) Configuring and troubleshooting.
15. a) Configuring and troubleshooting of /etc/grub.conf
    b) Configuring and trouble shooting of /etc/passwd

AUTONOMOUS EXAMINATION

Note: All the exercises have to be completed. Any one exercise from Part - A and any one exercise from Part - B will be given for examination. All the exercises should be given in the question paper and students are allowed to select question by a lot. All students should submit record notebook for the practical examination.

DETAILED ALLOCATION OF MARKS

Sl. No.	Name of The Activity	Max. Marks

1	Procedure Writing – One Question from Part - A	20
2	Procedure Writing – One Question from Part - B	15
3	Executing Exercise (Part - A)	20
4	Executing Exercise (Part - B)	20
5	Result (Part - A)	5
6	Result (Part - B)	5
7	Demonstration of Mini project	10
8	Viva-voce	5
Total		**100**

6366 - PROJECT WORK AND INTERNSHIP

Teaching and Scheme of Examination

No. of weeks per semester: 16

SUBJECT	INSTRUCTION		EXAMINATION			
	Hrs / Week	Hrs / Sem	Marks			Duration
			Internal Assessment	External Exam*	Total	
6366 PROJECT WORK AND INTERNSHIP	6 Hrs	96 Hrs	25	100	100	3 Hrs

*** Examination will be conducted for 100 marks and the marks obtained will be converted into 75 marks.**

Project Work and Internship:

The students of all the Diploma Courses have to do a Project Work as part of the Curriculum and in partial fulfillment for the award of Diploma by the State Board of Technical Education and Training, Tamil Nadu. The Project work must be reviewed twice in the same semester. The project work is approved during the V semester by the properly constituted committee with guidelines.

a) Internal assessment mark for Project Work and Internship:

Project Review - I	10 marks
Project Review - II	10 marks
Attendance	05 marks
Total	**25 marks**

Proper record should be maintained for the two Project Reviews and preserved for one semester after the publication of Exam results. It should be produced to the flying squad and the inspection team at the time of inspection/verification.

b) Allocation of Marks for Project Work and Internship

Demonstration / Presentation	25 marks
Project Report	25 marks
Viva-voce	30 marks
Internship Report	20 marks
Total	**100* marks**

*Examination will be conducted for 100 marks and will be converted to 75 marks.

c) Internship Report:

The internship training for a period of two weeks shall be undergone by every candidate at the end of IV / V semester during vacation. The certificate shall be produced along with the internship report for evaluation. The evaluation of internship training shall be done along with final year “Project Work & Internship” for 20 marks. The internship shall be undertaken in any industry / Government or Private certified agencies which are in social sector / Govt. Skill Centers / Institutions / Schemes.

A neatly prepared PROJECT REPORT as per the format has to be submitted by individual student during the Project Work and Internship Autonomous examination.