DIPLOMA IN ENGINEERING AND TECHNOLOGY

1042

DEPARTMENT OF INSTRUMENTATION AND CONTROL ENGINEERING

SEMESTER PATTERN

N – SCHEME

IMPLEMENTED FROM 2020 - 2021

CURRICULUM DEVELOPMENT CENTRE

DIRECTORATE OF TECHNICAL EDUCATION

CHENNAI-600 025, TAMIL NADU

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STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS (II / III YEAR)

N SCHEME
(implemented from Academic Year 2020-21 onwards)

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DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING (1042)	
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DIPLOMA COURSE IN INSTRUMENTATION AND CONTROL ENGINEERING
(IMPLEMENTED FROM 2021 – 2022)

N – SCHEME

REGULATIONS*
**(Applicable to the Diploma courses other than*
Diploma in Hotel Management and Catering Technology)

1. Description of the Course:

a. Full Time (3 years)

The Course for the Full Time Diploma in Engineering shall extend over a period of three academic years, consisting of 6 semesters* and the First Year is common to all Engineering Branches.

b. Sandwich (3½ years)

The Course for the Sandwich Diploma in Engineering shall extend over a period of three and half academic years, consisting of 7 semesters* and the First Year is common to all Engineering Branches. The subjects of three years full time diploma course being regrouped for academic convenience.

During 4^{th} and/or during 7^{th} semester the students undergo industrial training for six months / one year. Industrial training examination will be conducted after completion of every 6 months of industrial training.

c. Part Time (4 years)

The course for the Part Time Diploma in Engineering shall extend over a period of 4 academic years containing of 8 semesters*, the subjects of 3 year full time diploma courses being regrouped for academic convenience.

* ***Each Semester will have 16 weeks duration of study with 35 hrs. / Week for Regular Diploma Courses and 18 hrs. / Week for Part-Time Diploma Courses.***

The Curriculum for all the 6 Semesters of Diploma courses (Engineering & Special Diploma Courses viz. Textile Technology, Leather Technology, Printing Technology, Chemical Technology etc.) have been revised and revised curriculum is applicable for the candidates admitted from 2020 – 2021 academic year onwards.

2. Condition for Admission:

Condition for admission to the Diploma courses shall be required to have passed in The S.S.L.C Examination of the Board of Secondary Education, Tamil Nadu.

(Or)

The Anglo Indian High School Examination with eligibility for Higher Secondary Course in Tamil Nadu.

(Or)

The Matriculation Examination of Tamil Nadu.

(Or)

Any other Examinations recognized as equivalent to the above by the Board of Secondary Education, Tamil Nadu.

Note: In addition, at the time of admission the candidate will have to satisfy certain minimum requirements, which may be prescribed from time to time.

3. Admission to Second year (Lateral Entry):

A pass in HSC (academic) or (vocational) courses mentioned in the Higher Secondary Schools in Tamil Nadu affiliated to the Tamil Nadu Higher Secondary Board with eligibility for University Courses of study or equivalent examination & Should have studied the following subjects.

A pass in 2 Years ITI with appropriate Trade or Equivalent examination.

Sl. No	Courses	H.Sc Academic	H.Sc Vocational		Industrial Training Institutes Courses
			Subjects Studied		
		Subjects Studied	Related subjects	Vocational subjects	
1.	All the Regular and Sandwich Diploma Courses	Physics and Chemistry as compulsory along with Mathematics / Biology	Maths / Physics / Chemistry	Related Vocational Subjects Theory& Practical	2 years course to be passed with appropriate Trade
2.	Diploma Course in Commercial Practice	English & Accountancy English & Elements of Economics English & Elements of Commerce	English & Accountancy, English & Elements of Economics, English & Management Principles & Techniques, English & Typewriting	Accountancy & Auditing, Banking, Business Management, Co-operative Management, International Trade, Marketing & Salesmanship, Insurance & Material Management, Office Secretaryship.	-

- For the Diploma Courses related with Engineering/Technology, the related / equivalent subjects prescribed along with Practicals may also be taken for arriving the eligibility.
- Branch will be allotted according to merit through counseling by the respective Principal as per communal reservation.
- For admission to the Textile Technology, Leather Technology, Printing Technology, Chemical Technology and Commercial Practice Diploma courses the candidates studied the related subjects will be given first preference.

- *Candidates who have studied Commerce Subjects are not eligible for Engineering Diploma Courses.*

4. Age Limit: No Age limit.

5. Medium of Instruction: English

6. Eligibility for the Award of Diploma:

No candidate shall be eligible for the Diploma unless he/she has undergone the prescribed course of study for a period of not less than 3 academic years in any institution affiliated to the State Board of Technical Education and Training, Tamil Nadu, 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 Courses are as given below:

Diploma Course	Minimum Period	Maximum Period
Full Time	3 Years	6 Years
Full Time (Lateral Entry)	2 Years	5 Years
Sandwich	3½ Years	6½ Years
Part Time	4 Years	7 Years

This will come into effect from N Scheme onwards i.e. from the academic year 2020-2021.

7. 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 and practical subjects.

The curriculum outline is given in Annexure – I.

8. Examinations:

Board 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. Board Examinations are conducted for 100 marks and reduced to 75.

The total marks for result are 75 + 25 = 100 Marks.

9. 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 **5 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**

2 Tests each of 2 hours duration for a total of 50 marks are to be conducted. Average of the these two test marks will be taken and the marks to be reduced to:	05 Marks
The Test – III is to be the Model Examination covering all the five units and the marks obtained will be reduced to :	05 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	50	2 Hrs

		week		
Test III	**Model Examination:** Covering all the 5 Units. (Board Examinations-question paper-pattern).	End of 16th week	100	3 Hrs

From the Academic Year 2020 – 2021 onwards.

Question Paper Pattern for the Test - I and Test – II is as follows. The tests should be conducted by proper schedule. Retest marks should not be considered for internal assessment.

Without Choice:

Part A Type questions:	6 Questions × 1 mark	06 marks
Part B Type questions:	7 Questions × 2 marks	14 marks
Part C Type questions:	2 Questions × 15 marks	30 marks
	Total	**50 marks**

iii) Assignment **5 Marks**

For each subject Three Assignments are to be given each for 20 marks and the average marks scored should be reduced for 5 marks.

iv) Seminar Presentation **5 Marks**

The students have to select the topics either from their subjects or general subjects which will help to improve their grasping capacity as well as their 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 seminar (For First and 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 5 marks for each theory subject.

The respective subject faculty may suggest topics to the students and will evaluate the submitted materials and seminar presentation. (2 ½ marks for the material submitted in writing and 2 ½ 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 5 marks.

All Test Papers, Assignment Papers / Notebooks and the seminar presentation written material 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 Board Exam results and produced to the flying squad and the inspection team at the time of inspection/verification.

B. <u>For Practical Subjects:</u>

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

a) Attendance : **5 Marks**

(Award of marks same as theory subjects)

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 Board examinations.*
- The observation note book / manual should be maintained for 10 marks. The observation note book / manual with sketches, circuits, programme, reading and calculation written by the students manually depends upon the practical subject during practical classes should be evaluated properly during the practical class hours with date.
- The Record work for every completed exercise should be submitted in the subsequent practical classes and marks should be awarded for 10 marks 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 (including Observation and Record writing) and the marks awarded for attendance is to be added to arrive at the internal assessment mark for Practical. (20+5=25 marks)
- Only regular students, appearing first time have to submit the duly signed bonafide record note book/file during the Practical Board Examinations.

All the marks awarded for Assignments, Tests, Seminar presentation and Attendance should be entered periodically in the Personal Theory Log Book of the staff, who is handling the theory subject.

The marks awarded for Observation, Record work and Attendance should be entered periodically in the Personal Practical Log Book of the staff, who is handling the practical subject.

10. Communication Skill Practical, Computer Application Practical and Physical Education:

The Communication Skill Practical and Computer Application Practical with more emphasis are being introduced in First Year. Much Stress is given to increase the Communication skill and ICT skill of students.

As per the recommendation of MHRD and under Fit India scheme, the Physical education is introduced to encourage students to remain healthy and fit by including physical activities and sports.

11. 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. In order to encourage students to do worthwhile and innovative projects, every year prizes are awarded for the best three projects i.e. institution wise, region wise and state wise.

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 & Internship:

Project Review I	…	**10 marks**
Project Review II	…	**10 marks**
Attendance	…	**05 marks** (Award of marks same as theory subject pattern)
Total	…	**25 marks**

Proper record should be maintained for the two Project Reviews and preserved for one semester after the publication of Board Exams 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 & Internship in Board Examinations:

Demonstration/Presentation	25 marks
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 Centres / Institutions / Schemes.

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

12. Scheme of Examinations:

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

13.Criteria for Pass:

1. No candidate shall be eligible for the award of Diploma unless he/she has undergone the prescribed course of study successfully in an institution approved by AICTE and affiliated to the State Board of Technical Education & Training, Tamil Nadu 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/she 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 Board Examinations marks put together, subject to the condition that he/she secures at least a minimum of 4*0 marks out of 100 marks in the Board Theory Examinations and a minimum of 50 marks out of 100 marks in the Board Practical Examinations.*

14. **Classification of successful candidates:**

Classification of candidates who will pass out the final examinations from April 2023 onwards (Joined first year in 2020 -2021) will be 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/she 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 2 / 3 / 3½ / 4 years [Full time(lateral entry)/Full Time/Sandwich/Part Time] without any break in study.

First Class with Distinction:

A candidate will be declared to have passed in **First Class with Distinction** if he/she 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 2 / 3 / 3½ / 4 years [Full time(lateral entry)/Full Time/Sandwich/Part Time] without any break in study.

First Class:

A candidate will be declared to have passed in **First Class** if he/she secures not less than 60% of the aggregate marks in all the semesters put together and passes all the subjects within the stipulated period of study 2 / 3 / 3½ / 4 years [Full time(lateral entry)/Full Time/Sandwich/Part Time] without any break in study.

Second Class:

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

The above classifications are also applicable for the Sandwich / Part-Time students who pass out Final Examination from October 2023 /April 2024 onwards (both joined First Year in 2020 -2021)

15. 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 uniformly maintained as 7 hours corresponding to 7 periods of instruction (Theory & Practical).

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ANNEXURE I

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

1042 DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

CURRICULUM OUTLINE

THIRD SEMESTER (FULL TIME)

Subject Code	SUBJECT	HOURS PER WEEK			
		Theory Hours	Tutorial/ Drawing	Practical Hours	Total Hours
4042310	Basics of Electrical and Electronics Engineering	5	-	-	5
4042320	Basics of Instrumentation	5	-	-	5
4042330	C Programming	6	-	-	6
4042340	Electrical Engineering Practical	-	-	4	4
4042350	Electronics Engineering Practical	-	-	4	4
4042360	Basics of Instrumentation Practical	-	-	4	4
4042370	C Programming Practical	-	-	4	4
	Physical Education	-	-	2	2
	Library	-	-	1	1
	TOTAL	**16**	**-**	**19**	**35**

FOURTH SEMESTER (FULL TIME)

Subject Code	SUBJECT	HOURS PER WEEK			
		Theory Hours	Tutorial/ Drawing	Practical Hours	Total Hours
4042410	Analog and Digital Electronics	6	-	-	6
4042420	Measurement of Process variables	5	-	-	5
4042430	Measurements and Instruments	5	-	-	5
4020620	E-Vehicle Technology	4	-	-	4
4042450	Analog and Digital Electronic Practical	-	-	4	4
4042460	Measurement of Process variables Practical	-	-	4	4
4042470	Virtual Instrumentation Practical	-	-	4	4
	Physical Education	-	-	2	2
	Library		-	1	1
	TOTAL	**20**	**-**	**15**	**35**

FIFTH SEMESTER (FULL TIME)

Subject Code	SUBJECT	HOURS PER WEEK			
		Theory Hours	Tutorial/ Drawing	Practical Hours	Total Hours
4042510	Process Control Instrumentation	5	-	-	5
4042520	Control Engineering	6	-	-	6
	Elective Theory - I				
4042531	1. Microcontroller	5	-	-	5
4042532	2. Industrial Instrumentation				
4042533	3. Industrial Power Electronics				
4042540	Process Control Instrumentation Practical	-	-	4	4
4042550	Control Engineering Simulation Practical	-	-	4	4
	Elective Practical – I				
4042561	1. Microcontroller Practical	-	-	4	4
4042562	2. Industrial Instrumentation Practical				
4042563	3. Industrial Power Electronics Practical				
4040570	Entrepreneurship and startup			4	4
	Library		-	1	1
	Physical education		-	2	2
	TOTAL	**16**	**-**	**19**	**35**

SIXTH SEMESTER (FULL TIME)

Subject Code	SUBJECT	HOURS PER WEEK			
		Theory Hours	Tutorial/ Drawing	Practical Hours	Total Hours
4042610	Industrial Automation and Drives	5	-	-	5
4042620	Bio Medical Instrumentation	5	-	-	5
	Elective Theory – II				
4042631	1. Programmable Logic Controller	5	-	-	5
4042632	2. Power Plant Instrumentation				
4042633	3. Embedded System Design with ARDUINO				
4042640	Industrial Automation Practical	-	-	6	6
	Elective Practical – II				
4042651	1. Programmable Logic Controller Practical	-	-	5	5
4042652	2. P & ID using CAD Practical				
4042653	3. Embedded System Design with ARDUINO Practical				
4042660	Project Work and Internship	-	-	6	6
	Library	-	-	1	1
	Physical Education	-	-	2	2
	TOTAL	**15**	**-**	**20**	**35**

ANNEXURE II

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

1042 DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SYLLABUS

N-SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

SCHEME OF EXAMINATION

THIRD SEMESTER (FULL TIME)

Subject Code	Subject	Examination Marks			Minimum for Pass	Duration of Exam (in Hours)
		Internal Assessment Marks	Board Exam Marks	Total Marks		
4042310	Basics of Electrical and Electronics Engineering	25	75	100	40	3
4042320	Basic of Instrumentation	25	75	100	40	3
4042330	C Programming	25	75	100	40	3
4042340	Electrical Engineering Practical	25	75	100	50	3
4042350	Electronics Engineering Practical	25	75	100	50	3
4042360	Basics of Instrumentation Practical	25	75	100	50	3
4042370	C Programming Practical	25	75	100	50	3
	TOTAL	**175**	**525**	**700**		

FOURTH SEMESTER (FULL TIME)

Subject Code	Subject	Examination Marks			Minimum for Pass	Duration of Exam (in Hours)
		Internal Assessment Marks	Board Exam Marks	Total Marks		
4042410	Analog and Digital Electronics	25	75	100	40	3
4042420	Measurement of Process Variables	25	75	100	40	3
4042430	Measurements & Instruments	25	75	100	40	3
4020620	E-Vehicle Technology	25	75	100	40	3
4042450	Analog and Digital Electronics Practical	25	75	100	50	3
4042460	Measurement of Process Variables Practical	25	75	100	50	3
4042470	Virtual Instrumentation Practical	25	75	100	50	3
	TOTAL	**175**	**525**	**700**		

FIFTH SEMESTER (FULL TIME)

Subject Code	Subject	Examination Marks			Minimum for Pass	Duration of Exam (in Hours)
		Internal Assessment Marks	Board Exam Marks	Total Marks		
4042510	Process Control Instrumentation	25	75	100	40	3
4042520	Control Engineering	25	75	100	40	3
	Elective Theory - I					
4042531	1. Microcontoller	25	75	100	40	3
4042532	2. Industrial Instrumentation					
4042533	3. Industrial Power Electronics					
4042540	Process Control Instrumentation Practical	25	75	100	50	3
4042550	Control Engineering Simulation Practical	25	75	100	50	3
	Elective Practical - I					
4042561	1. Microcontroller Practical	25	75	100	50	3
4042562	2. Industrial Instrumentation Practical					
4042563	3. Industrial Power Electronics Practical					
4040570	Entrepreneurship and Startup	25	75	100	50	3
	TOTAL	**175**	**525**	**700**		

SIXTH SEMESTER (FULL TIME)

Subject Code	Subject	Examination Marks			Minimum for Pass	Duration of Exam (in Hours)
		Internal Assessment Marks	Board Exam Marks	Total Marks		
4042610	Industrial Automation Drives	25	75	100	40	3
4042620	Bio-medical Instrumentation	25	75	100	40	3
	Elective Theory – II					
4042631	1. Programmable Logic Controller	25	75	100	40	3
4042632	2. Power Plant Instrumentation					
4042633	3. Embedded System Design with ARDUINO					
4042640	Industrial Automation Practical	25	75	100	50	3
	Elective Practical - II					
4042651	1. Programmable Logic Controller Practical	25	75	100	50	3
4042652	2. P&ID using CAD Practical					
4042653	3. Embedded System with ARDUINO Practical					
4042660	Project Work and Internship	25	75	100	50	3
	TOTAL	**150**	**450**	**600**		

EQUIVALENT PAPERS (M SCHEME TO N SCHEME)

III SEMESTER (W.E.F. OCTOBER 2021)

M SCHEME		N SCHEME	
Subject Code	Subject Name	Subject Code	Subject Name
34031	Electronic Devices & Circuits	--	No Equivalent
34232	Electrical Circuits & Machines	--	No Equivalent
34233	Basics of Instrumentation	4042330	Basics of Instrumentation
34234	Electrical & Electronics Practical	--	No alternate paper
34235	Basics of Instrumentation Practical	4042360	Basics of Instrumentation Practical
35236	C Programming Practical	4042370	C Programming Practical
34237	Computer Application and Simulation Practical	--	No alternate paper

IV SEMESTER (W.E.F. APRIL 2022)

M SCHEME		N SCHEME	
Subject Code	Subject Name	Subject Code	Subject Name
34241	Analog and Digital Electronics	4042410	Analog and Digital Electronics
34242	Measurements and Instruments	4042430	Measurements and Instruments
34243	Measurement of Process Variables	4042420	Measurement of Process Variables
34244	Industrial Instrumentation	4042532	Industrial Instrumentation **(w.e.f. October 2022)**
34245	Analog and Digital Electronics Practical	4042450	Analog and Digital Electronics Practical
34246	Measurement of Process Variables Practical	4042460	Measurement of Process Variables Practical
30002	Life and Employability Skill Practical*	40001	Communication Skill Practical

V SEMESTER (W.E.F. OCTOBER 2022)

M SCHEME		N SCHEME	
Subject Code	Subject Name	Subject Code	Subject Name
34251	Process Control Instrumentation	4042510	Process Control Instrumentation
34052	Microcontroller	4042531	Microcontroller
34253	Control Engineering	4042520	Control Engineering
Elective Theory - I			
34271	1. Instrumentation System Design	-	No alternate paper
34272	2. Programmable Logic Controller	4042631	Programmable Logic Controller **(w.e.f. April 2023)**
34273	3. Industrial Power Electronics	4042533	Industrial Power Electronics
34255	Process Control Instrumentation Practical	4042540	Process Control Instrumentation Practical
34056	Microcontroller Practical	4042561	Microcontroller Practical
34257	LABVIEW & MATLAB Practical	-	No alternate paper

VI SEMESTER (W.E.F. APRIL 2023)

M SCHEME		N SCHEME	
Subject Code	Subject Name	Subject Code	Subject Name
34062	Bio-Medical Instrumentation	4042620	Bio–medical Instrumentation
34262	Industrial Automation & Drives	4042610	Industrial Automation & Drives
Elective Theory - II			
34763	1. Robotics	-	No alternate paper
34082	2. Test Engineering	-	No alternate paper
34283	3. Power Plant Instrumentation	4042632	Power Plant Instrumentation
34264	Industrial Automation Practical	4042640	Industrial Automation Practical
Elective Practical - II			
34284	1. P & I Drawings using CAD Practical	4042652	P & I Drawings using CAD Practical
34085	2. Test Engineering Practical	-	No alternate paper
34084	3. P & I Drawings using CAD Practical	4042652	P & I Drawings using CAD Practical
34266	Programmable Logic Controller Practical	4042651	Programmable Logic Controller Practical
34267	Project Work	--	No alternate paper

III SEMESTER

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042310**

Semester : III

Subject Title : **BASICS OF ELECTRICAL AND ELCTRONICS ENGINEERING**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Basics of Electrical and Electronics Engineering	5	80	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	DC and AC Circuits	14
II	DC Machines and Concept of 3 Phase Supply	14
III	AC Machines and Transformer	14
IV	Diode and Transistor Based Circuits	14
V	Oscillators, FET and Optical Devices	14
	Revision	3
	Tests & Model Examination	7
	Total	**80**

RATIONALE:

Basics of electric circuit theory and electrical machines are vital for Instrumentation engineers. Electronic components checking characteristics must be studied by the budding Instrumentation Engineers before they go for further applications. For this basic subject must be taught in full understanding of the principles

OBJECTIVES:

On completion of the following units of syllabus contents, the students must be able to:

- Understand the Electrical quantities and Circuits
- Understand to analyze DC circuits by applying theorems
- Understand the AC fundamentals and AC circuits with R,L,C componensts
- Understand the construction and working of DC generators
- Understand the construction and working of DC Motors
- Understand the concept of 3 phase supply
- Understand the construction and working of 3 phase alternator and 3 phase induction motors
- Understand the working of stepper motor
- Understand the construction and working of Transformer
- Understand the construction and working of Diode
- Understand the working principle of different types of rectifiers
- Understand the different transistor configurations
- Differentiate various types of amplifiers
- Study the performance of different transistor oscillators
- Know the working principle of optoelectronic devices
- Study the performance of solar cell with principle and applications

4042310 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**DC and AC Circuits** Concept of electrical quantities – Voltage – current – resistance – power – energy – ohm's law – Resistances in series – Resistances in parallel – series parallel circuits – Kirchhoff's laws, Thevenin's, Norton's, Superposition and maximum power transfer theorems – Statement and explanations – Simple problems	6
	AC fundamentals – AC waveform – sinusoidal and non-sinusoidal – period – frequency – cycle – amplitude – phase – peak value – average value – RMS value (effective value) – form factor – crest factor- energy stored in a inductor and capacitor– derivation - AC Through pure resistor, inductor and Capacitor – Concept of impedance – vector diagram. Power in AC circuits – power factor – RL, RC and RLC series and parallel circuits.	8
II	**DC Machines & Concept of 3ϕ Supply** DC machines – Types – constructional details of DC machines – DC generators – principle – types – emf equation- DC motor – types – motor action – back emf – torque speed characteristics – starting of motors using 3 and 4 point starters – speed control of DC motor-applications.	7
	Concept of 3ϕ supply – line and phase voltage and current in star and delta connected circuits – three phase power – Measurement of three phase power by two watt meter method – advantages of three phase over single phase system.	7
III	**AC Machines & Transformer** AC machines – 3ϕ alternator – construction and working – relation between speed and frequency. 3ϕ Induction motor – construction – types – principle of operation – methods of starting of 3ϕ induction motor – slip. Single phase induction motor – principle of operation – capacitor start - motors – Applications – principle of operation - Stepper motor.	8
	Transformer – Ideal transformer – principle of working – constructional details – emf equation – turns ratio – core loss – copper loss – efficiency – regulation – SC and OC tests – simple problems. Auto transformer – construction and working – applications.	6

IV	**Diode and Transistor based Circuits** Diodes - PN junction diode-Forward and Reverse bias characteristics - Half wave rectifier – Full wave rectifier (Center tapped, Bridge) Specification - Zener diode - working principle-Characteristics - Zener diode as a voltage regulator – NPN and PNP transistor – operation- Transistor as an amplifier – Transistor as a switch - Transistor biasing - CB, CE, CC Configurations – Characteristics-RC coupled amplifier – Emitter follower and its application - Astable, and Monostable Multivibrators using Transistors - Schmitt Trigger using Transistors	14
V	**Oscillators, FET & Optical Devices** Transistor Oscillator – Condition for oscillations (Barkhausen criterion) General form of LC oscillator –– RC Phase shift oscillator- Crystal oscillator. Field Effect Transistor – Construction – Working principle of FET – Difference between FET and BJT – SCR – Introduction – Working – Comparison between SCR and Transistor– VI Characteristics – SCR as a switch , Controlled rectifier Classification of opto electronic devices – Symbols, Characteristics, Working of LDR, LED, 7 segment LED and LCD – Opto coupler - Photo transistor - Solar Cell Principles – Applications.	4 5 5
	Seminar, Revision and Test	10

TEXT BOOKS

1. A Text Book of Electrical Technology, Vol I and II by Theraja B L. S Chand & Co.
2. Circuit Theory by Nagoor Kani , RBA publications
3. Principles of Electronics by V K Mehta and Rohit Mehta, S. Chand Publications
4. Electronic Devices and Circuits by Salivahanan, N Sureshkumar and A Vallavaraj

REFERENCE BOOKS

1. Circuit Theory by Arumugam & Premkumar, Khanna Publishers
2. Electronic Principles by Malvino, Tata McGraw Hill publication, 2010
3. Electronic Devices and Circuits by Allen Motershed , PHI

E-LECTURES

UNIT	TOPIC	URL	
II	AC THROUGHPURE INDUCTOR AND CAPACITOR	https://www. youtube. com/watch? v=e9YRpLKD0 Us	
I	KVL AND KCL	https://www. youtube. com/watch? v=zX5SiFQuxd8	
I	KVL AND KCL(COPY)	https://www. youtube. com/watch? v=zX5SiFQuxd8	
I	RESISTOR INSERIES AND PARALLEL	https://www. youtube. com/watch? v=W7SZQT26J ac	
I	MESH METHOD AND THEVENIN THEOREM	https://www.youtube. com/watch?v=B- cjGGCB74Q&lis t=PL1b9Ht9ISqI	

UNIT	TOPIC	URL	
I	THEVENINS THEOROM	https://www. youtube. com/watch? v=snUsb99vQO g	
I	NORTON THEOROM	https://www. youtube. com/watch? v=EHdcvuUpws 0	
I	SUPERPOSITION AND MAX POWER TRANSFER THEROMS AND INTRO TO	https://www. youtube. com/watch? v=m-rwjWajKj0	
II	AC THROUGE PURE CAP AND INDUCTANCE	https://www. youtube. com/watch? v=CiNL736ific	
II	AC THROUGH PURE INDUCTOR AND CAPACITOR	https://www. youtube. com/watch? v=e9YRpLKD0 Us	
II	INTRODUCTION TO RL CIRCUITS	https://www. youtube. com/watch? v=cIDoAoJGd0 g	

UNIT	TOPIC	URL	
II	AC THROUGH RC SERIES CIRCUIT	https://www. youtube. com/watch? v=BzIkW2APge Q	
II	RLC SERIES RESONANCE	https://www. youtube. com/watch? v=WdfkQN12n RI	
II	RLC PARALLEL	https://www. youtube. com/watch? v=59V5AGqdvc g&list=PL1b9Ht 9ISqIHn-	
III	TRANSFORME RS AND DC MACHINES	https://www. youtube. com/watch? v=pDoY-FWVXWY	
III	DC MACHINES	https://www. youtube. com/watch? v=EFtt5_0mA34 &list=PL1b9Ht9I SqIHn-	
III	DC MOTORS	https://www. youtube. com/watch? v=NlyAZAZ2Ka s&list=PL1b9Ht 9ISqIHn-	

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042320**

Semester : III

Subject Title : **BASICS OF INSTRUMENTATION**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Basics of Instrumentation	5	80	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	Basics of Instrumentation	14
II	Performance characteristics of Instruments	14
III	Sensors and Transducers	14
IV	Mechanical and Optical Transducers	14
V	Electrical Transducers	14
	Revision	3
	Tests & Model Examination	7
	Total	**80**

RATIONALE

Instrumentation and Control Engineers plays a major role in process industries. The students of Instrumentation and Control Engineering branch need a brief idea about the basic concepts of instrumentation, various transducers and their characteristics which can be helpful to them to study the core subjects during their academics. This subject covers the basic needs of instrumentation and it makes the students to understand the importance of instrumentation in industries.

OBJECTIVES

On completion of the Units mentioned above, the students would be able to

- Define measurement, Instrument, Instrumentation system.
- List and explain the major components of an Instrumentation system for bourdon tube and pressure thermometer.
- List the three types of standards and describe the purpose of each type of
- standard Concept of calibration.
- Explain the classification of errors.
- Concept of statistical analysis of test data.
- List the static characteristics and describe the effect of each on the performance.
- List the dynamic characteristics and describe the effect of each on the performance.
- List the standard test input signals.
- Describe the dynamic response of instruments.
- Concept of time constant.
- Describe the purpose of major components in a transducer.
- Explain the difference between primary and secondary transducer.
- Explain the difference between Active and Passive transducer
- Explain the difference between Analog and Digital transducer
- Explain the difference between Transducer and Inverse transducer
- Explain the characteristics of transducer
- Discuss criteria to consider in choosing a transducer.
- Compare and contrast Electrical transducer and mechanical transducer.

- Explain the pressure sensor, proximity sensor, displacement sensor.
- Explain the magnetic sensor, Bio sensor, Hall-effect sensor and optical sensor.
- Describe the principle of working, construction and application, of the mechanical transducer.
- Explain the elastic elements.
- Explain the mechanical pressure transducer.
- Explain the Thermal detector.
- Explain the Hydro pneumatic elements.
- Describe the principle of working, construction and application of the optical transducer.
- Describe the principle of working, construction and application of Electrical transducer.
- Explain variable resistive transducer and their types.
- Explain variable Inductive transducer.
- Explain the principle of LVDT
- Explain variable capacitive transducer.
- Explain the piezo-electric transducer

4042320 – BASICS OF INSTRUMENTATION

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**1. FUNDAMENTALS OF INSTRUMENTATION** Definition – Measurement, Instrument, Instrumentation system. Generalized Functional block diagram of an Instrumentation system – Examples – Bourdon tube pressure gauge, Pressure Thermometer. Definition – Standards, Primary, Secondary and Working Standards –Definition – Limiting Error, Relative error, Calibration, Zero error, Backlash error- Classification of errors – Gross error, Systematic error, Random error. Statistical analysis of test data – Arithmetic mean, Deviation, Standard Deviation, Variance, Simple problems.	14
II	**2. PERFORMANCE CHARACTERISTICS OF INSTRUMENTS** **2.1. Static Characteristics** True value, static Error, static correction Range, Span, Accuracy, Precision, Significant of figure, Range of doubt, Dead time, Dead zone, Hysteresis, Threshold, Resolution, Sensitivity, Linearity, Reproducibility, Stability, Loading effect, Input impedance and Output impedance. **2.2. Dynamic Characteristics** Speed of response, Measuring lag, Fidelity and Dynamic error. Standard Test input signals - Dynamic response – Steady state and Transient response.	9 5
III	**3. TRANSDUCERS AND SENSORS** Transducer – Definition, classification – Primary and Secondary transducer, Active and Passive transducer, Analog and Digital transducer, Transducer and Inverse Transducer (with one example for each classification). Characteristics of transducer – Input characteristics, Output characteristics and transducer Response. Factors to be considered in the selecting of Transducers. Electrical Transducer- Advantages of electrical Transducer over Mechanical Transducer. Sensors – Pressure Sensor, Proximity and Displacement sensor, Magnetic sensor, Bio sensor, Hall-effect sensor, Optical sensor.	10 4
V	**4. MECHANICAL TRANSDUCER** Definition- Mechanical pressure transducer - Elastic element – Bourdon tube, Bellows, Diaphragms. Manometers – U Tube manometer, Well type manometer, Barometer, Inclined tube manometer, Ring balance manometer, Micro manometer,	

	manometric fluids-Construction, Principle, Working and Applications only –Thermal detectors – Liquid in glass thermometer, Filled system thermometer, Bi-metallic thermometer-Construction, Principle, Working and Applications only. Hydro-pneumatic elements – Venturi and Orifice - Construction, Principle, Working and Applications only.	10 4
V	**5. ELECTRICAL TRANSDUCER** Definition- Resistive Transducer-Potentiometer–types, Piezo-Resistive effect- Strain gauge – types – bonded, unbounded, semiconductor strain gauge- Resistance Temperature Detector - Thermo-couple, Thermistor, Thermo-diodes and transistors – Construction, Principle, Working and Applications only. Variable Inductance Transducer - LVDT, Variable capacitance transducer - Construction, Principle, Working and Applications only. Piezo-electric Transducer – Piezoelectric effect, materials, Modes of operation, Properties of Piezoelectric crystals, Equivalent circuit – Applications.	10 4
	Seminar, Revision and Test	10

TEXT BOOK

1. A course in Electrical and Electronic measurement and Instrumentation by A.K. Shawney, Dhanpat Rai & co., Reprint 2010.

REFERENCE BOOKS

1. HERMAN. K. P NEUBERT, Instrument transducers, An Introduction to Their Performance and Design, Oxford University Press, 2nd Edition.

2. K .SHAWNEY, PUNEET SHAWNEY, A Course in Mechanical Measurement and Instrumentation, Dhanpat Rai & Co, 12th Edition, 2001–2002.

3. D. S. KUMAR, Mechanical Measurements & Control, Metropolitan Book Co Pvt. Ltd, 3rd Edition 1989.

4. S.K. SINGH, Industrial Instrumentation & control, Tata Mc Graw Hill Publishing Company Ltd. 13th Edition 1997.

5. C. NAKRA, K. K. CHAUDRY, Instrumentation Measurement and Analysis, 2nd Edition, Tata McGraw Hill Publishing Company.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042330**

Semester : III

Subject Title : **C PROGRAMMING**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
C Programming	6	80	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	BASICS OF COMPUTERS AND PROGRAMMING	14
II	INTRODUCTION TO C, OPERATORS AND I/O STATEMENTS	14
III	BRANCHING, LOOPING, ARRAYS AND FUNCTIONS	16
IV	STRUCTURES, DYNAMIC MEMORY MANAGEMENT	13
V	C PROGRAMS FOR SELECTED PROBLEMS	13
	Revision	3
	Tests & Model Examination	7
	Total	**80**

RATIONALE

'C' is the most widely used computer language, which is being taught as a core course. C is general purpose structural language that is powerful, efficient and compact, which combines features of high level language and low-level language. It is closer to both Man and Machine. Due to this inherent flexibility and tolerance it is suitable for different development environments. Due to these powerful features, C has not lost its importance and popularity in recently developed and advanced software industry. C can also be used for system level programming and it is still considered as first priority programming language. This course covers the basic concepts of C. This course will act as "Programming concept developer" for students. It will also act as "Backbone" for subjects like OOPS, Visual Basic, Windows Programming, JAVA etc.

OBJECTIVES

At the end of the Course, the students will be able to

- Understand the basic concepts of Computers and Programming
- Describe the concepts of Constants, Variables, Data types and operators.
- Develop programs using input and output operations.
- Understand the structure and usage of different looping and branching statements.
- Define arrays and array handling.
- Explain user-defined functions, structures.
- Understand the dynamic data structure and memory management.
- Develop programs for selected mathematical and engineering problems.

4042330 C PROGRAMMING

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**1. BASICS OF COMPUTERS AND PROGRAMMING** **1.1. Basics of Computers** Definition of Computer – Generation of Computers – Basic Block Diagram of Computer – CPU – Arithmetic Logic Unit – Control Unit – Input Devices – Output Devices – Main Memory - Secondary Storage Devices – Number Systems – Binary, Octal and Hexadecimal – Introduction to Software – Types – System Software and Application Software – Operating Systems. **1.2. Basics of Programming** Computer Languages – Types – Machine Language – Assembly Language - High Level Language – Assemblers – Interpreters - Compilers – Editors – Flowcharts and Algorithms – Flow chart for addition of two numbers, greater number of two numbers, and sum of a series (1 + 2 + 3 + ... + N)	7 7
II	**2. INTRODUCTION TO C, OPERATORS AND I/O STATEMENTS** **2.1. Introduction to C** Importance of C – Basic Structure of C program – Executing a C Program - C Character Set – Constants - Keywords – Identifiers – Constants and variables – Data types - Storage classes – Preprocessor directives – Header files – Comment statement - Declaration of variables – Assigning values to variables – Initialization of variables – Defining symbolic constants. **2.2. Operators** Arithmetic operators – Relational operators – Logical operators – Assignment operators - Increment and Decrement operators – Conditional operators – Bitwise operators - Special operators – Precedence and Associativity of operators. **2.3. I/O Statements** Formatted Input – scanf() - Formatted output – printf() - Unformatted I/O statements – putchar(), getchar(), puts() and gets() – Console I/O – cscanf() and cprintf()	5 5 4
III	**3. BRANCHING, LOOPING, ARRAYS AND FUNCTIONS** **3.1. Branching** Introduction – conditional and unconditional - if statement – if ... else – if ... else ... if ladder - nested if ... else - switch statement – goto statement.	4

	3.2. Looping Statements Introduction - while, do ... while statements – difference between while and do ... while - for loop - break and continue statements. **3.3. Arrays** Declaration and initialization of one dimensional - two dimensional and character arrays – Accessing array elements. **3.4. Functions** Built-in functions: Math functions: sqrt(), log(), abs(), exp(), pow(), ceil(), floor(), sin(), cos() and tan() - Character oriented functions: isdigit(), isalpha(), isupper(), islower(), toupper() and tolower() – User Defined Functions – Function definition – Declaring type of function – Parameter passing - Function call and return values - Recursion.	4 4 4
V	**4. POINTERS, STRUCTURES AND DYNAMIC MEMORY MANAGEMENT** **4.1. Pointers** Introduction to Pointers – Declaring Pointers – Text Strings and Pointers. **4.2. Structures** Structure – Definition, initialization, arrays of structures - Arrays within structures - Structures within structures. **4.3. Dynamic Memory Management** Introduction – dynamic memory allocation – allocating a block memory – malloc() – allocating multiple blocks of memory – calloc() – releasing the used space: free – altering the size of a block – realloc().	4 4 5
V	**5. C PROGRAMS FOR SELECTED PROBLEMS** Program to find sum of series using while loop - Program to find factorial of a number using functions - Program to swap the values of two variables. Program to implement Ohms law - Program to find resonant frequency of RLC Circuit - Program to find equivalent resistance of three resistances connected in series and parallel - Program to display the average, RMS, form factor and crest factor from the given peak value - Program to find the arithmetic mean, range, deviation and standard deviation of the give 10 readings (data) - Program to convert Celsius to Fahrenheit and vice versa using function.	5 8
	Seminar, Revision and Test	10

TEXT BOOK

1. Programming in ANSI C, 4th Edition, Prof. E. Balagurusamy, Tata McGraw Hill Publications.

REFERENCE BOOKS

1. Programming and Problem Solving using C by ISRD Group, Lucknow, Tata McGraw Hill, New Delhi, 6th Reprint, 2010.
2. Let Us C, Yeswanth Kanetkar, BPB Publications, 4th Revised Edition.
3. A Text Book on C, E. Karthikeyan, PHI, New Delhi, 2008.
4. Programming in C, D. Ravichandran, New Age International Publishers, First Edition.
5. Computer Concepts and Programming in C, Dr S S Khandare, S. Chand & Company, New Delhi, 2010.
6. Complete Knowledge in C, Sukhendu Dey, Debobrata Dutta, Narosa Publishing House, New Delhi, 2010.
7. Programming in C, Reema Theraja, Oxford University Press, 2011.
8. Practical Programming, Steve Oualline, O Reilly Shroff Publishers, 11th Edition, 2010.
9. Computer Concepts and C Programming by R. Rajaram, Scitech Publications, Chennai.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042340**

Semester : III

Subject Title : **ELECTRICAL ENGINEERING PRACTICAL**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Electrical Engineering Practical	4	64	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE

The fundamental practical knowledge about AC and DC circuit is essential for all diploma holders. The working principle of DC generator, induction motors and transformer is further understood by conducting load test.

OBJECTIVES

- Verify Ohm's & Kirchhoff's law
- Verify Thevinin's, Norton's, Superposition and Maximum Power Transfer theorem.
- Conduct load test on DC generators.
- Conduct load test on single phase inductor motor.
- Measure 3 phase power using two wattmeter method.
- Conduct load test on 3 phase induction motor.
- Conduct OC & SC test on single phase transformer.
- Conduct load test on single phase transformer.

4042340 ELECTRICAL ENGINEERING PRACTICAL

LIST OF EXPERIMENTS

1. Verification of Ohm's Law
2. Verification of Kirchhoff's Voltage and Current Laws.
3. Verification of Thevinin's Theorem for a DC circuit.
4. Verification of Norton's Theorem for a DC circuit.
5. Verification of Superposition Theorem for a DC circuit.
6. Verification of Maximum Power Transfer Theorem for a DC circuit.
7. Load Test on DC Shunt Generator
8. Load Test on Single Phase Induction Motor
9. Measurement of 3 Phase Power using Two Wattmeter method.
10. Load test on 3 Phase Induction Motor.
11. Open Circuit and Short Circuit Test on Single Phase Transformer.
12. Load Test on Single Phase Transformer.

SCHEME OF EVALUATION

SNo	Description	Allocation of Marks
1	Circuit Diagram	30
2	Connections & Procedure	30
3	Tabulation & Graph	25
4	Result	10
5	Viva Voce	5
TOTAL		**100**

EQUIPMENTS REQUIRED

SNo	Name of the Equipments	Range	Required Nos
1.	DC Ammeter	(0 – 100) mA	2 nos.
2.	DC Ammeter	(0 – 50) mA	3 nos.
3.	DC Voltmeter	(0 -10) V	5 nos.
4.	DC Voltmeter	(0 -30) V	2 nos.
5.	Variable DC Power Supply	(0 – 30) V / 2A	5 nos.
4.	DC Shunt Generator	---	1 no.
6.	Single Phase Induction Motor with loading arrangement	---	1 no.
7.	Three Phase Induction Motor with loading arrangement	---	1 no.
8.	Single Phase Transformer	---	2 nos.
9.	DC Voltmeter	(0- 300) V	2 nos.
10.	DC Ammeter	(0 – 5) A	1 no.
11.	AC Ammeter	(0 – 10) A	2 nos.
12.	AC Voltmeter	(0 – 50) V	1 nos.
13.	AC Voltmeter	(0 – 300) V	2 nos.
14.	Wattmeter	300 V / 5 A	2 nos.
15.	Single Phase Load (Lamp or Resistive)	--	1 no.
16.	Resistors	As required	

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042350**

Semester : III

Subject Title : **ELECTRONICS ENGINEERING PRACTICAL**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Electronics Engineering Practical	4	64	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE

Knowledge of basic electronic circuits is quite essential for a student of Instrumentation and Control Engineering. With the knowledge of active and passive components the student will work successful in every field of the branch.

OBJECTIVES

- Experimentally plot VI characteristics of PN junction diode and Zener diode.
- Construct voltage regulator using ICs.
- Construct full wave, half wave and bridge rectifier circuits and study the output waveforms.
- Experimentally plot input and output characteristics of Common Emitter Transistor Configuration.
- Draw frequency response of RC coupled amplifier.
- Construct RC phase shift oscillator.
- Experimentally plot VI characteristics of FET.
- Experimentally plot VI characteristics of SCR.
- Experimentally plot characteristics of LED & LDR.

4042350 ELECTRONICS ENGINEERING PRACTICAL

LIST OF EXPERIMENTS

1. Construct and plot the VI characteristics of PN junction diode and find the cut in voltage.
2. Construct and plot the VI characteristics of Zener diode and find the breakdown voltage.
3. Construct voltage regulator circuit using Zener diode.
4. Construct full wave rectifier, half wave rectifier circuit and observe the waveform.
5. Construct bridge rectifier and observe the waveform.
6. Construct and draw the input and output characteristics of CE transistor configuration and also find its input and output resistance.
7. Construct and draw the frequency response of RC coupled amplifier and determine the 3-db bandwidth.
8. Construct RC phase shift oscillator circuit and obtain the frequency of oscillation.
9. Construct and plot the VI characteristics of FET.
10. Experimentally obtain the VI characteristics of SCR.
11. Experimentally obtain the characteristics of LED.
12. Experimentally obtain the characteristics of LDR.

SCHEME OF EVALUATION

SNo	Description	Allocation of Marks
1	Circuit Diagram	30
2	Connections & Procedure	30
3	Tabulation & Graph	25
4	Result	10
5	Viva Voce	5
TOTAL		**100**

EQUIPMENTS REQUIRED

SNo	Name of the Equipments	Range	Required Nos
1	Regulated power supply	0 - 30V	6
2	Regulated power supply	0 - 60V	1
3	Signal generator	1 MHz	4
4	Dual trace CRO	30 MHz	4
5	Transformer	12 – 0 – 12 V	5
6	Digital Multimeter	-	5

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042360**

Semester : III

Subject Title : **BASICS OF INSTRUMENTATION PRACTICAL**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Basics of Instrumentation Practical	4	64	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE

As in any process and instrumentation industries calibration is a vital process to be done, and sensor and transducers is fundamental device, in this subject practice is given to the students in this regard.

OBJECTIVE

- To understand the calibration procedure ammeter , voltmeter and Thermometer is to be calibrated
- To get practice to use Multimeter and CRO to measure electrical parameters
- To understand the characteristics of Transducers , some of their(strain gauge, LVDT, Thermistor, RTD) characteristics to be obtained experimentally

4042360 BASICS OF INSTRUMENTATION PRACTICAL
LIST OF EXPERIMENTS

1. Calibrate the given Ammeter with the standard Ammeter of same range

2. Calibrate the given Voltmeter with the standard voltmeter of same range

3. Calibrate the given thermometer against the standard thermometer

4. Conduct experiment to measure the voltage across a resistor using moving coil voltmeter in a single loop simple DC series circuit having 10V DC and two 1KΩ resistors in series. Observe minimum 6 readings by each individual of a batch. Perform statistical analysis with observed readings to find Arithmetic mean, deviation, standard deviation and variance

5. Conduct experiment to measure the voltage across a resistor using moving coil voltmeter in a single loop simple DC series circuit having 10V DC and two 1KΩ resistors in series. Observe the following static characteristics of the voltmeter: range, span, Accuracy, Precision and linearity

6. Conduct experiment to Measure pressure using U tube manometer

7. Experimentally obtain V-I characteristics of Potentiometer and observe linearity.

8. Experimentally obtain the Characteristics of Strain gauge

9. Experimentally obtain the Characteristics of LVDT

10. Experimentally obtain the Characteristics of Thermistor.

11. Experimentally obtain the Characteristics of Resistance Temperature Detector.

12. Experimentally obtain the Characteristics of thermocouple.

SCHEME OF EVALUATION

SNo	Description	Allocation of Marks
1	Circuit Diagram	30
2	Connections & Procedure	30
3	Tabulation & Graph	25
4	Result	10
5	Viva Voce	5
TOTAL		**100**

EQUIPMENTS REQUIRED

SNo	Name of the Equipments	Required Nos
1	Ammeter (0 - 50) mA	4
2	Voltmeter (0 – 10V), (0-5V)	4
3	Regulated Power Supply (0-30V)	4
4	Rheostat	4
5	Thermometer	2
6	Pressure measuring setup using U tube manometer	1
7	Digital Multimeter	6
8	CRO Dual Trace 20 MHz / 30 MHz	2
9	Strain measurement module using Strain gauge	2
10	Displacement measurement module using LVDT	2
11	Thermistor with industrial standard	2
12	3 wire RTD (PT-50 / PT-100) with industrial standard	2
13	Thermocouple (J-type / K-type) with industrial standard	2
14	Water bath with heater arrangement	3

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042370**

Semester : III

Subject Title : **C PROGRAMMING PRACTICAL**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Basics of Instrumentation Practical	4	64	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE

This subject is a fundamental for the student to learn how to write a program in high level language . so it will be useful for Instrumentation and control engineers to write coding and to develop the software. Further practice for writing simple program for instrumentation application is insisted.

OBJECTIVES

At the end of the Course, the students will be able to

- Analyze the given problem.
- Think the logic to solve the given problem.
- Describe the concepts of constants, variables, data types and operators. Develop programs using input and output operations.

- Write programs using different looping and branching statements. Write programs based on arrays.
- Write programs using the concept of Pointers.
- Write programs for solving simple equations used in circuit theory. Write programs to convert Celsius to Fahrenheit

4042370 C PROGRAMMING PRACTICAL
LIST OF EXPERIMENTS

1. Write C language program to find the solution of a quadratic equation

2. Write C language program to find whether the given number is a positive number, negative number or zero

3. Write C language program to find the sum of series using While loop

4. Write C language program to perform the Arithmetic operation based on the numeric key press using switch case statement. (1-Addition, 2-Subtraction, 3-Multiplication, 4-Division)

5. Write C language program to implement Matrix addition

6. Write C language program to find factorial of given N numbers using function

7. Write C language program to prepare the total marks for N students by reading the Name, Reg.No, Marks 1 to Marks 6 using array of structure

8. Write C language program to swap the values of two variables using pointer

9. Write C language program to calculate the equivalent resistance of three resistances connected (a) in series (b) in parallel.

10. Write C language program to display the average, RMS, form factor and crest factor from the given peak value

11. Write C language program to find the Arithmetic mean, Range, Deviation and standard deviation of the give 10 readings (data)

12. Write C language program to convert Celsius to Fahrenheit using function.

SCHEME OF EVALUATION

SNo	Description	Allocation of Marks
1	Writing Algorithm	20
2	Writing Program	40
3	Executing Program	25
4	Result	10
5	Viva Voce	5
TOTAL		**100**

EQUIPMENTS REQUIRED

SNo	Name of the Equipments / Software	Required Nos
1	Desktop Computers	30
2	Laser Printer	1
3	Uninterrupted Power Supply (5 KVA) (1 Hour Backup)	1
4	C Compiler with Editor	--

IV SEMESTER

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042410**

Semester : IV

Subject Title : **ANALOG AND DIGITAL ELECTRONICS**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Analog and Digital Electronics	5	80	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	Linear Ics: Op. amp. Timer and their applications	14
II	Boolean Algebra and reduction technique	14
III	Combinational Logic circuits	14
IV	Sequential Logic circuits	14
V	D/A, A/D and Memory	14
	Revision	3
	Tests & Model Examination	7
	Total	**80**

RATIONALE

Digital electronics replaces the analog circuits in many fields. Using digital circuits is easier . Diploma holders must have knowledge about the fundamental laws used in digital electronics and the working principle of digital circuits. Operational amplifiers find application in timer circuits . This subject deals with both analog and digital electronic circuits.

OBJECTIVES

- Explain the characteristics and applications of operational amp.
- Learn the concepts of Astable and Mono stable Multivibrator using 555.
- Recognize the different number systems such as binary, BCD, Octal, Hexadecimal
- Familiarize the Truth Table and symbol of Logic gates
- Learn the operation of Adders and subtractor
- Distinguish between Combinational Logic and Sequential Logic
- Familiarize the reduction technique using Karnaugh map(2 variable to 4 variable)
- Familiarize the concept of multiplexer, Demultiplexer , encoder and decoder
- Explain various Flip flops , registers and counters
- Study the different types of A/D and D/A converters

4042410 ANALOG AND DIGITAL ELECTRONICS

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**1.1. Linear ICs: Op-amps, Timers and their Applications** Operational amplifier – Ideal Op.Amp – Block diagram and characteristics –Op-amp parameters – CMRR – Slew rate – Applications of op-amp – Inverting amplifier – Virtual ground-Summing amplifier – Non inverting amplifier – Voltage follower – Comparator – Zero crossing detector – Differential Amplifer – Instrumentation Amplifier - Integrator – Differentiator – V to I converter – I to V converter, Circuit diagram and working of ramp, triangular, square wave Generators, low pass and high pass filters using op. amps. **1.2. 555 Timer** 555 Timer - Functional Block diagram – Astable, Monostable and Schmitt Trigger – Sequence timer,555 timer can be used as PWM.	14
II	**2. Boolean Algebra and Reduction Technique** Number systems – Decimal – Binary – Octal – Hexadecimal – BCD – Conversion from one number system to other – Boolean Algebra – Basic laws and Demorgan's Theorems – Logic gates – OR – AND – NOT – NOR – NAND – EX-OR Symbols, Truth table and Boolean expression – Realization of gates using universal gates NAND, and NOR –– Boolean expression for outputs – Simplification of Boolean expression using Karnaugh map (up to 4 variable)- Problems using 2, 3, and 4 variables - Constructing logic circuits for the Boolean expressions.	14
III	**3. Combinational Logic Circuits** Arithmetic circuits – Binary addition – Binary Subtraction – 1's complement and 2's complement – Signed binary numbers – Design, Construction and working of Half adder – Full adder – Half subtractor – Full subtractor – Parity Generator and checker – Digital comparator – Arithmetic Logic Unit - Decoder – 3 to 8 decoder – BCD to seven segment decoder – Encoder – Multiplexer – Demultiplexer – Digital Logic families – TTL - CMOS – LS series – Fan in – Fan out – Propagation delay – Noise immunity for the above families.	14
IV	**4. Sequential Logic Circuits** Flip-flops – RS – D – T – JK – Edge triggered FF – Asynchronous Binary Counter – Decade counter – Mod n counter – Ripple Up counter- Ripple Down Counter – Preset table counter – Synchronous counter – Design method- State diagram-state table-Excitation table – Ring counter – Johnson counter – Shift register – 4 bit shift register – Serial in Serial out – Serial in Parallel out – Parallel in serial out- Parallel in parallel out	14

V	**5. D/A, A/D Converters and Memory** D/A Converter – Basic concepts – Weighted Resistor D/A converter - R-2R Ladder D/A converter – Specification of DAC IC. ADC - Sampling and quantization – Analog to digital conversion using Ramp method - Successive approximation method – Dual slope method, Flash type ADC, Memory – Static Memory – Dynamic Memory – Static Memory organization in terms of address lines, control lines and data lines –– SDRAM – DDR RAM	14
	Seminar, Revision and Test	10

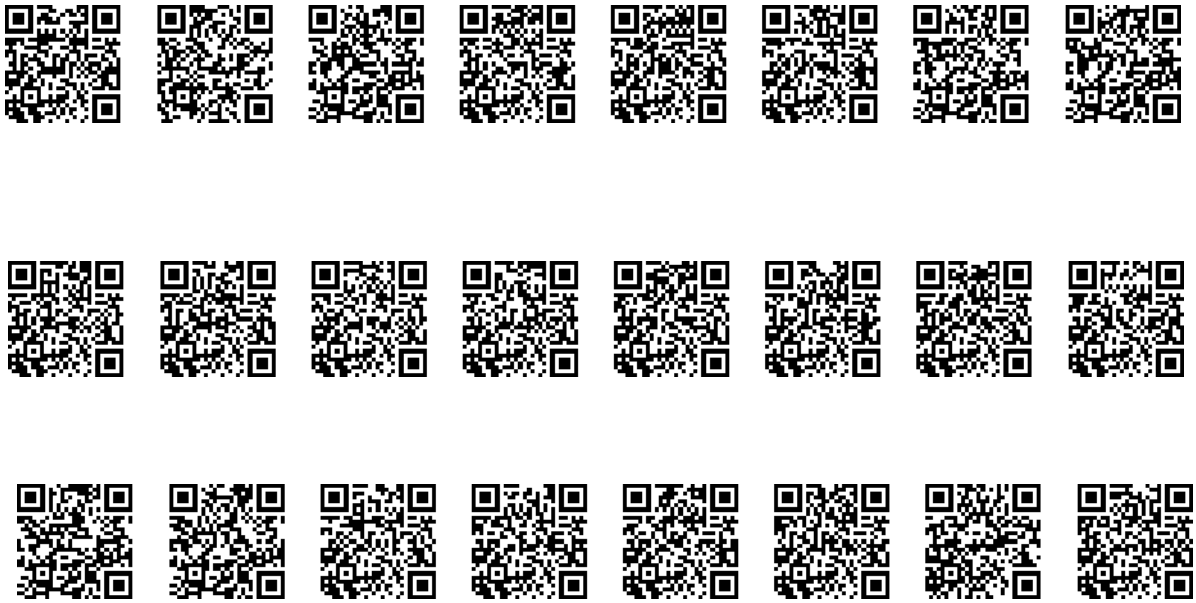
TEXT BOOKS

1. Linear Integrated circuits by D.Roy Choudhury
2. Modern Digital Electronics by R.P. Jain.
3. Digital Electronics by Godse, 3rd Edition.

REFERENCE BOOKS

1. Digital Principles and Applications by Albert Paul Malvino and Donald P. Leach, TMH.
2. Digital Electronics by Roger L. Tokenism Macmillan, McGraw – Hill.
3. Digital Electronics – An Introduction to Theory and Practice by William H.Goth Mann, PHI.
4. Electronic Devices, Applications and Integrated Circuits by Satnam P.Mathur and Others, Umesh Publications

E-LECTURES FOR ANALOG ELECTRONICS



STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042420**

Semester : IV

Subject Title : **MEASUREMENT OF PROCESS VARIABLES**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Measurement of Process Variables	5	80	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	Measurement of Temperature	14
II	Measurement of Pressure	14
III	Measurement of Flow (Mechanical)	14
IV	Measurement of Flow (Electrical)	14
V	Measurement of Level, Humidity and moisture	14
	Revision	3
	Tests & Model Examination	7
	Total	**80**

RATIONALE

Instrumentation engineers must be conversant with the details of measurement of process variables in industries. In any process industries, the major process variables involved are temperature, pressure, flow and level. This subject covers the detailed study of principle, construction, operation, advantages, limitations and applications of the various transducers used in process industries. It also helps the students to understand about the availability of various transducers by different principles to measure the same process variable. This subject gives an idea about the selection of transducers for a given process variable by analyzing the advantages and limitations of each transducer.

OBJECTIVES

Completion of the following units of syllabus, the students must be able to

- Know what is temperature and its unit.
- Know the concepts of non-electrical methods of temperature measurements.
- Know the concept of electrical methods of temperature measurements.
- Know the Cold junction compensation of thermocouples.
- Know the concepts of high temperature measurements.
- Know the concepts of temperature transmitters.
- Know what is pressure, types of pressure and its units.
- Know the concepts of electrical methods of pressure measurements.
- Know the methods of measuring vacuum.
- Know the concepts of pressure transmitters.
- Know about the telemetry.
- Know about the types of Flow.
- Know about the importance of Reynolds's number.
- Know about Bernoulli's theorem.
- Know about Differential pressure type flow meters.
- Know about positive displacement type flow meter.
- Know about Inferential flow meter.
- Know about different type of Electrical flow meters.
- Know about measurement of solid flow.
- Know the concepts of Non-electrical methods of Level measurements.
- Know the concepts of electrical methods of Level measurements.
- Know the concepts of Moisture and Humidity

4042420 MEASUREMENT OF PROCESS VARIABLES

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**1. MEASUREMENT OF TEMPERATURE** **1.1. Mechanical Methods** Liquid in glass thermometer– liquid in steel thermometers, Gas and vapour pressure thermometer - Bimetallic thermometer - Construction, working, range, advantages, disadvantages and applications of above. **1.2. Electrical Methods** Thermo couples – Thermoelectric laws – series and parallel combination – thermopile – Bolo meter – Measurement of output of thermocouples using potentiometer and milli voltmeter – RTD – Thermistors. Construction, working, range, advantages, disadvantages and applications of above. **1.3. High Temperature Measurement** Non contact methods – Total Radiation Pyrometers – Selective radiation pyrometer - Photo electric pyrometers – Optical pyrometers – Temperature transmitters.	5 5 4
II	**2. MEASUREMENT OF PRESSURE** Types and units of pressure **2.1. Mechanical Methods** Manometers (all types) – Elastic elements – Bellows – Diaphragms – Bourdon Tube. **2.2. Electrical Methods** Pressure measurements using strain gauge, capacitive transducer, LVDT and Piezo-electric transducer.Construction, working, range, advantages, disadvantages and applications of above. **2.3. Pressure Calibration**: Dead weight tester. **2.4. Transmitters**: Differential pressure transmitters.	4 10
III	**3. MEASUREMENT OF FLOW (MECHANICAL)** Bernoulli's theorem – Continuity equation – Reynolds's number – Types of flow – Inferential flow meters – Differential pressure type meters – Orifice plates – Venturi tube – Flow Nozzle – Dall tube - Pitot tube (No derivation) – Positive displacement type meters – Nutating type meter – Oscillation piston type – Construction,principle, working,advantages and disadvantages of above.	14

IV	**4. MEASUREMENT OF FLOW (ELECTRICAL)** Electromagnetic flow meter – Ultrasonic flow meter – Doppler and Transit time method – Swirl meter – Vortex shedding meter - Thermal mass flow meter – solid flow measurement using conveyor belt method – Turbine flow – Targetflow meter – Hot wire anemometer- Construction, principle, working, advantages and disadvantages of the above.	14
V	**5. MEASUREMENT OF LEVEL, HUMIDITY AND MOISTURE** Level – sight glass method - level in open and closed vessel- Measuring by the movement of float. **5.1. Electrical Methods**: Change in conductance – change in capacitance - Radiation method – solid level – bin type and diaphragm type – Moisture – Moisture in granular materials, solid penetrable material in paper and textiles. Humidity – Measurement of humidity – Absolute humidity –Relative humidity – Psychrometer – Hair Hygrometer. Density and specific gravity – Definition – Measurement using weighing tube type. Construction, principle, working, advantages and disadvantages of the above.	14
	Seminar, Revision and Test	10

TEXT BOOK

1. A. K. Shawney, A Course in Electrical & Electronic Measurements and Instrumentation, Dhanpat Rai & CO, Reprint 2010.

   (Page Nos: 1384–1402, 918-924, 964-969, 1014-1015, 1028-1035, 1219,1225 - 230, 1402 - 1418)

REFERENCE BOOKS

1. S. K. Singh, Industrial Instrumentation and Control, Tata McGraw Hill, 2005.

2 . D. Patranabis, Principles of Industrial Instrumentation, Tata McGraw Hill 2005.

3. Arun K. Ghosh, Introduction to measurements and Instrumentation, 3rd Edition. PHI Learning Pvt. Ltd.

4. Pugazhendhi, Electronic Measurement and Instrumentation, RBA Publishers.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042430**

Semester : IV

Subject Title : **MEASUREMENTS AND INSTRUMENTS**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Measurements and Instruments	5	80	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	Measuring Instruments	18
II	Bridges and Oscilloscope	18
III	Test Instruments	14
IV	Digital Instruments - I	10
V	Digital Instruments - II	10
	Revision	3
	Tests & Model Examination	7
	Total	**80**

RATIONALE

Instrumentation and Control Engineers plays a major role in process industries. The students of Instrumentation and Control Engineering branch need a brief idea about the basic concepts of instrumentation, various transducers and their characteristics which can be helpful to them to study the core subjects during their academics. This subject covers the basic needs of instrumentation and it makes the students to understand the importance of instrumentation in industries.

OBJECTIVES

On completion of the Units mentioned above, the students would be able to

- Explain the construction and working of indicating instruments for measurement of D.C and A.C voltage, current Power & Energy.
- Understand the working and applications of Multimeter for Ω, V, I measurement.
- Explain range extension methods for Ammeters and Voltmeters.
- Understand the resistance measurement with voltmeter and Ammeter
- Understand the resistance measurement with ohmmeter
- Understand the dynometer type wattmeter, single phase energy meter and
- DC potentiometer
- Explain the construction and working and practical application of Wheatstone Bridge for Resistance measurement.
- Explain the construction and working of AC Bridges & measurement of L and C using three bridges.
- Explain the construction and working of AC Bridges & measurement of frequency using Wien bridge.
- Explain the construction, working and applications of CRO.
- Explain the voltage probe and current probe with active and passive components.
- Explain the working and application of Power Supply as a test instrument.
- Understand the use of Audio signal generator, Frequency generator, and Megger for testing of electronic/electrical circuits.
- Explain the working and use of CT’s and PT’s
- Compare Digital Vs Analog Instruments.
- Explain the working of different types of DVM.
- Explain the block diagram and circuit diagram of DFM.
- Use Digital Multimeter.
- Explain the working of EC and Digital Panel meter using LCD.

4042430 MEASUREMENTS AND INSTRUMENTS

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**1. MEASURING INSTRUMENTS** Construction , working and Equations of Permanent magnet and Moving coil instrument , Attraction and Repulsion type Moving iron instrument –—Electro static Instrument-Electro dynamic instrument-Ballistic Galvanometer – Ammeter with internal resistance – Extending the range –Multi range ammeter, simple problems, Voltmeter- Extending the range-Multi range voltmeter- simple problems –Resistance measurement with voltmeter and ammeter-Construction and working of Ohm meter - rectifier type ac volt meter- 1φ induction type energy meter, DC potentiometer - Kelvin varley potential divider	18
II	**2. BRIDGES AND OSCILLOSCOPE** **2.1. BRIDGES** DC Bridge -Construction, working, derivation of balance equation and application of measurement of resistance by Wheatstone bridge -AC Bridge – Balance equation of AC bridge in Ratio form and Product form, measurement of unknown lossy inductor using standard variable inductor, Maxwell's Bridge – Hay's bridge-Measurement of unknown capacitance by Schering bridge – measurement of frequency using Wien bridge.-simple problems **2.2. CRO** Block diagram of oscilloscope – construction and working of CRT – horizontal deflection and vertical deflection – time base generator – CRO probes –voltage – current – active – passive probes - applications of CRO.	18
III	**3. TEST INSTRUMENTS** Block diagram, working and applications of DC power supply–fixed and variable –— Megger – working and applications. Instrument transformer – Current Transformer(C) and Potential Transformer (PT) – simple problems - Recorders-Diagram and working of Strip chart recorders – XY recorder – ultra violet recorder - Analog Tape recorder and Digital tape recorder-Applications- Advantage-Disadvantages	14
IV	**4. DIGITAL INSTRUMENTS - I** Digital vs Analog instruments – inverting and non inverting Schmitt trigger circuit -Digital Frequency Meter –Block diagram- circuit diagram for frequency measurement– Period measurement-Simple problems - Digital tachometer – digital panel meter using LCD – Digital storage oscilloscope, mixed storage oscilloscope. Applications.	10

V	**5. DIGITAL INSTRUMENTS – II** Digital voltmeter - Linear ramp type voltmeter – Digital ramp type voltmeter – successive approximation type volt meter - Dual slope voltmeter -Digital Multimeter– auto ranging – auto zeroing – auto polarity – simple problems Function generator to generate triangular and pulse and sinusoidal wave- Block diagram- Circuit diagram.	10
	Seminar, Revision and Test	10

TEXT BOOKS

1. A Course in Electrical and electronic measurements and instrumentation by A. K. Sawheny, Dhanpat Rai & Sons. 1986
(Page Nos: 292 – 329, 585 - 599, 605, 1171 - 1173, 785 - 814, 865 - 867, 390 - 412,1303 - 1315, 1295, 825, 1372)

2. Electronic Instrumentation and Measurements: David A. Bell

REFERENCE BOOKS

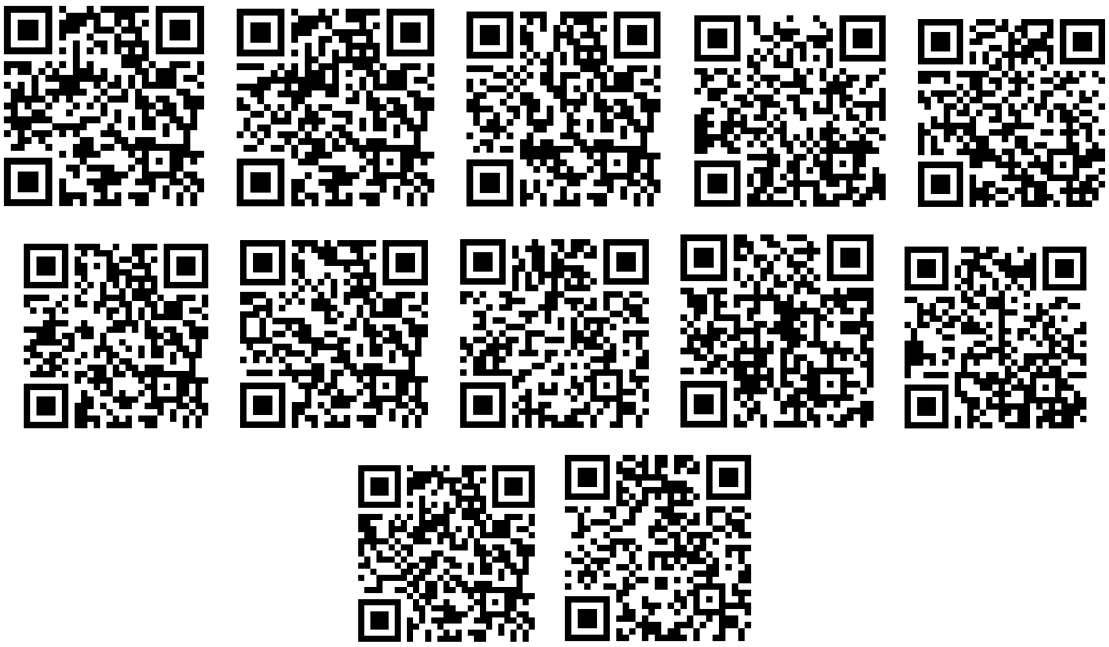
1. Modern Electronics Instrumentation and Measurement Techniques by Albert D.Herfrick.

2. Electrical and Electronics Measurements and Instrumentation by Umesh Sinha, Satya Prakashan, Tech India Publication, 1992.

E-LECTURES
(Click Ctrl and Link to open the video in YouTube)

Topic	Link
Moving Iron Instrument	https://www.youtube.com/watch?v=MAKeeXJqUNg&t=315s
Ammeter and Voltmeter	https://www.youtube.com/watch?v=uHvuvZQqZmM&t=771s
Wheatstone Bridge	https://www.youtube.com/watch?v=Yg2b72Y1ZaI&t=390s
AC Bridge – balancing	https://www.youtube.com/watch?v=wk0AVu2_mmM&t=592s
AC Bridge – Schering's	https://www.youtube.com/watch?v=bsbmcLhCnkY&t=34s
CRO	https://www.youtube.com/watch?v=0hCgkW14zwc&t=2636s
CRO-Lissajous pattern	https://www.youtube.com/watch?v=xhTgPx1fMJw&t=1542s
CRO Probes	https://www.youtube.com/watch?v=H10To429lqI&t=1318s
Megger	https://www.youtube.com/watch?v=HC4NUc-u9i0&t=1332s

Current and Potential Transformer	https://www.youtube.com/watch?v=Q1Zj6mBJrnQ&t=1069s
Digital Frequency Meter	https://www.youtube.com/watch?v=-NaTKpjt-rA&t=2105s
Linear Ramp type voltmeter	https://www.youtube.com/watch?v=pxDLPUEnPS8&t=808s
555 Astable multivibrator	https://www.youtube.com/watch?v=muqek4j8J7E&t=658s
Function generator	https://www.youtube.com/watch?v=aZzaaiqafJI&t=2291s



STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4020620**

Semester : IV

Subject Title : **E-VEHICLE TECHNOLOGY AND POLICY**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
E-Vehicle Technology and Policy	4	64	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	Environmental Impact and History & Electric Vehicle Types	12
II	Electric Vehicle & Drive System	12
III	Energy Storages, Charging System, Effects and Impacts	11
IV	Electric Mobility Policy Framework India	11
V	Tamilnadu E-Vehicle Policy 2019	11
	Tests & Model Examination	7
	Total	**64**

RATIONALE

The world is transitioning to cleaner mobility options with the aim at improving air quality and reducing dependency on fossil fuels. Electric Vehicles (EVs) have emerged a popular clean mobility choice to reduce emissions. EVs are powered fully or partially by batteries, they can help to reduce dependence on fossil fuels also air quality. Tamil Nadu is one of the most advanced states in India. Tamil Nadu has a highly developed industrial eco-system and is very strong in sectors like automobiles and auto-components. Many globally renowned companies have setup their manufacturing facilities in Tamil Nadu. Due the rapid depletion of fossil fuel and increase in fuel cost, environmental pollution, the shift to clean transport is necessary. This subject introduced by keeping all the above factors.

OBJECTIVES

- To learn the environmental impact and history of Electric Vehicles.
- To understand the concept of Electric Vehicle and its types.
- To study the configurations of Electric Vehicles
- To acquire knowledge about Energy Storages, Charging System, Effects and Impacts
- To appreciate the Electric Mobility Policy Frame work India and EV Policy Tamil Nadu 2019.

4020620 E-VEHICLE TECHNOLOGY AND POLICY

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**Environmental Impact and History & Electric Vehicle Types** Air pollution – Petroleum resources – History of Electric vehicles - History of Hybrid Electric Vehicles – History of Fuel Cell Vehicles – Hybrid electric Vehicle (HEV) - Plug-in Hybrid Electric Vehicle (PHEV) - Battery Electric Vehicle (BEV) – Fuel Cell Electric Vehicle (FCEV) – Description.	12
II	**Electric Vehicle & Drive System** 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. Electric Propulsion Systems: Drive Systems: DC motor drives - Principle of operation – Induction Motor drives - Basic operation principles – Permanent Magnetic Brush Less DC Motor Drives – Principles – Construction and classification.	12
III	**Energy Storages, Charging System, Effects and Impacts** Electrochemical Batteries – Battery Technologies – Lead Acid Batteries – Nickel Based Batteries – Lithium Based Batteries – Charging system –DC charging – Wireless charging – Power conversion techniques. Effects of EV – Impacts on Power grid – Impacts on Environment – Impacts on Economy.	11
IV	**Electric Mobility Policy Framework India** 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 – Key Performance Indicator - Global impact – Trends and Future Developments.	11
V	**Tamil Nadu E-Vehicle Policy 2019** Vehicle Population in Tamil nadu – Need of EV Policy – Advantage of EV Eco system – Scope and Applicability of EV Policy – 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 – R&D and Business Incubation – Recycling Ecosystem – Battery and EVs.	11
	Seminar, Revision and Test	7

REFERENCE 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 ElectricVehicle (IJSR),Akshat Bansal, Akriti Agarwal

3. A Comprehensive Study of Key Electric Vehicle (EV)Components, Technologies, Challenges, Impacts, andFuture Direction of Development (MDPI),Fuad Un-Noor, Sanjeevi kumarPadmanaban, Lucian Mihet-Popa, Mohammad Nurunnabi Mollah and Eklas Hossain.

4. Electric Vehicles: A future Projection CII October 2020 report.

5. Design and analysis of aluminum/air battery system for electric vehicles, Shaohua Yang, Harold Knickle, Elsevier.

6. Propelling Electric Vehicles in India, Technical study of Electric Vehicles and Charging Infrastructure

7. ZERO EMISSION VEHICLES (ZEVs): TOWARDS A POLICY FRAMEWORK – NITI Aayog.

8. FASTER ADOPTION OF ELECTRIC VEHICLES IN INDIA: PERSPECTIVE OF CONSUMERS AND INDUSTRY, The Energy and Resources Institute, New Delhi.

9. India EV Story: Emerging Opportunities by Innovation Norway.

4020620 E-VEHICLE TECHNOLOGY AND POLICY

QUESTION PAPER PATTERN

Time: 3 Hrs. Max. Marks: 100

PART - A Five questions will be asked covering all units. All questions are to be answered. Each question carries 1 mark.

PART- B Fifteen questions will be asked covering all the units. Three questions from each unit. Answer any ten questions. Each question carries 2 marks.

PART - C Five questions will be asked Either or type. One question from every unit. Answer either A or B. Each question carries 15 marks.A and B have subdivisions. (7 + 8)

The questions are to be numbered from 1 to 25. All the units are to be covered with equal weightage.

PART – A	Definitions and Statements. Question Number 1 to 5	5 x 1 = 5 Marks
PART – B	Short answer type questions Question Number 6 to 20	10 x 2 = 20 Marks
PART – C	Descriptive answer type questions (Either A or B) Question number 21 to 25	5 x 15 = 75 Marks
TOTAL		**100 Marks**

Board Examinations will be conducted for 100 Marks and converted to 75 Marks.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042450**

Semester : IV

Subject Title : **ANALOG AND DIGITAL ELECTRONICS PRACTICAL**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Analog and Digital Electronics Practical	4	64	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE

As instrumentation signal conditioning circuits are constructed using analog and digital ICs it is mandatory for Instrumentation engineer to get practice with constructing and testing fundamental Digital circuit .Also analog to Digital and Digital to Analog conversion is also learnt in this subject practically.

OBJECTIVES

- Illustrate the working Operational Amplifier, Differentiator and Integrator.
- Realize about the different types of thee pin IC Regulators
- Familiarize the truth table of logic gates
- Realize the Logic circuit of Boolean Expression.
- Distinguish on the operation of Adder and subtractor
- Verify the truth table of multiplexer, Demultiplexer, decoder and encoder.
- Verify the truth table of D- flip flop, T flip flop & J-K flip flop.
- Learn the operation of shift registers and counters.
- Study the operation of A/D and D/A converters

4042450 ANALOG AND DIGITAL ELECTRONICS PRACTICAL
LIST OF EXPERIMENTS

1. Construct the inverting amplifier and Non inverting amplifier with gain 10 an observe output voltages for the given positive and negative DC input voltages, and Draw the Voltage transfer characteristic curve.

2. Construct the practical Integrator and Differentiator circuit using operational amplifier with DC gain and corner frequency . observe the input and output waveforms and frequency response.

3. Construct an astable multivibrator using IC 555 timer and observe the output Waveform using CRO.

4. Experimentally obtain the output of IC voltage regulator power supplies using IC 7805 and 7912.

5. Construct Instrumentation amplifier circuit using Operational amplifiers and test it.

6. Construct to V to I and I to V converter circuit and test it.

7. Experimentally verify the Truth table of OR, AND, NOT, NOR NAND and XOR gate using 7432,7408,7404,7402 and 7486.

8. Experimentally verify the universal property of NAND and NOR gates.

9. Design ,Construct and test Half adder, full adder using Gates.

10. Design, Construct and test Half subtractor, full subtractor using Gates.

11. Experimentally verify the truth table of D, T, JK, Flip-Flop.

12. Construct 4 bit ripple counter using Flip Flop and observe the counting sequence Using LED's.

13. Construct and verify R-2R ladder Digital to Analog converter using operational amplifier.

14. Construct and verify A/D convertor using ADC 0808 IC.

SCHEME OF EVALUATION

SNo	Description	Allocation of Marks
1	Circuit Diagram & Truth table	30
2	Connection & Procedure	30
3	Tabulation & Graph	25
4	Result	10
5	Viva Voce	5
TOTAL		**100**

EQUIPMENTS REQUIRED

SNo	Name of the Equipments / Software	Required Nos
1.	Analog Trainer with power +and –ve supply to construct opamp circuit	10
2.	Digital Trainer with power supply	10
3.	Cathode Ray Oscilloscope	2
4.	Audio Oscillator	2
5.	Opamp Ic 741	10
6.	Ic Regulator 7805,7912	5
7.	Digital Gate IC 7404,7408,7432,7486,7402,7410,7400	10 each
8.	Digital Flip Flop IC 7473,7474, 7476	10 each
9.	ADC 0808 IC	5
10.	Bread board and connecting wires	
11.	Digital multimeter	10

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042460**

Semester : IV

Subject Title : **MEASUREMENT OF PROCESS VARIABLES PRACTICAL**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Measurement of Process Variables Practical	4	64	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE

Instrumentation and Control Engineers plays a major role in process industries. The students of Instrumentation and Control Engineering branch need practical knowledge to measure various parameters such as Temperature, pressure, Flow, etc. This subject gives practical exposure to the students about measurement of process variables of instrumentation industries.

OBJECTIVES

- To understand the extension of the range of meters
- To get practice to measure voltage, current and frequency using CRO
- To get practice to measure Flow, Viscosity
- To get practice to measure resistance, capacitance using Bridges
- To understand the characteristics of DPT experimentally

4042460 MEASUREMENT OF PROCESS VARIABLES PRACTICAL
LIST OF EXPERIMENTS

1. Conduct experiment to extend the range of an Ammeter.
2. Conduct experiment to extend the Range of a Voltmeter.
3. Conduct experiment to Measure the frequency using Lissajeous pattern in CRO
4. Conduct experiment to Measure resistance using Wheatstone bridge.
5. Conduct experiment to measure unknown capacitance using Schering bridge
6. Experimentally verify the characteristics of RTD
7. Conduct experiment to measure flow.
8. Experimentally measure the viscosity using say bolt viscometer.
9. Conduct experiment to Calibrate the pressure gauge using master gauge.
10. Experimentally obtain the Transient response of Thermocouple with and without well .
11. Experimentally obtain the Characteristics of temperature transmitter.
12. Experimentally obtain the Characteristics of differential pressure transmitter.

SCHEME OF EVALUATION

SNo	Description	Allocation of Marks
1	Circuit diagram	30
2	Connection & Procedure	30
3	Tabulation & graph	25
4	Result	10
5	Viva Voce	5
TOTAL		**100**

EQUIPMENTS REQUIRED

SNo	Name of the Equipments / Software	Required Nos
1.	Cathode Ray Oscilloscope	2
2.	Audio Oscillator	2
3.	Ammeter with 3 different range	2
4.	Voltmeter with 3 different range	10
5.	Decade Resistance Box	5
6.	Galvanometer	2
7.	Decade capacitance box and capacitors of different range	5 each
8.	RTD	3
9.	Flow rate measuring setup	1
10.	Say bolt visco meter	1
11.	Calibration setup for pressure gauge	1
12.	Thermo couple	5
13.	Temperature Transmitter	2
14.	Differential pressure Transmitter	2
15.	Bread board and connecting wires	10
16.	Digital multimeter	10

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042470**

Semester : IV

Subject Title : **VIRTUAL INSTRUMENTATION PRACTICAL**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Virtual Instrumentation Practical	4	64	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE

As Virtual Instrumentation is one of the key industrial oriented subject, It is essential to give practical exposure to Instrumentation and control engineers. In this subject Experiments are suggested to perform using LABVIEW soft wares. It would be helpful for studying further in this field.

OBJECTIVES

- To get practice with LABVIEW
- To develop front panel and block diagram for signal generator
- To generate virtual CRO to add two waveforms
- To develop front panel and block diagram for Temperature control system and Tank level control system
- To develop front panel and block diagram for Linear algebra calculator
- To develop front panel and block diagram for temperature and Level control
- To develop digital logic functions

4042460 VITRUAL INSTRUMENTATION PRACTICAL
LIST OF EXPERIMENTS

1. Create a VI that takes temperature in degree Centigrade as input and displays the temperature both in degree Centigrade and degree Fahrenheit. Use temperature indicator for display.

2. Create a VI to evaluate the equation y = 4a + 3b + 5c using arithmetic block or formula node.

3. Create a VI to compute and display the roots of a quadratic equation: $ax^2 + bx + c$ by taking the values of a, b and c as inputs.

4. Create a VI to simulate a simple calculator which performs addition, subtraction, multiplication and division using case structure.

5. Design a VI to display whether the given integer is odd or even.

6. Design a VI that takes two integer as input and displays its remainder and quotient.

7. Device virtual function generator and CRO with front panel and block diagram for generation of signals using function generator and measurement of frequency and amplitude using CRO.

8. Design virtual CRO capable of addition of two waveforms with front panel and block diagram.

9. Design front panel and block diagram to simulate logic gate functions: AND, OR, NOT, NAND, NOR, EX-OR and EX-NOR.

10. Design front panel and block diagram to simulate temperature control system.

11. Design front panel and block diagram to simulate tank control system.

12. Design a VI to simulate half adder.

SCHEME OF EVALUATION

SNo	Description	Allocation of Marks
1	LabView Front Panel & Block Diagram	30
2	Execution	30
3	Observation & Procedure	25
4	Result	10
5	Viva Voce	5
TOTAL		**100**

EQUIPMENTS / SOFTWARE REQUIRED

SNo	Name of the Equipments / Software	Required Nos
1.	Pentium PC (Dual Core)	30
2.	Laser Printer	2
3.	UPS 5 KVA with One Hour Backup	1
4.	LabView Licensed Software (Multiuser)	1

V SEMESTER

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042510**

Semester : V

Subject Title : **PROCESS CONTROL INSTRUMENTATION**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Process Control Instrumentation	5	80	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	Simple process control systems and terminology	14
II	Control principles	14
III	Tuning of controllers	12
IV	Final control elements	15
V	Complex control systems	15
	Revision	3
	Tests & Model Examination	7
	Total	**80**

RATIONALE

In industries, there is a huge demand of qualified engineers in the areas of Process Control Instrumentation. The basic concepts and the detailed study of Process Control are covered in this subject. The importance is given to make the students to understand about the elements of Closed Loop Control System in detail. The students of Instrumentation and Control engineering branch are having wide career options in process industries. This subject provide a general idea to the students to select any one of the career options like Project engineers, Maintenance engineers, Erection and Commissioning engineers, Automation engineers, Design engineers etc.

OBJECTIVES

- Understand the process and a single loop feed back control system and its terminology
- Learn the basic Temperature, Pressure, Level single loop feed back control system
- Learn to draw the P&I diagrams for the single loop level control system
- Concepts Reverse & direct action.
- Compare P,I,D, PI,PD,PID controller action.
- Concept of P/I and I/P converter.
- List the characteristics of control valve.
- Concept of Cavitation & Flashing .
- Describe feed forward control system.
- List the advantages of FLC

4042510 PROCESS CONTROL INSTRUMENTATION

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**1. SIMPLE PROCESS CONTROL SYSTEMS AND TERMINOLOGY** Process – Continuous and Batch process – process variables Functional block diagram of an automatic process control system – set point – measured value – error - simple liquid level control system – flow control system – temperature control system with transportation lag – self regulation – Introduction to Piping and Instrumentation diagram- symbols for equipments, piping, instrumentation and control, P&ID diagram for simple liquid level control system	14
II	**2. CONTROL PRINCIPLES** Controller – reverse and direct action, controller modes – discontinuous – ON-OFF Control with differential gap, without differential gap – continuous – proportional controller – proportional band (PB) – effect of PB on a controller output – offset – integral control – Derivative control - PI – PD - PID definition, salient features, applications and limitations of above controllers – selection of control action – electronic controllers – error detector – two position controller – P,I,D, PI, PD, PID controllers – pneumatic controllers for PID action – flapper nozzle mechanism, pneumatic relay	14
III	**3. TUNING OF CONTROLLERS** Concept of tuning – criteria for controller tuning – quarter Decay ratio, IAE, ISE, ITAE – methods of tuning – open loop response method – process reaction curve – closed loop response method – ultimate cycle method - damped oscillation method.	12
IV	**4. FINAL CONTROL ELEMENTS** Signal converters – P to I converter, I to P converter – actuator – electrical, pneumatic, hydraulic–control valve – characteristics - quick opening, linear, equal percentage- pneumatic valve – solenoid valve –split range control valve – single seat and double seat plug – electric motor actuated control valve – control valve sizing – CV rating – selection of a control valve – effect of cavitation and flashing on control valve performance	15
V	**5. COMPLEX CONTROL SYSTEMS** Feed forward control system, Feed forward control of heat exchanger. comparison of feedback control system and feed forward control system. Ratio control – examples -Cascade control – cascade control of heat exchanger – cascade control of distillation column. Direct digital control(DDC) of single loop, Direct digital control with multiple control loops. Introduction to DCS-block diagram	15
	Seminar, Revision and Test	10

TEXT / REFERENCE BOOKS

1. Process control instrumentation technology by C.D. Johnson
   (Page No: 1-10, 440-476, 483-504, 339-342)

2. Introduction to Process Engineering and Design by S B Thakore & B I Bhatt, Tata McGraw-Hill publishing company Limited, New Delhi
   (Page no. 43-44, 54-67)

3. Process Control and Instrumentation by R.P. Vyas, Central Techno Publications, Nagpur, Second Edition
   (Page no. 222 – 242, 254-258)

REFERENCE WEBSITES

http://en.wikipedia.org/wiki/PID_controller
http://en.wikipedia.org/wiki/Control_valves

VIDEO LECTURES

https://nptel.ac.in/courses/103/103/103103037/
https://freevideolectures.com/course/3126/process-control-and-instrumentation

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042520**

Semester : V

Subject Title : **CONTROL ENGINEERING**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Control Engineering	6	96	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	Basics of control systems, Laplace transform and transfer function	18
II	Block diagram, signal flow graph representation and components	18
III	Time response	17
IV	Frequency response	17
V	Stability	16
	Revision	3
	Tests & Model Examination	7
	Total	**96**

RATIONALE

The aim of this subject is to introduce the basic concepts of control theory to the students. It provides the basic idea about how the physical systems can be represented by a mathematical model to perform a detailed analysis. There are lot of advancements in the field of Control Engineering in which the students can do research during their higher studies.

OBJECTIVES

- To understand the system, control system and its types
- To practice the Laplace transform and Inverse Laplace transform for given function
- To understand the transfer function and study the transfer function of Mechanical system, Electrical system
- To understand the block diagram of a system and rules to reduce the block diagram and practicing reducing
- To understand the signal flow graph and solve using Masons gain formula
- To study the Time domain specifications of a I order and II order system and its specifications
- To study the Frequency domain specifications of a I order and II order system and its specifications
- To draw the Bode plot for the given transfer function
- To draw the Polar plot for the given transfer function
- To understand the stability of the system and analyze the stability of the system using Routh stability criterion
- To analyze the stability using root locus method

4042520 CONTROL ENGINEERING

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**BASICS OF CONTROL SYSTEMS, LAPLACE TRANSFORM AND TRANSFER FUNCTION** System – Linear & Non Linear, Continuous & Discrete - Control system - open loop & closed loop – Examples – Basics of Laplace transform – Inverse Laplace transform – Transfer function – Order and type of a transfer function – pole/zero plot - Transfer function of Translational Mechanical system (simple second order system with one mass) – Transfer function of Electrical systems - RC, RL, RLC networks	18
II	**BLOCK DIAGRAM AND SIGNAL FLOW GRAPH REPRESENTATION** **Block Diagram:** Introduction – advantages – rules for block diagram reduction – simple problems. **Signal Flow Graph:** Rules for reduction – Mason's gain formula – applications of Mason's formula – simple problems – comparison of block diagram reduction and signal flow graph methods.	18
III	**TIME RESPONSE** Standard test signals (step, ramp, sine ,Parabolic and impulse) – order and Type of system - I order, II order system – derivation – step response of I order, II order system (undamped & critical damping) – time domain specifications (definition & formulas only) – steady state error, static error constants – problems.	17
IV	**FREQUENCY RESPONSE** Frequency response of linear system –Advantages – Frequency domain specifications (definitions only) – bode plot – gain margin – phase margin – problems – polar plot- problems.	17
V	**STABILITY** Definition – Location of the roots on the s-plane for stability absolute stability – relative stability– characteristic equation – Routh's stability criterion technique – construction of root locus – problems(only for real values)	16
	Seminar, Revision and Test	10

TEXT BOOKS

1. Control systems by A.Nagoorkani, RBA publishers, 2006
   (Page no. 1-36, 70- 129, 255-280, 284-327, 343-417, 455- 490)

REFERENCE BOOKS

1. Automatic Control System by Benjamin S.Kuo,Printice Hall of India Pvt. Ltd., Seventh Edition,1995.
2. Advanced Control Theory by I.J.Nagrath and M.Gopal, New Age International Publishers, II edition, 2002
3. Control Systems by A. Anandkumar, EEE, PHI
4. Control Engineering Theory & Practice by M.N. Bandyopadhiyay, PHI

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042531**

Semester : V

Subject Title : **MICROCONTROLLER**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Microcontroller	6	96	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	Embedded system and Architecture of 8051	18
II	Programming Examples	17
III	I/O and Timer	17
IV	Interrupt and Serial Communication	17
V	Interfacing Techniques.	17
	Revision	3
	Tests & Model Examination	7
	Total	**96**

RATIONALE

Controlling all the machineries are realized through Electronics. Without Electronics controlling the machines, devices, systems are not possible. Microcontroller is the most reliable, cost effective and flexible for all control activities. It plays major role in Machines, domestic gadgets, automobile etc. Here is an attempt to introduce the familiar Intel 8051 microcontroller with some programming examples.

OBJECTIVES

On completion of the following units of syllabus contents, the students must be able to

- Explain Architecture of 8051 Microcontroller.
- Explain the functions of various registers.
- Understand interrupt structure of 8051.
- Understand serial data communication concepts.
- Understand the programming techniques.
- Explain various addressing modes.
- Write simple programs using 8051.
- Understand the block diagram and control word formats for peripheral devices.
- Understand how to interface with RS232C.
- Understand how to interface with 8255.
- Understand various application of 8051 Microcontroller

4042531 MICROCONTROLLER

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**EMBEDDED SYSTEM & ARCHITECTURE OF 8051** **1.1. EMBEDDED SYSTEM** Embedded system-Characteristic of embedded system- structure of embedded system- Processors in embedded system-Microprocessor-Microcontroller-Microprocessor Vs Microcontroller – Compiler- cross compiler- Assembler-Simulator-Emulator-Criteria for choosing microcontroller for embedded applications- 8051 family members-comparison **1.2. ARCHITECTURE OF 8051** Features of 8051 Microcontroller- Pin details of 8051- Block diagram of 8051 Microcontroller –Functions of each block - ALU – ROM – RAM – Special function registers –Program Counter – PSW register –Stack - I/O Ports – Timer – Interrupt –Serial Port – Memory Organization of 8051-Oscillator and Clock - Clock Cycle – State - Machine Cycle –Instruction cycle – Reset – Power on Reset – Overview of 8051 family	8 10
II	**PROGRAMMING EXAMPLES** **2.1. INSTRUCTION SET OF 8051** Instruction set of 8051 – Classification of 8051 Instructions – Data transfer Instructions – Arithmetic Instructions – Logical instructions –Branching instructions – Bit Manipulation Instructions **2.2. ASSEMBLER AND ADDRESSING MODES** Assembling and running an 8051 program –Structure of Assembly Language –Assembler directives - Different addressing modes of 8051 **2.3. PROGRAMS** Moving block of data between internal memory locations -8bit Addition & subtraction – 8 Bit Multiplication and Division – square and cube of 8 bit number ,Biggest Number /Smallest Number – Ascending order / Descending order -BCD to ASCII Conversion – ASCII to BCD Conversion ––-Time delay routines	7 2 8
III	**I/O AND TIMER** **3.1. I/O:** Bit addresses for I/O and RAM – I/O programming – I/O bit manipulation programming. **3.2. TIMER:** Programming 8051 Timers – Timer 0 and Timer 1 registers – Different modes of Timer – Mode 0 Programming – Mode 1 Programming - Mode 2 Programming - Counter programming – Different modes of Counter – Mode 0 Programming – Mode 1 Programming -Mode 2 Programming (simple programs)	7 10

IV	**INTERRUPT AND SERIAL COMMUNICATION** **4.1. SERIAL COMMUNICATION** Basics of Serial programming – RS 232 Standards - 8051 connection to RS 232 – 8051 Serial Communication Programming - Programming 8051to transmit data serially - Programming 8051 to Receive data serially. **4.2. INTERRUPT** 8051 Interrupts – Programming Timer Interrupts – Programming external hardware interrupts – Programming the serial communication interrupt –Interrupt priority in 8051 (simple programs).	9 8
V	**INTERFACING TECHNIQUES** **5.1. IC 8255** IC 8255 – Block Diagram – Modes of 8255. **5.2. INTERFACING TECHNIQUES** Interfacing external memory to 8051– 8051 interfacing with the 8255 – ASM Programming – Relays – Sensor interfacing –ADC interfacing – DAC interfacing - Keyboard interfacing – Seven segment LED Display Interfacing - Stepper Motor interfacing – DC motor interfacing using PWM	6 11
	Seminar, Revision and Test	10

TEXT BOOKS

1. Microcontrollers, Principles and Applications – Ajit pal – PHI Ltd., 2011.

REFERENCE BOOKS

1. 8051 Microcontroller and Embedded Systems using Assembly and C by Mazidi, Mazidi and D.MacKinlay, 2006 Pearson Education Low Price Edition.

2. Microprocessor and Microcontroller by R.Theagarajan, Sci Tech Publication, Chennai

3. 8051 Microcontroller by Kenneth J.Ayala.

WEBSITES

1. https://www.tutorialspoint.com/embedded_systems/es_microcontroller.htm

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042532**

Semester : V

Subject Title : **INDUSTRIAL INSTRUMENTATION**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Industrial Instrumentation	5	80	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	Comparators	14
II	Measurement of velocity and Acceleration	14
III	Measurement of Force, Torque and Shaft power	14
IV	Measurement of PH and Gas analysis	14
V	Chromatography and spectral method of analysis	14
	Revision	3
	Tests & Model Examination	7
	Total	**80**

RATIONALE

Industrial Instrumentation covers the topics of measurement of variables related to Mechanical instrumentation and Analytical instrumentation. It gives detailed information to the students about the measurement of variables related to velocity, acceleration, force, torque, shaft power, pH and gas analysis. It also provides an idea about Chromatographs, detectors and spectral analysis. This subject provides an exposure to the environmental pollution monitoring and control.

OBJECTIVES

- Know about the various Mechanical, Optical, Electronic and Pneumatic comparators.
- Study the different method of measurement of Linear and Angular velocity and Accelerometer.
- Study the different methods of Force, Torque and Shaft power measurement.
- Study about PH and its measuring electrode and PH measurement methods.
- Study about various Gas analysis.
- Study about Chromatography and Spectroscopy

4042532 INDUSTRIAL INSTRUMENTATION

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**1. COMPARATORS** Introduction -Types - Mechanical Comparators - Dial Gauge - Reed type comparator - Optical comparators - Optical lever - Cooke Optical Comparator - Zeiss ultra optimeter - Electrical Comparator - Electronic comparator - Pneumatic Comparators - Solex Pneumatic Comparator - Principle of operation, construction, advantages and disadvantages of the above comparators.	14
II	**2. MEASUREMENT OF VELOCITY & ACCELERATION** Linear Velocity Measurement - Doppler effect method - Linear encoder - Angular velocity measurement – Tachometer - Eddy current or Drug cup rotor A.C tacho generator - Angular encoder – Accelerometer - Seismic Accelerometer – Piezoelectric Accelerometer – Strain gauge Accelerometer – LVDT accelerometer - Principle of operation, construction, advantages and disadvantages of the above.	14
III	**3. MEASUREMENT OF FORCE, TORQUE AND SHAFT POWER** **3.1. Force Measurement**: Definition- Principle of operation and construction - Equal and Unequal arm balance – Pendulum scale – Elastic element spring – Proving Ring - Load cell - Hydraulic load cell – Pneumatic load cell – Strain gauge load cell. **3.2. Torque Measurement**: Definition - Principle of operation and construction of - Mechanical torsion meter -Optical torsion meter – Electrical torsion meter – Strain gauge torsion meter. **3.3. Shaft Power Measurement**: Definition- Principle of operation and construction of - Prony brake Dynamometer – Rope Brake Dynamometer – Fluid Friction (Hydraulic) Dynamometer – Eddy current Dynamometer .	5 5 4
IV	**4. MEASUREMENT OF pH & GAS ANALYSIS** **4.1. pH**: Definition - Electrodes - Principle of operation and construction - Hydrogen electrode - Calomel electrode - Quinhydrone electrode - Antimony electrode - Glass electrode. **4.2. Gas Analyzer**: Principle of operation and construction - Oxygen analyzer – Paramagnetic oxygen analyzer – CO analyzer – SO2 analyzer.	7 7

V	**5. CHROMATOGRAPHY AND SPECTRAL METHOD OF ANALYSIS** **5.1. Chromatography**: Definition - Classification - Principle of operation and construction – Gas Chromatography – Liquid chromatography – Partion coefficient - Retention time - Dead time –Retention ratio Chromatogram - Significance and advantages of chromatography. **5.2. Detectors**: Principle of operation and Construction of TCD, FID, FPD, ECD. **5.3. Spectral Analysis**: EMR Spectrum - Beer's law - IR/UV spectro photometer-working and applications - IR/UV radiation sources -monochromator - Sample handling	8 2 4
	Seminar, Revision and Test	10

TEXT BOOK

1. A.K.Sawhney and Puneet Sawhney, "Mechanical measurements and Instrumentation & Control", Dhanpat Rai & Co (P) ltd, 12th edition 2001.

REFERENCE BOOKS

1. R.K.Rajpat "Mechanical measurements and Instrumentation" S.K.Kataria & Sons, New Delhi – 3

2. Gurdeep R Chatwal and Sham K. Anand "Instrumentation Methods and Chemical Analysis", Himalaya Publishing House.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042533**

Semester : V

Subject Title : **INDUSTRIAL POWER ELECTRONICS**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Industrial Power Electronics	5	80	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	POWER DEVICES AND TRIGGER CIRCUITS	14
II	CONVERTERS (Qualitative treatment only)	14
III	CHOPPERS	14
IV	INVERTERS & APPLICATIONS	14
V	AC VOLTAGE CONTROLLERS	14
	Revision	3
	Tests & Model Examination	7
	Total	**80**

OBJECTIVES

- To Study working principle of power devices.
- To Study the methods of triggering
- To know about use of pulse transformer & opto isolator.
- To learn about converters and its types.
- To understand commutation concepts in SCR
- To Learn about choppers.
- To Study about inverters and types.
- To understand the concept of HVDC.
- To know about UPS and its types.
- To study about basics of numerical control of machines.
- To learn AC single phase controller with resistive load
- To learn AC single phase controller with RL load
- To learn Three phase full wave controller
- To learn single phase cyclo converter

4042533 INDUSTRIAL POWER ELECTRONICS

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**1. POWER DEVICES AND TRIGGER CIRCUITS** Thyristor family –Working principle ,VI characteristics, Applications of SCR – Definitions for holding current, latching current, dv/dt rating, di/dt rating– Symbol, principle of working ,VI characteristics ,applications of Insulated gate bipolar transistor (IGBT), MOSFET and GTO. Triggering of SCR - Gate triggering –Types – Concepts of DC triggering, AC triggering, Pulse gate triggering – Pulse transformer in trigger circuit – Electrical isolation by opto isolator - Resistance firing circuit and waveform – Resistance capacitor firing circuit and waveform, Synchronized UJT triggering (ramp triggering) and waveform – Ramp and pedestal trigger circuit for ac load.	14
II	**2. CONVERTERS (Qualitative treatment only)** Converters – Definition – Single phase Half controlled bridge converter with resistive load and resistive inductive load- importance of flywheel diode – Single phase fully controlled bridge converter with resistive load – voltage and current waveforms – Single phase fully controlled bridge converter with RL load —voltage and current waveforms. Commutation- Natural commutation – Forced commutation – Types of forced commutation (mention the types only) 3 phase half controlled bridge converter with resistive load - current and voltage waveform -3 phase fully controlled bridge with resistive load – current and voltage waveforms. Dual converter – modes of Dual converter	14
III	**3. CHOPPERS** Introduction – applications -principle of chopper-control strategies (time ratio and current limit control)-types of chopper- type A, B, C, D, and E- step up chopper –Jones chopper – Morgan chopper- chopper using MOSFET – PWM control circuit for driving MOSFET in chopper. DC Transmission- principle – advantages – drawbacks.	14

IV	**4. INVERTERS AND APPLICATIONS** Inverter Definition Requirement of an inverter –Single phase inverter with resistive load – Single phase inverter with RL load – Methods to obtain sine wave output from an inverter- output voltage control in inverters - McMurray inverter – advantages- Basic 3 phase bridge inverter with 120 conduction mode – circuit, trigger sequence, waveform – Through pass inverter – Parallel inverter using IGBT. UPS – Need for UPS –ON Line UPS -OFF Line UPS - Comparison of ON line and OFF line UPS	14
V	**5. AC VOLTAGE REGULATORS** Introduction to AC Voltage Controller – Principle of On-Off Control – Principle of Phase Control – Single Phase voltage Controller with Resistive Loads – Single Phase voltage Controller with RL load - Three Phase Full Wave Controller – Cyclo converters – Single Phase Cyclo converters – AC Voltage controllers with PWM Control**.**	14
	Seminar, Revision and Test	10

TEXT / REFERENCE BOOKS

1. Industrial & Power Electronics, Harish C. Rai – Umesh Publication, 5th Edition,1994

2. Power Electronics, Dr.P.S. Bimbhra, Khanna publishers, 2nd Edition, 1998.

3. Power Electronics, M.H.Rashid, PHI Publications, 3rd edition, 2005.

4. Power Electronics, Vedam Subrahmanyam, New Age International Publishers, Second Edition, 2006

5. Power Electronics, Dr. P.S. Bimbhra, Khanna Publishers

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042540**

Semester : V

Subject Title : **PROCESS CONTROL INSTRUMENTATION PRACTICAL**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Process Control Instrumentation Practical	4	64	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE

This is the key subject in an Instrumentation and control Engineering. It is mandatory to study various control strategy being used in process industries. Various elements involved in controlling a plant such as controller, Final control elements are dealt in detail in this subject.

OBJECTIVES

- To get practice of controlling temperature in a single feedback loop
- To get practice of On-Off controlling of temperature, pressure, level of a process
- To get practice of Proportional control of Temperature process
- To get practice of Proportional-Integral control of pressure process
- To get practice of Proportional-Integral-Derivative control of level process
- To get practice of Proportional –Derivative of level process
- To get practice of working of I to P converter
- To understand the characteristics of control valve practically
- To get practice of working with P to I converter

4042540 PROCESS CONTROL INSTRUMENTATION PRACTICAL
LIST OF EXPERIMENTS

1. Perform Closed loop control of temperature process using thermistor.
2. Experimentally implement On - Off Control in a Temperature Process .
3. Experimentally implement On-Off Control in a Level Process
4. Experimentally implement On-Off Control in a Pressure Process
5. Conduct experiment to observe response of a proportional controller in a Temperature Process
6. Conduct experiment to observe response of PI controller in a Pressure Process
7. Conduct experiment to observe response of PID controller in a Level Process
8. Conduct experiment to observe response of PD controller in a Level Process
9. Experimentally obtain the Characteristics of Control Valve
10. Experimentally obtain the characteristics of P to I converter
11. Experimentally obtain the characteristics of I to P converter
12. Conduct experiment using Motorized control valve

SCHEME OF EVALUATION

SNo	Description	Allocation of Marks
1	Circuit diagram	30
2	Connections & procedure	30
3	Tabulation & Graph	25
4	Result	10
5	Viva Voce	5
TOTAL		**100**

EQUIPMENTS / SOFTWARE REQUIRED

SNo	Name of the Equipments / Software	Required Nos
1.	Temperature Control Station with accessories	1
2.	Level Control Station with accessories	1
3.	Pressure Control Station with accessories	1
4.	Control Valve setup with accessories	1
5.	Motorized Control Valve Setup with accessories	1
6.	P/I Conversion Setup and I/P converter setup with accessories	1
7.	Compressor unit	1

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042550**

Semester : V

Subject Title : **CONTROL ENGINEERING SIMULATION PRACTICAL**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Control Engineering Simulation Practical	4	64	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE

This is the key subject in an Instrumentation and control Engineering. It is mandatory to study mathematical description of system and process to analyze them. In this practical subject whatever is learned in control Engineering theory subject is studied in practice by simulation using MATLAB or open source tool SCILAB.

OBJECTIVES

- To get practice of finding Laplace and Inverse Laplace transform of the function
- To get practice to analyze the Pole, Zero locations and drawing plot of the given transfer function
- To get practice to analyze step and Impulse response of I order and II order system
- To get practice to obtain the time domain behavior of second order system
- To get practice to find the transfer function from the Block diagram
- To get practice to get transfer function from Mason's Gain formula
- To get practice to find stability of the given transfer function using Ruth Hurwitz criterion
- To get practice to draw Polar plot, Bode plot, and Root locus plot for the given transfer function

4042550 CONTROL ENGINEERING SIMULATION PRACTICAL
LIST OF EXPERIMENTS

1. Write and execute Matlab /Scilab/octave code to obtain
   a) Laplace transform of given function
   b) Inverse Laplace transform of given function

2. Write and execute Matlab/Scilab/octave code to obtain
   a) Pole, zero, gain values from a given transfer function
   b) Transfer function model from pole, zero, gain values
   c) Pole, zero plot of a transfer function

3. Write and execute Matlab/Scilab/octave code to determine
   a) step response of first order system.
   b) impulse response of first order system

4. Write and execute Matlab/Scilab/octave code to determine
   a) step response of 2^{nd} order system
   b) impulse response of 2^{nd} order system

5. Write and execute Matlab/Scilab/octave code to find time domain specifications for a typical second order system.

6. Write and execute Matlab/Scilab/octave code to find transfer function of the following systems using block diagram reduction technique.
   a) blocks connected in series
   b) blocks connected in parallel

7. Write and execute Matlab/Scilab/octave code to obtain transfer function of a signal flow graph using Masons gain formula.

8. Write and execute Matlab/Scilab/octave code to find stability of a given system using Routh Hurwitz criteria.

9. Write and execute Matlab/Scilab/octave code to sketch root locus of a given system.

10. Write and execute Matlab/Scilab/octave code to obtain polar plot of a given system.

11. Write and execute Matlab/Scilab/octave code to obtain Bode plot of a given system.

12. Write and execute Matlab/Scilab/octave code to obtain step response of a second order system for (a) under damped and (b) critically damped conditions.

SCHEME OF EVALUATION

SNo	Description	Allocation of Marks
1	Algorithm	30
2	Program	30
3	Debugging and Execution	25
4	Result	10
5	Viva-voce	5
TOTAL		**100**

EQUIPMENTS / SOFTWARE REQUIRED

SNo	Name of the Equipments / Software	Required Nos
1.	Desktop / Laptop Computer	15
2.	Laser Printer	1
3.	5 KVA Uninterrupted Power Supply (with atleast one hour backup)	1
4.	MATLAB Software (Multiuser) OR Scilab open source software Link to download Scilab software https://www.scilab.org/download/6.1.0 OR Octave open source software Link to download Octave software https://www.gnu.org/software/octave/download online cloud link for Scilab https://cloud.scilab.in/ online cloud link for Octave https://octave-online.net/	1

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042561**

Semester : V

Subject Title : **MICROCONTROLLER PRACTICAL**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Microcontroller Practical	4	64	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE

As microcontroller is like the brain of any Digital control system, it is obvious that control engineer must have practical knowledge about it. Whatever is covered in microcontroller theory is dealt in this subject practically. This subject gives opportunity to learn hardware ,programming and interfacing of real system with microcontroller. This is the basis for embedded system.

OBJECTIVE

- To write program for performing Arithmetic operations and execute it
- To write program for performing Logical operations and execute it
- To write program for performing Timing operations and execute it.
- To write program for performing Code conversions and execute it.
- To interface Digital input and outputs with microcontroller
- To interface hexadecimal key board with microcontroller
- To interface ADC and DAC with Microcontroller
- To interface DC motor and stepper motor with microcontroller
- To establish communication between two microcontroller

4042561 MICROCONTROLLER PRACTICAL
LIST OF EXPERIMENTS

PART - A
PROGRAMMING

1. Write an assembly language program to move block of data between external memory locations and execute the same in 8051 Kit

2. Write an Assembly Language Program for 8bit addition and subtraction with data stored at internal and external memory locations and execute same in the 8051 Kit.

3. Write an Assembly Language Program for 8bit Multiplication and Division of two numbers with data stored at external memory locations and execute the same in the 8051 Kit.

4. Write an Assembly Language Program for Arranging the given data stored at external memory locations in Ascending order and execute the same in the 8051 Kit.

5. Write an Assembly Language Program to convert ASCII code stored at external memory location to BCD and BCD to ASCII execute the same in the 8051 Kit.

6. Write an Assembly Language Program to set the timer / Counter of 8051 in Timer mode to generate time delay 0.5 sec and in counter mode to count the event.

PART - B
INTERFACING WITH APPLICATION BOARDS

1. Write an Assembly Language Program to interface the Digital I/O board with 8051 through 8255A PPI chip and to blink the 8 LED's connected to the 8255.

2. Write an Assembly Language Program to interface the multi digit 7 segment LED display board with 8051 through 8255 PPI chip and to display the word "ICE" and test it.

3. Write an Assembly Language Program for interfacing 8 bit ADC and test it.

4. Write an Assembly Language Program for interfacing 8 bit DAC and test it.

5. Write an Assembly Language Program for interfacing STEPPER MOTOR and test it.

6. Write an Assembly Language Program for Sending data through serial port

SCHEME OF EVALUATION

SNo	Description	Allocation of Marks
1	Algorithm	30
2	Program	30
3	Debugging and Execution	25
4	Result	10
5	Viva-voce	5
TOTAL		**100**

EQUIPMENTS / SOFTWARE REQUIRED

SNo	Name of the Equipments / Software	Required Nos
1.	8051 Microcontroller Kit	12
2.	Digital I/O Interface Board	2
3.	Seven Segment LED Display Interface Board	2
4.	8-bit ADC Interface Board	2
5.	8-bit DAC Interface Board	2
6.	Stepper Motor Control Interface Board	2
7.	RS232 Serial Cable	2

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042562**

Semester : V

Subject Title : **INDUSTRIAL INSTRUMENTATION PRACTICAL**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Industrial Instrumentation Practical	4	64	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE

Industrial Instrumentation covers the topics of measurement of variables related to Mechanical instrumentation and Analytical instrumentation .It gives detailed information to the students about the measurement of variables related to velocity, acceleration, force, torque, shaft power, pH and gas analysis. This subject is designed to implement whatever is studied industrial instrumentation theory subject including measuring force, velocity, displacement, distance etc., using measuring instrumental setup and also to construct signal conditioning circuits and testing it.

OBJECTIVES

- To measure displacement in mm using LVDT experimental setup
- To measure angular velocity using stroboscope
- To Measure force using strain gauge.
- Measurement of force using Hydraulic load cell.
- Construct and test an electronic comparator.
- Measurement of pH values for different solutions.
- Construct and test an Piezoelectric accelerometer.
- Construct and test an AD converter.
- Construct and test an DA converter.
- Construct and test frequency to voltage converter.
- Construct and test voltage to frequency converter.
- Measurement of distance using Ultrasonic method

4042562 INDUSTRIAL INSTRUMENTATION PRACTICAL
LIST OF EXPERIMENTS

1. Measurement of displacement using LVDT.
2. Measurement of angular velocity using Stroboscope.
3. Measurement of force using strain gauge.
4. Measurement of force using Hydraulic load cell.
5. Construct and test an electronic comparator.
6. Measurement of pH values for different solutions.
7. Conduct experiment using piezoelectric accelerometer.
8. Construct and test an A/D converter.
9. Construct and test an D/A converter.
10. Construct and test frequency to voltage converter.
11. Construct and test voltage to frequency converter.
12. Measurement of distance using Ultrasonic method.

SCHEME OF EVALUATION

SNo	Description	Allocation of Marks
1	Circuit Diagram	30
2	Connection and Procedure	30
3	Tabulation and Graph	25
4	Result	10
5	Viva Voce	5
TOTAL		**100**

EQUIPMENTS REQUIRED

SNo	Name of the Equipments / Software	Required Nos
1.	Displacement measurement module using LVDT	1
2.	Speed measurement using Stroboscope	1
3.	Force measurement module using Strain gauge	1
4.	Hydraulic load cell	1
5.	AD converter trainer kit	1
6.	DA converter trainer kit	1
7.	PH meter	1
8.	Frequency to voltage converter trainer kit	1
9.	Voltage and frequency trainer kit	1
10.	Distance measurement using Ultrasonic meter	1
11.	Piezoelectric accelerometer	1

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042563**

Semester : V

Subject Title : **INDUSTRIAL POWER ELECTRONICS PRACTICAL**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Industrial Power Electronics Practical	4	64	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE

Industrial power electronics is the vital subject for the control engineer must have practical knowledge about it. Whatever is covered in Industrial power electronics theory is dealt in this subject practically. This subject gives opportunity to learn and understand in practice whatever studied in theory.

OBJECTIVE

- To understand the VI characteristics of MOSFET
- To understand the RC firing circuit of SCR
- To understand a single phase Half Controlled/Full controlled
- Bridge converter with resistive load.
- To get practice in DC chopper using MOSFET and step up chopper
- To get practice in SCR commutation circuit
- To get practice in Single phase inverter
- To get practice in openloop speed control of single phase AC motor
- To get practice in three phase half controlled converter with R load
- To get practice in three phase fully controlled converter with R load

4042563 INDUSTRIAL POWER ELECTRONICS PRACTICAL
LIST OF EXPERIMENTS

1. Obtain the VI Characteristics of MOSFET.
2. Construct and test the RC firing circuit for SCR.
3. Construct and test a single phase Half Controlled Bridge converter with resistive load.
4. Construct and test a single phase Fully Controlled Bridge converter with resistive load.
5. Construct and test a PWM based DC Chopper using MOSFET / IGBT.
6. Construct and test a Step up Chopper.
7. Construct and test the SCR Commutation circuits.
8. Construct and test a single phase inverter.
9. Construct and test the single phase parallel inverter using MOSFET / IGBT.
10. Construct and test the open loop speed control of single phase AC motor.
11. Simulate the three phase half controlled converter with R load.
12. Simulate the three phase fully controlled converter with R load.

SCHEME OF EVALUATION

SNo	Description	Allocation of Marks
1	Circuit diagram	30
2	Connections & procedure	30
3	Tabulation & Graph	25
4	Result	10
5	Viva Voce	5
TOTAL		**100**

EQUIPMENTS REQUIRED

SNo	Name of the Equipments / Software	Required Nos
1.	Characteristics of MOSFET Trainer Kit	1
2.	RC Firing Circuit for SCR Trainer Kit	1
3.	Single Phase Half Controlled Bridge Converter with R load Trainer Kit	1
4.	Single Phase Fully Controlled Bridge Converter with R load Trainer Kit	1
5.	PWM based Step down DC Chopper using MOSFET / IGBT Trainer Kit	1
6.	SCR Commutation Circuit Trainer Kit	1
7.	Step up Chopper Trainer Kit	1
8.	Single Phase Inverter Trainer Kit	1
9.	Single Phase Parallel Inverter using MOSFET / IGBT Trainer Kit	1
10.	Open Loop Speed Control of Single phase AC motor Trainer Kit	1
11.	Any Simulation Software- PSpice/ MultiSIM / MATLAB	--
12.	20 MHz Dual Trace CRO with suitable probes	4

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4040570**

Semester : V

Subject Title : **ENTREPRENEURSHIP AND STARTUPS**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Entrepreneurship and Start Ups	4	64	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	Entrepreneurship – Introduction and Process	13
II	Business Idea and Banking	13
III	Start ups, E-cell and Success Stories	13
IV	Pricing and Cost Analysis	13
V	Business Plan Preparation	12
	Total	**64**

RATIONALE

Development of a diploma curriculum is a dynamic process responsive to the society and reflecting the needs and aspiration of its learners. Fast changing society deserves changes in educational curriculum particularly to establish relevance to emerging socio-economic environments; to ensure equity of opportunity and participation and finally promoting concern for excellence. In this context the course on entrepreneurship and start ups aims at instilling and stimulating human urge for excellence by realizing individual potential for generating and putting to use the inputs, relevant to social prosperity and thereby ensure good means of living for every individual, provides jobs and develop Indian economy.

OBJECTIVES

At the end of the study of 5th semester the students will be able to

- Acquire Entrepreneurial spirit and resourcefulness
- Understand the concept and process of entrepreneurship
- Acquire entrepreneurial quality, competency and motivation
- Learn the process and skills of creation and management of entrepreneurial venture
- Familiarization with various uses of human resource for earning dignified means of living
- Know its contribution in and role in the growth and development of individual and the nation
- Understand the formation of E-cell
- Survey and analyze the market to understand customer needs
- Understand the importance of generation of ideas and product selection
- Learn the preparation of project feasibility report
- Understand the importance of sales and turnover
- Familiarize of various financial and non financial schemes
- Aware the concept of incubation and starts ups

4040570 ENTREPRENEURSHI AND STARTUPS

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**Entrepreneurship – Introduction and Process** • 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	13
II	**Business Idea and Banking** • Types of Business: Manufacturing, Trading and Services. • Stakeholders: sellers, vendors and consumers and Competitors • E- commerce Business Models • Types of Resources - Human, Capital and Entrepreneurial tools and resources • Selection and utilization of human resources and professionals, etc. • Goals of Business; 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 • Various sources of Information • Role of financial institutions • Role of Government policy • Entrepreneurial support systems • Incentive schemes for state government • Incentive schemes for Central governments	13

III	**Start ups, E-cell and Success Stories** • Concept of Incubation centre's • Visit and report of DIC , financial institutions and other relevance institutions • Success stories of Indian and global business legends • Field Visit to MSME's • Study visit to Incubation centers and start ups • Learn to earn • Startup and its stages • Role of Technology – E-commerce and Social Media • Role of E-Cell • E-Cell to Entrepreneurship	13
IV	**Pricing and Cost Analysis** • Unit of Sale, Unit Price and Unit Cost - for single product or service • Types of Costs - Start up, Variable and Fixed • Income Statement • Cash flow Projections • Break Even Analysis - for single product or service • Taxes • Financial Business Case Study • Understand the meaning and concept of the term Cash Inflow and Cash Outflow • Price • Calculate Per Unit Cost of a single product • Operational Costs • Understand the importance and preparation of Income Statement • Prepare a Cash Flow Projection • Projections • Pricing and Factors affecting pricing. • Launch Strategies after pricing and proof of concept	13
V	**Business Plan Preparation** • Generation of Ideas. • Business Ideas vs. Business Opportunities • Opportunity Assessment – Factors, Micro and Macro Market Environment • Selecting the Right Opportunity • Product selection • New product development and analysis • Feasibility Study Report – Technical analysis, financial analysis and commercial analysis • Market Research - Concept, Importance and Process • Market Sensing and Testing • Marketing and Sales strategy • Digital marketing • Branding - Business name, logo, tag line	12

	• Promotion strategy • Business Plan Preparation • Social Entrepreneurship as Problem • Solving - Concept and Importance • Risk Taking-Concept • Types of business risks • Execution of Business Plan	
	Seminar, Revision and Test	10

Note: (i) Unit 1, 2 & 3 contents are common for all diploma programs

(ii) Unit 4 & Unit 5 contents are optional; Conveners/HoDs are requeste framing with their branch specific contents.

REFERNCE BOOKS

1. Dr. G.K. Varshney, Fundamentals of Entrepreneurship, Sahitya Bhawan Publications, Agra - 282002

2. Dr. G.K. Varshney, Business Regulatory Framework , Sahitya Bhawan Publications, Agra – 282002

3. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Entrepreneurship , McGraw Hill (India) Private Limited, Noida – 201301

4. M.Scarborough, R.Cornwell, Essentials of Entrepreneurship and small business management, Pearson Education India, Noida – 201301

5. Charantimath Poornima M. Entrepreneurship Development and Small Business Enterprises, Pearson Education, Noida - 201301

6. Trott, Innovation Management and New Product Development, Pearson Education, Noida – 201301

7. M N Arora, A Textbook of Cost and Management Accounting, Vikas Publishing House Pvt. Ltd., New Delhi-110044

8. Prasanna Chandra, Financial Management, Tata McGraw Hill Education Private Limited,New Delhi

9. I. V. Trivedi, Renu Jatana, Indian Banking System, RBSA Publishers, Rajasthan Simon Daniel, HOW TO START A BUSINESS IN INDIA, BUUKS, Chennai – 600018.

10. Ramani Sarada, The Business Plan Write-Up Simplified - A practitioners guide to writing the Business Plan, Notion Press Media Pvt. Ltd., Chennai 600095.

BOARD EXAMINATION – EVALUATION PATTERN

INTERNAL MARK ALLOCATION

Assignment (Theory Portion)*	10
Seminar Presentation	10
Attendance	5
Total	25

Note: Two assignments should be submitted. The same must be evaluated and converted to 10 marks.

Guidelines for Assignment

First assignment	...	Unit I
Second assignment	...	Unit II
Guidelines for Seminar Presentation	...	Unit III

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

BOARD EXAMINATION

Note:

1. The students should be taught all units and proper exposure and field visit also arranged. All the portions should be completed before examinations.

2. The students should maintain theory assignment and seminar presentation. The assignment and seminar presentation should be submitted during the Board Practical Examinations.

3. The question paper consists of theory and practical portions. All students should write the answers for theory questions (40 Marks) and practical portions (60 Marks) should be completed for board examinations.

4. All exercises should be given in the question paper and students are allowed to select by lot. If required the dimensions of the exercises may be varied for every batch. No fixed time allotted for each portion and students have liberty to do the examination for 3 Hrs.

5. For Written Examination: Theory Question and Answer: 45 Marks

   Ten questions will be asked for 3 marks each.
   Five questions from each Unit 1 & 2 (10 x 3 = 30).
   Three questions will be asked for 5 marks each.

One question from each unit 1, 2 & 3. (3 X 5 = 15)

6. For Practical Examination: The business plan/Feasibility report or Report on Unit 4 & 5 should be submitted during the board 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 & (3 questions x 5 marks: 15 marks)	45
Part B	Practical Examination – Submission on Business Plan/Feasibility Report or Report on Unit 4 & 5	40
Part C	Viva voce	15
	Total	**100**

MODEL QUESTION PAPER
ENTREPRENEURSHIP AND START UPS

Time: 1 Hour Max. Marks: 45

PART – A (45 marks)

Answer ten questions in brief
(10 x 3=30)

1. Define entrepreneurship.
2. State the process of entrepreneurship
3. What are the benefits of being an entrepreneur?
4. How do entrepreneurs act as problem solvers?
5. Outline the role of networking in entrepreneurship.
6. List the various types of business
7. Outline the business model.
8. Suggest the various goals of business.
9. How selection of human resources is carried out?
10. Specify the role of government policy on entrepreneurship.

Answer three questions in details
(3 x 5 = 15)

11. Describe the importance of innovation on entrepreneurship.
12. Enumerate the various incentive schemes for the central government.
13. How technology will play a major role in E- commerce?

PART – B (40 marks)

Practical Examination
Submission on Business Plan / Feasibility Report or Report on Unit 4 & 5

PART - C (15 marks)
Viva Voce

VI SEMESTER

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042610**

Semester : VI

Subject Title : **INDUSTRIAL AUTOMATION AND DRIVES**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Industrial Automation and Drives	5	80	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	Industrial drives	14
II	Pneumatic and hydraulic systems	14
III	Pumps and Compressors	14
IV	Distributed control system(DCS)	14
V	Robotics	14
	Revision	3
	Tests & Model Examination	7
	Total	**80**

RATIONALE

A diploma holder employed in automated manufacturing units/assembly lines, process industry, Power generation stations needs to know about systems/components required for automation of a modern industrial unit. Diploma holder in industry are required to trouble shoot/change automation sequences for optimizing the production through automatic machines/assembly lines. They must be familiar with Hydraulic and Pneumatic systems and Electric drives so that can handle it.

OBJECTIVES

After learning this subject the student will be able to

- Understand the different types of stepper motors and their control
- Understand the AC and DC servo motors and their control
- Understand the elements of Hydraulic system –
- Understand the elements of Pneumatic systems
- Understand the directional control valve, single acting and double acting cylinder
- Understand the different types of pumps
- Understand the different types of compressors
- Understand the architecture and components of Distributed Control System
- Understand the anatomy of Robot and Sensors needed for Robot
- Understand the Robot programming languages
- Understand the Automated guided veicle

4042610 INDUSTRIAL AUTOMATION AND DRIVES

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**1. INDUSTRIAL DRIVES** Electric drive - Definition - Parts - Types - Individual - Group - Multi motor. Stepper motor - Definition - Step angle - Slewing rate - Types -Variable reluctance -Hybrid - Closed loop control of stepper motor - Drive system(any one) - logic sequencer - Optical encoder. Servo motor - Definition - Types - DC servo motor - Permanent magnet DC motors - Brushless motor - AC servo motor - Working of an AC servo motor in control system - Induction motors - Eddy current drive for speed control of induction motors.	14
II	**2. PNEUMATIC AND HYDRAULIC SYSTEMS** Hydraulic system - Elements of Hydraulic system – Hydraulic power supply and accumulator. Pneumatic system-Introduction - Elements of Pneumatic power supply - Filter - Regulator-lubricator(FRL) - Pressure control valves - Pressure relief valve - Pressure reducing valve - Directional control valve(DCV) - Poppet and spool valve - 3/2 DCV - 4/3 DCV - 5/2 DCV - Valve symbols - Pneumatic circuits - Control of a single acting cylinder and double acting cylinder - Comparison between hydraulics and Pneumatics.	14
III	**3. PUMPS & COMPRESSORS:** **3.1 PUMPS** Introduction – Pumps Vs Compressors – Positive Displacement Vs Non Positive Displacement Devices – Classification of Hydraulic Pumps – Positive Displacement Pumps – Rotary Pumps – Reciprocating Pumps – Metering Pumps – Dynamic / Non-Positive Displacement Pumps – Centrifugal Pumps – Pump Selection Parameters – Comparison of Positive and Non Positive Displacement Pumps **3.2. COMPRESSORS** Air Compressors – Types of Air Compressors – Positive Displacement Compressors – Rotary Compressors – Reciprocating Compressors – Piston Compressors – Diaphragm Compressors – Dynamic Compressors – Comparison of Different Compressors – Specifications of Compressors.	7 7
IV	**4. DISTRIBUTED CONTROL SYSTEM (DCS)** Evolution of distributed control system - Definition of DCS – Block diagram – Functional elements of DCS - Elements of local control unit -Operator interfaces-Engineering interfaces -Types of information displays - Architecture of anyone commercial DCS - Advantages of DCS - Selection of DCS - List of various DCS and their manufactures.	14

V	**5. ROBOTICS** Definition - Robot anatomy - Classification of robots - sensors - Contact and non-contact - Touch, tactile, range and proximity sensor - End effectors -Types of end effectors - Robot programming languages - Robot drives - Applications of robots - One specific application of industrial robot – Material handling - Automated guided vehicle system	14
	Seminar, Revision and Test	10

TEXT/REFERENCE BOOKS

1. G.K.Dubey, 'Fundamentals of Electrical Drives', Narosa Publication,2002.

2. M.S.Berde, "Electric Motor Drives" Khanna publishers.2008 3.

3. R.Srinivasan"Special electrical Machines" lakshmi publication.2012 4.

4. V.jayakumar"applied hydraulics and pneumatics"lakshmi publication.2010

5. R.srinivasan"hydraulic and pneumatic controls"second edition 2010 MCgraw-hill education(india) pvt.ltd

6. Frank D.petruzella"programmable logic controls"third edition TATA mcgraw hill edition 2010.

7. Pradheep kumar srivastava, 'Programmable logic controllers with applications', BPB publications.2004.

8. John W.Webb, Ronald A.Reis, 'Programmable logic controllers- Principles and Applications', Fifth Edition, Prentice Hall of India

9. Michel P.Lukas, 'Distributed Control system', van Nostrand Reinhold Co, 1986.

10. Fu K.S, Gonzales et al, 'Robotics-Control, sensing, Vision and Intelligence, McGraw Hill.1987

11. Michel P.Groover, 'Industrial Robots-Technology, Programming and Applications', McGraw Hill.2012.

12. P.Jaganathan "Robotics" lakshmi publication.2012

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042620**

Semester : VI

Subject Title : **BIO MEDICAL INSTRUMENTATION**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Programmable Logic Controllers	5	80	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	Bio-electric signals, electrodes and clinical measurement	14
II	Bio - medical recorders	14
III	Therapeutic instruments	14
IV	Biotelemetry and patient safety	14
V	Modern imaging techniques	14
	Revision	3
	Tests & Model Examination	7
	Total	**80**

RATIONALE

Bio medical engineering education is in the growing stage. But every year, there is a tremendous increase in the use of modern medical equipment in the hospital and health care industry therefore it is necessary for every student to understand the functioning of various medical equipments. This subject to enable the students to learn the basic principles of different biomedical instruments viz Clinical measurement, Bio - medical recorders, Therapeutic instruments, Biotelemetry and Modern imaging techniques instruments.

OBJECTIVES

After learning this subject the student will be able to understand the about

- The generation of Bio-potential and its measurement using various electrodes.
- The measurement of blood pressure.
- The measurement of lung volume.
- The measurement of respiration rate.
- The measurement of body temperature and skin temperature.
- The principles of operations of ECG recorder.
- The principles of operations of EEG recorder.
- The principles of operations of ENG recorder.
- The working principles of audio meter.
- The principles of operations of pacemaker.
- The basic principle of dialysis.
- The basic principle of short wave diathermy.
- The basic principle of ventilators.
- The working principles of telemetry.
- The basic principle of telemedicine.
- To learn about patient safety.
- The various methods of accident prevention.
- The basic principle of various types of lasers.
- The basic principle of CT and MRI scanner.
- The principle of operation of various imaging techniques.

4042620 BIO-MEDICAL INSTRUMENTATION

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**1.1. BIO-ELECTRIC SIGNALS AND ELECTRODES** Elementary ideas of cell structure, Bio – potential and their generation – resting and action potential – propagation of action potential. Electrodes – Micro – Skin surface – needle electrodes. **1.2. CLINICAL MEASUREMENT** Measurement of Blood pressure (direct, indirect) – blood flow meter (Electro magnetic& 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.	7 7
II	**2. BIO - MEDICAL RECORDERS** Electro cardiogram-Normal ECG values -Electro cardiograph (ECG) – Lead system – ECG electrodes – ECG amplifiers – ECG recording units – analysis of ECG curves. Nervous system – EEG recorder – 10-20 lead system – recording techniques – EEG wave types – Clinical use of EEG – brain tumour. Electro – myograph (EMG) – EMG waves – measurement of conduction velocity EMG recording techniques – Electro – Retinograph (ERG) – Audiometer - principle – types – Basics audiometer working	14
III	**3. THERAPEUTIC INSTRUMENTS** Cardiac pacemaker – classification – External pace makers – implantable pacemaker – pacing techniques – programmable pacemaker – Cardiac defibrillators – types – AC and DC defibrillators - Heart lung machine with Block diagram. Dialysis – Hemo dialysis – peritoneal dialysis. Endoscopes-types-Endoscopic laser coagulator and applications – physiotherapy equipment – short wave diathermy – micro wave diathermy – ultrasonic therapy unit (block / circuit) – Ventilators – types – modern ventilator block diagram.	14
IV	**4.BIOTELEMETRY AND PATIENT SAFETY** Introduction to biotelemetry – physiological – adaptable to biotelemetry components of a biotelemetry system – application of telemetry – elements of biotelemetry; AM, FM transmitter and receiver – requirements for biotelemetry system – radio telemetry with sub carrier single channel and multi channel telemetry – Telemedicine; introduction, working, applications. **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	14

	distribution system. Safety aspects in electro surgical units – burns, high frequency current hazards, Explosion hazards.	
V	**5. MODERN IMAGING TECHNIQUES** LASER beam properties – block diagram – operation of CO2 and NDYag LASER – applications of LASER in medicine. X ray apparatus – block diagram – operation – special techniques in X-ray imaging – Tomogram – computerized Axial tomography – Ultrasonic imaging techniques – Echo cardiography – Angiography – CT scanner - Magnetic resonance imaging techniques.	14
	Seminar, Revision and Test	10

TEXT BOOKS

1. Dr.M. Arumugam – Biomedical Instrumentation ,Anuradha Publications, Chennai
   (Page no. 1-15, 21-33, 117-136,142-159,164-179, 182-195, 202-209, 212-215, 255– 256, 274-277, 285-286, 266-268, 293-297, 299- 310, 319-320, 329 – 340, 347-358, 360-367, 374-390, 390,400)

REFERENCE BOOKS

1. Leslie Cromwell – Fred j. Wibell, Erich A.P Feither – Bio medical Instrumentation and measurements, II Edition.
   (Page no. 49-64, 63-76, 93-97, 106-149,195-205, 260-276, 296-303, 316 – 339,363- 383,430-439)

2. Jacobson and Webstar – Medicine and Clinical Engineering.

3. R.S .Khandpur – Hand book of Bio –Medical Instrumentation.

4. Medical Electronics - Kumara Doss

5. Introduction to Medical Electronics. B.R. Klin

6. Introduction to Biomedical Instrumentation Mandeep Singh Prentice Hall India 2010

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042631**

Semester : VI

Subject Title : **PROGRAMMABLE LOGIC CONTROLLERS**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Programmable Logic Controllers	5	80	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	Introduction to PLC	16
II	PLC Programming - I	14
III	PLC Programming - II	14
IV	Communication Protocols	12
V	SCADA and HMI	14
	Revision	3
	Tests & Model Examination	7
	Total	**80**

RATIONALE

A diploma holder when employed in automated industrial process controls or in automated power station will be required to know the basics of Programmable Logic Controllers, their working and their programming. In industry, many manufacturing processes demand a sequence of operation, which are to be performed repetitively. Early automation systems were mechanical in design, timing and sequencing being effected by gears and cams. Slowly these design concepts were replaced by electrical drives which were controlled by relays and now by programmable logic controllers (PLCs). PLCs are widely used in all industries for efficient control operations. A diploma holder in industry is called upon to design, modify and troubleshoot such control circuits. Looking at the industrial applications of PLCs in the modern industry, this subject finds its usefulness in the present curriculum

OBJECTIVES

- To understand the detailed Hardware of PLC and its parts
- To understand the working of PLC and scan cycle
- To understand the program and data memory organization
- To know the Different timers of PLC and programming them
- To know the different counters of PLC and its parameters
- To understand the Ladder logic programming of PLC
- To develop simple ladder programs
- To study the Advanced instructions of PLC
- To understand the communication module of PLC
- To understand different editors and features of SCADA
- To understand the HMI

4042631 PROGRAMMABLE LOGIC CONTROLLERS

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**1. ARCHITECTURE AND OPERATION OF PLC** Automation – Needs and Benefits - PLC – Definition – Functional Block Diagram of PLC – CPU – Power Supply – Memory (ROM, RAM, EPROM, EEPROM) – I/O Modules (Discrete, Analog, DC and AC) – Input Field Devices – Output Field Devices – Memory Organization: System Memory – Data Memory - Comparison between Hardwired Control and PLC Control - Advantages and Disadvantages of PLC	8
	Classification of PLC: According to Architecture: Open Architecture – Closed Architecture – According to I/O: Fixed I/O – Modular I/O – According to Output: Relay Output – Transistor Output – TRIAC Output – According to Small, Medium and Large – Micro PLC – Pico/Nano PLC	8
	Add on Modules – PLC Specifications – Criteria for Selecting PLC - Leading Manufactures of PLC – Application Areas of PLC – PLC Working Principle – Self Test - Input Scan – Program Scan – Output Scan - Communication Ports available in PLC – PLC Programming Software	
II	**2. PLC PROGRAMMING – I** Types of PLC Programming Languages – Ladder Diagram (LD) – Functional Block Diagram (FBD) – Structured Text (ST) – Instruction List (IL) – Sequential Function Chart (SFC)	4
	Ladder Programming – Advantages – Terminologies – Power Rails – Rungs – Binary Input Devices – Binary Output Devices – Basic Ladder Logic Symbols - Relay Type Instructions: Examine If Closed (XIC), Examine If Opened (XIO), Output Energize (OTE), One Shot Rising (OSR).	5
	Logical Instructions: AND, OR, NAND, NOR, XOR, NOT, Clear (CLR) - Timer Instructions: On Delay (TON), Off Delay (TOF), Retentive (RTO) and Non-retentive (RES) – Counter Instructions: Count-Up (CTU), Count-Down (CTD), Reset (RST) and High-Speed Counter (HSC).	5

III	**3. PLC PROGRAMMING - II** **Data Manipulation Instructions:** Move (MOV), Masked Move (MVM) - Math Instructions: CPT, ADD, SUB, MUL, DIV, SQR, NEG – Data Compare Instructions: Equal (EQU) EQU, Less Than (LES), Less Than or Equal (LEQ), Not Equal (NEQ), Greater Than (GRT), Greater Than or Equal (GEQ). **Branching Instructions:** Jump to Label (JMP), Label (LBL), Jump to Subroutine (JSR), Return (RET), Subroutine (SBR), Temporary End (TND), Master Control Reset (MCR), Suspend (SUS) – Shift & Sequence Instructions: Bit Shift Left (BSL), Bit Shift Right (BSR), Sequencer Output (SQO), Sequencer Compare (SQC), Sequencer Load (SQL). **Different Modes of PLC** – Program Mode – Monitor Mode – Run Mode – Entering and Running PLC Program.	7 5 2
IV	**4. COMMUNICATION PROTOCOLS:** Data Communication – Transmission Modes – Simplex, Half Duplex and Duplex – Serial and Parallel – Network Topology: Star, Bus and Ring- Advantages and disadvantages – OSI Reference Model – TCP/IP – FTP - RS 232 – RS 485 – MODBUS – Ethernet – Profinet – HART – Field bus – MODBUS – CAN – USB – FireWire – RS 232 to USB – RS 485 to USB	12
V	**5. SCADA AND HMI** Introduction to SCADA – Typical SCADA architecture / block diagram – Benefits of SCADA – Various Editors for SCADA - SCADA Features: I/O points – Industrial Standard Communication – Graphical Operator Interface – Data Visualization Tools – Alarm Management – User Authority Management – Remote Monitoring – Client Server. HMI Features: Graphical Representation – Operator Inputs – Interaction with Control Process - OPC Server and Client - Storing Data in Cloud. Applications of SCADA – Traffic light control – Water distribution – Pipeline Control.	7 7
	Seminar, Revision and Test	10

TEXT / REFERENCE BOOKS

1. Introduction to Programmable Logic Controllers by G. Dunning, Thomson / Delmar Learning, New Delhi (3rd edition).

2. Programmable Logic Controller by V.R. Jadhav, Khanna Publishers, New Delhi, 2017.

3. Programmable Logic Controllers by F.D. Petruzella, McGraw Hill India, New Delhi, 2003.

4. Supervisory Control and Data Acquisition by S.A. Boyar, ISA Publications, USA.

5. Programmable Logic Controllers and Industrial Automation – An Introduction by Madhuchandra Mitra, Samarjit Sengupta, Penram International.

6. Programmable Logic Controllers, Jack Hackworth, Federic Hackworth, PHI Learning, New Delhi.

7. Madhuchhanda Mitra ,Samarjit sen Gupta,"PLC and Industrial Automation and Introduction", Penram international Publishing (India) Pvt Ltd.

8. Pradeep Kumar Srivastava, "Exploring Programmable Logic Controller with applications", BPB Publication

9. W. Bolton,"Programmable logic controller" IV Edition Reed Elsevier India Pvt Ltd.

10. Gary Dunning,"Introduction to PLC", IIIrd edition Thomson del mar learning

11. Industrial Automation and Process Control by Jon Stenerson, PHI Learning, New Delhi.

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042632**

Semester : VI

Subject Title : **POWER PLANT INSTRUMENTATION**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Power Plant Instrumentation	5	80	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	Overview Of Power Generation	18
II	Measurements In Power Plant	14
III	Analysers In Power Plant	14
IV	Control Loops In Boiler	12
V	Turbine-Monitoring And Control	12
	Revision	3
	Tests & Model Examination	7
	Total	**80**

RATIONALE

The fuel and power are the most important items on which national standard of life depend. Therefore the increase and power potential of nation is considered most important among all. This subject enables the students to learn the basic principles of different methods of power generation and the instrumentation and control involved in the power generation process.

OBJECTIVES

After learning this subject the student will be able to understand about

- The methods of power generation
- The operation of hydro, thermal, solar, wind and nuclear power plants
- The types of boilers and its classification
- The Piping and Instrumentation drawing of boiler
- The Differential pressure measurement of airflow
- The Inferential and Non-Inferential measurements of combustion airflow
- The measurement of Steam flow, Steam pressure and Steam temperature
- The measurement of Dust and Smoke
- The principle of operation of Flue gas Analyser,
- The principle of operation of Electrical conductivity meter
- The principle of operation of Auto analyser
- The principle of operation of Air pollution monitoring system
- The furnace draft control using feed forward and feed back control
- The Boiler feed water pumping and heating system
- The Instrumentation and control in turbines

4042632 POWER PLANT INSTRUMENTATION
DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**OVERVIEW OF POWER GENERTATION** Hydro electric power plant-Introduction-Hydrology-Hydrograph-Classification of Hydro electric power plant-Components used in hydro electric power plant-Thermal power plant – Circuits in thermal power plant-Working of thermal power plant-Coal handling system - Ash and Dust handling system-Draft system-Economizer-Air pre heater-Solar power plant-principle-Flat plate collector-Solar thermal power generation-Photo voltaic power generation-Nuclear power plant- Principle - Pressurized water reactor-Boiling water reactor-Components used in nuclear power plant-Wind power plant-Principles- Basic components of wind energy conversion system-Boilers-Basic boiler-Boiler types and classification- Co-Generation system-toping cycle, bottoming cycle.	18
II	**MEASUREMENTS IN POWER PLANT** Air flow measurements-Variable Head flow meters-Hot wire anemometer Oil flow measurements-Steam flow measurements-Steam pressure measurements- Steam temperature measurements-Drum level measurements -Dust measurements Smoke measurements-Radiation Detectors-Pressure Gauges-Strain Gauges.	14
III	**ANALYSERS IN POWER PLANT** Flue gas Oxygen analyser-Paramagnetic oxygen Analyser - Zirconium oxygen probe - Measurement of CO2 in flue gas - Thermal conductivity method- Infrared gas analyser – Measurement of impurities in feed water and steam-Electrical conductivity meter –Dissolved Oxygenanalyser-pHmeter-ChromotographyAirpollutionmonitoringInstruments.	14
IV	**CONTROL LOOPS IN BOILER** Boiler control system-Basic block diagram-Combustion control-Single point positioning – parallel positioning- Metering control system - Measurement of furnace draft-furnace draft control using feed forward and feedback control-Drum level control-single, two and three element control – steam temperature control- cascade and feed forward plus feedback control- -Boiler feed water pumping and heating system – Flue gas dew point control-Soot blowing.	12
V	**TURBINE-MONITORING AND CONTROL** Introduction- Speed, Vibration, Shell Temperature monitoring and control–Steam pressure control–Lubrication system for steam turbines–Cooling system.	12
	Seminar, Revision and Test	10

TEXT BOOKS

1) Power plant instrumebntation by K.Krishnaswamy & M.Ponnibala PHI
2) Power plant instrumentation by Tamilmani sam's Publisher

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042633**

Semester : VI

Subject Title : **EMBEDDED SYSTEM DESIGN WITH ARDUINO**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Embedded System Design with Arduino	5	80	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

Topics and Allocation of Hours

Unit	Topic	Hours
I	Introduction to Embedded system	12
II	ARDUINO Hardware	12
III	ARDUINO software and Library functions	14
IV	ARDUINO interface with devices , sensors,& Actuators	18
V	Embedded application development with ARDUINO	14
	Revision	3
	Tests & Model Examination	7
	Total	**80**

RATIONALE

Embedded system is inevitable in today's Industrial applications. ARDUINO is an open source based prototyping platform used to sense and control physical devices. The purpose of this subject is to become familiar with ARDUINO based embedded system design methods both in hardware and software.

OBJECTIVES

After learning this subject the student will be able to understand

- What is embedded system?
- Classification and characteristics and applications of embedded system
- Different types of ARDUINO BOARDS and its descriptions
- Embedded C programming
- Structure of ARDUINO sketch
- ARDUINO built in library functions
- Interface with input and output devices like, switches, LED's
- Interface different kind of sensors with ARDUINO board
- Interface with Actuators like stepper motor, DC motor, and servo motor
- To build applications like digital ohmmeter, digital thermometer
- To build applications like digital lux meters, and distance measuring meter
- To build applications with wireless communication interface like Bluetooth
- To build applications to measure humidity
- To build application to interface with internet

4042633 EMBEDDED SYSTEM DESIGN WITH ARDUINO

DETAILED SYLLABUS

Unit	Name of the Topics	Hours
I	**1. INTRODUCTION TO EMBEDDED SYTEMS** Definition of Embedded Systems - Embedded System vs General Computing Systems - Embedded Systems Classification (Small Scale, Medium Scale and Sophisticated) – Major Application Areas – Purpose of Embedded Systems - Characteristics and Quality Attributes of Embedded Systems.	12
II	**2. ARDUINO HARDWARE** Arduino – Advantages – Arduino History – Arduino Family: Arduino Uno, Arduino Mega and Arduino Nano – Arduino uno Board descriptions – Arduino Mega Board descriptions – Arduino Nano Board descriptions -Arduino Due Board description - Arduino Board installation - Digital and Analog Peripherals – Arduino Mega Ports – Pins – Communication Models – Communication Interface	12
III	**3. ARDUINO SOFTWARE & LIBRARY FUNCTIONS** Embedded C – Difference between C and Embedded C – Data types- constant-Variables-Variable scope (local , global)-Operators for Arduino – Arithmetic, logical, Boolean, bitwise, compound – control Statements – if- if else- if elseif else –switch case –While – Do while –for loop- infinite loop – Function declaration –Time manipulation functions- declaring array- Arduino Function Libraries: pinMode() function-digitalRead(), digitalWrite() function- analogRead function()- analogReference() function - Familiarizing with Arduino IDE – Sketch designing for Arduino	14
IV	**4. ARDUINO INTERFACE WITH DEVICES, SENSORS and ACTUATORS** **4.1 Hardware and Arduino sketch for interfacing Devices** Arduino Hardware and sketch for - Blinking LED, Brightness control of LED, Reading analog voltage, Reading analog voltage and displaying in LED Bar graph, Interfacing seven segment Display- Interfacing 16 X 2 LCD display, Interfacing relays and buzzer with switches **4.2 Hardware and Arduino Sketch for interfacing Sensors** Arduino Hardware and Sketch for – temperature sensor LM35, Humidity sensor DHT22, IR motion sensor PIR – ultrasonic sensor HC-SR04- Light sensor LDR **4.3 Hardware and Arduino Sketch for interfacing Actuators** Arduino hardware and sketch for DC Motor- Servo motor – Stepper Motor	18

V	**5. EMBEDDED APPLICATION DEVELOPMENT WITH ARDUINO** Arduino Hardware and sketch for - measuring unknown resistance, to measure temperature, to measure light intensity, to measure distance in cm – to measure angle of rotation using potentiometer – to measure humidity – to communicate with android phone through Bluetooth – to use wifi and local area network – to send data through internet- switches and LED control using I^2C protocol	14
	Seminar, Revision and Test	10

TEXT BOOKS / REFERENCE BOOKS / WEBSITES

1. Introduction to Embedded Systems (2nd Edition) by K V Shibu, McGrawHill India

2. Embedded Systems Architecture, Programming and Design by Raj Kamal, Tata McGraw-Hill Publishing

3. Arduino Based Embedded Systems Interfacing, Simulation and LabView GUI by Rajesh Singh, Anita Gehlot, Bhupendra Singh, Sushaban Choudhury, CRC Press

4. Sams Teach Yourself Arduino Programming in 24 Hours by Richard Blu

5. Arduino for Dummies by John Nussey

6. Arduino Cookbook (3rd edition) by Michael Margolis, Brian Jepson and Nicholas Robert Weldin, O'reilly

7. Arduino Made Simple with Interactive Projects by Ashwin Pajankar, BPB Publications

8. https://arduino.cc

9. https://www.tutorialspoint.com/arduino/

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042640**

Semester : VI

Subject Title : **INDUSTRIAL AUTOMATION PRACTICAL**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Industrial Automation Practical	5	80	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE

As Automation plays the vital role in process industries, manufacturing sectors, it is Essential for an Instrumentation and control engineer to understand the practical aspects Of Automation. In most of the automation process double acting and single acting cylinders plays the role of actuating element. Hence in this subject it is dealt practically.

OBJECTIVES

- To get practice to operate single and double acting cylinder
- To get practice to operate cylinder from different position using shuttle valve
- To get practice to operate double acting cylinder in multi cycles
- To get practice to operate Hydraulic motor
- To get practice to control the speed of Double acting cylinder, Hydraulic motor
- To get practice to control the DC motor using SCR
- To get practice to measure ratio and efficiency of transformer
- To get practice to operate the single phase and three phase induction motors and obtain their characteristics

4042640 INDUSTRIAL AUTOMATION PRACTICAL
LIST OF EXPERIMENTS

1. Conduct experiment to operate single acting cylinder
   a) using 3/2 solenoid valve and push button
   b) using 5/2 solenoid valve and 2 push buttons.

2. Conduct experiment to operate Double acting cylinder
   a) using 2nos. of 3/2 solenoid valve and 2 push buttons
   b) using 5/2 solenoid valve and 2 push buttons

3. Conduct experiment to Operate single acting cylinder using PLC
   a) using OR Logic
   b) using AND logic

4. Conduct experiment to Operate single acting cylinder using PLC
   a) using on-delay Logic
   b) using off-delay logic

5. Conduct experiment to Operate single acting cylinder using PLC for fixed number of cycles using counter instruction and electrical switches

6. Conduct experiment to operate Double acting cylinder using PLC Single cycle, Forward, Time delay and return

7. Conduct experiment to operate Double acting cylinder using PLC N cycles using counter and one set of electrical limit switches and one no. 5/2 solenoid valve

8. Conduct experiment to perform Sequential operation of 2 nos. of double acting cylinders using PLC for the sequence A+ B+ B- and A- using 2 nos. of 5/2 solenoid valves and 2 sets of electrical limit switches

9. Conduct Experiment to operate hydraulic motor directly.

10. Conduct experiment to control the Speed of hydraulic motor using metering in and metering out control.

11. Conduct experiment to control the speed of DC motor using SCR.

12. Conduct experiment to Measure voltage ratio and efficiency of transformer by loading the transformer.

13. Experimentally obtain the Load characteristics of 3-phase induction motor.

14. Experimentally obtain the Load characteristics of 1-phase induction motor.

SCHEME OF EVALUATION

SNo	Description	Allocation of Marks
1	Circuit diagram	30
2	Program / procedure	30
3	Tabulation & Graph	25
4	Result	10
5	Viva Voce	5
TOTAL		**100**

EQUIPMENTS REQUIRED

SNo	Name of the Equipments / Software	Required Nos
1.	Pneumatic control Station with accessories	1
2.	Hydraulic control station with accessories	1
3.	SCR method of speed control of DC motor setup with accessories	1
4.	Load test on single phase transformer setup with accessories	1
5.	Load characteristics of three phase induction motor setup with accessories	1
6.	Load characteristics of single phase induction motor setup with accessories	1
7.	PLC based Electro Pneumatic Kit	2

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU

DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042651**

Semester : VI

Subject Title : **PROGRAMMABLE LOGIC CONTROLLER PRACTICAL**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Programmable Logic Controller Practical	6	96	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE

This subject gives practical exposure for whatever students study in the theory paper. In any industry PLC is extensively used for automation of a process. Hence it is mandatory for the control engineering students to learn practically a PLC to implement automation in a process.

OBJECTIVE

- To develop ladder logic program for basic functions and implementing in a PLC
- To develop ladder logic using Timers in a PLC
- To develop and implement ladder logic for the timer application
- To develop and implement ladder logic for the counter function in a PLC
- To develop and implement ladder logic using sequencer in a PLC

- To develop and implement ladder logic to control a motor
- To develop and implement ladder logic to control a conveyor belt
- To develop and implement ladder logic to control a lift
- To develop and implement ladder logic to control a water level in a Tank

4042651 PROGRAMMABLE LOGIC CONTROLLER PRACTICAL
LIST OF EXPERIMENTS

1. Write and implement a Ladder logic program using Latch circuit.

2. Write and implement a Ladder logic program for the Logical functions.

3. Write and implement a Ladder logic program for the On delay and Off delay timer functions.

4. Write and implement a Ladder logic program for the Cyclic On/Off of an output using Timer instructions.

5. Write and implement a Ladder logic program to count an event.

6. Write and implement a Ladder logic program to toggle an output.

7. Write and implement a Ladder logic program for the sequence control of four outputs repetitively.

The following experiments are to be conducted by interfacing PLC with I/O devices:

8. Write and implement a Ladder Logic program for the On/Off Control of a motor.

9. Write and implement a Ladder logic program for the On/Off Level Control.

10. Write and implement a Ladder logic program for Conveyor control.

11. Write and implement a Ladder logic program for Lift control.

12. Write and implement a Ladder Logic program to count the number of students inside a Classroom by placing photoelectric sensor at the entry and exit.

SCHEME OF EVALUATION

SNo	Description	Allocation of Marks
1	LADDER LOGIC	30
2	EXECUTION OF PROGRAM	30
3	OBSERVATION & PROCEDURE	25
4	RESULT	10
5	VIVA VOCE	5
TOTAL		**100**

EQUIPMENTS REQUIRED

SNo	Name of the Equipments / Software	Required Nos
1.	Programmable Logic Controller (PLC) with battery	4
2.	PC Pentium Dual Core	4
3.	PC to PLC interface cable	4
	Moduels required for PLC Interfacing	
5.	On / Off Motor module with provision for PLC	1
6.	On / Off Level Control System with provision for PLC	1
7.	Conveyor Control System with provision for PLC	1
8.	Lift Control System with provision for PLC interface	1
9.	Photo electric sensor	1

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU
DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042652**

Semester : VI

Subject Title : **P & I DRAWINGS USING CAD PRACTICAL**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
P & I Drawings using CAD Practical	5	80	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE

P&IDs are essential in the engineering and design of piping systems and process plants. By diagraming the functional relationship of piping, instrumentation and equipment components, they illustrate the interaction of the process components used to control an entire process. P&IDs include equipment, physical sequences of process branches, valves, instrumentation reducers and control interlocks. they are also important to the maintenance of the equipment used and the ability to adjust the process that they represent. Diploma in instrumentation and control engineers must be familiar with P&I Drawings , and also they have to practice to draw P&I Diagrams. This practical subject gives hands on training to draw diagrams.

OBJECTIVES

After learning this subject student will be able to

- To draw various symbols and abbreviations used in P&I Diagram
- Draw the P&ID of a Drum type Boiler with only measurement points
- Draw the P&ID of Feedback control system in a chemical reactor for the control of temperature and pressure.

- Draw the P&ID of Feed back control system in a tank for the control of level and inlet flow rate.
- Draw the P&ID of Cascade control system in a steam heat exchanger and Distillation column.
- Draw the P&ID of Feed forward control system in a stirred tank heater.
- Draw the P&ID of a ratio control system for the control of two flow rates by ratio.
- Draw the P&ID of Split range control scheme in a process.
- Draw the P&ID of On/Off Level, Flow and Pressure Control of Centrifugal Pump
- Draw the P&ID for measurement of furnace draft in Boiler
- Draw the P&ID of Boiler feed water pumping and heating system
- Draw the P&ID of flue gas dew point control.
- Draw the P&ID of Lube oil cooler.

4042652 P&I DRAWINGS USING CAD PRACTICAL
LIST OF EXPERIMENTS

1. Study of various symbols and abbreviations used in P&I Diagram.

2. Draw the P&ID of a Drum type Boiler with only measurement points.

3. Draw the P&ID of Feedback control system in a chemical reactor for the control of temperature and pressure.

4. Draw the P&ID of Feed back control system in a tank for the control of level and inlet flow rate.

5. Draw the P&ID of Cascade control system in a steam heat exchanger and Distillation column.

6. Draw the P&ID of Feed forward control system in a stirred tank heater.

7. Draw the P&ID of a ratio control system for the control of two flow rates by ratio.

8. Draw the P&ID of Split range control scheme in a process.

9. Draw the P&ID of On/Off Level, Flow and Pressure Control of Centrifugal Pump.

10. Draw the P&ID for measurement of furnace draft in Boiler

11. Draw the P&ID of Boiler feed water pumping and heating system.

12. Draw the P&ID of flue gas dew point control.

13. Draw the P&ID of Lube oil cooler

REFERENCE BOOKS

1. Bela G. Liptak, Instrument Engineers Hand Book – Process Control, Third Edition.

2. Andrews & William, Applied Instrumentation in Process Industries.

3. C.D.Johnson, Process Control Instrumentation Technology, Prentice Hall of India.

SCHEME OF EVALUATION

SNo	Description	Allocation of Marks
1	DRAWING P&ID	25
2	P&ID DRAWING USING CAD	50
3	PROCEDURE & RESULT	20
4	VIVA VOCE	5
TOTAL		**100**

EQUIPMENTS / SOFTWARE REQUIRED

SNo	Name of the Equipments / Software	Required Nos
1.	Pentium PC (Dual Core)	30
2.	Laser Printer	1
3.	UPS 5 KVA with One Hour Backup	1
4.	CAD / CAD P & ID 2021 / EdrawMax Software (Multiuser)	1

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N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042653**

Semester : VI

Subject Title : **EMBEDDED SYSTEM DESIGN WITH ARDUINO PRACTICAL**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Embedded System Design with Arduino Practical	5	80	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

RATIONALE

The Arduino platform has become quite popular with people just starting out with electronics. Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. Arduino is one of those Embedded System Devices (called as an Embedded Development Board), which got very famous in the maker's community due to its free and open source nature. Instrumentation Engineers must be familiar with embedded system development.

OBJECTIVES

After learning this subject student will be able to

- Familiar with ARDUINO board, ARDUINO IDE and ARDUINO sketch
- To interface ARDUINO board with LCD
- Design digital ohmmeter to measure unknown resistance.
- Design digital thermometer to measure unknown temperature

- Design digital Lux meter to measure light intensity.
- Design embedded system to measure distance
- Design embedded system to measure humidity.
- Design embedded system to measure humidity
- Design embedded system to measure angular measurement
- Design embedded system to control stepper motor and servomotor
- Design embedded system to use I2C protocol and SPI protocol
- Design embedded system to communicate with Android phone through bluetooth
- Design embedded system to communicate with wifi and local area network
- Design embedded system to communicate with Internet

4042653 EMBEDDED SYSTEM WITH ARDUINO PRACTICAL
LIST OF EXPERIMENTS

1. Familiarization of ARDUINO board, ARDUINO IDE and ARDUINO sketch. Develop c program to blink LED in the ARDUINO board.

2. Construct a circuit to interface 16 X 2 LCD to ARDUINO hardware. Write a C program to display your name in the LCD.

3. Construct circuit using ARDUINO hardware and develop C program to measure unknown resistance and test it

4. Construct circuit using ARDUINO hardware and develop C program to measure temperature using LM35 temperature sensor and test it

5. Construct circuit using ARDUINO hardware and develop C program to measure light intensity using LDR and test it

6. Construct circuit using ARDUINO hardware and develop C program to measure distance using ultrasonic distance sensor and test it

7. Construct circuit using ARDUINO hardware and develop C program to measure angular displacement using potentiometer sensor and test it

8. Construct circuit using ARDUINO hardware and develop C program to measure humidity using Humidity sensor and test it

9. Construct circuit using ARDUINO hardware and develop C program to control speed, step and direction of Bipolar stepper motor

10. Construct circuit using ARDUINO hardware and develop C program to control Servo motor for angular positioning.

11. Construct circuit using ARDUINO hardware and develop C program to interface switches and LED using I2C protocol

12. Develop C program to Send data from one ARDUINO board to another ARDUINO board through SPI protocol (switch in one ARDUINO and LED in another ARDUINO)

13. Construct circuit using ARDUINO hardware and develop c program to communicate with Android phone through Bluetooth shield

14. Construct circuit using ARDUINO hardware and develop c program to use wifi and Local area network

15. Construct circuit using ARDUINO hardware and develop c program to send data through Internet

SCHEME OF EVALUATION

SNo	Description	Allocation of Marks
1	Circuit diagram	20
2	C program	40
3	Execution/Debugging	25
4	Result	10
5	Viva-voce	5
TOTAL		**100**

EQUIPMENTS / SOFTWARE REQUIRED

SNo	Name of the Equipments / Software	Required Nos
1.	ARDUINO/ESP8266 Development Kit With switches, sensors, LCD, LED's, POT, LDR etc.,	10
2.	Connecting wires	--
3.	ARDUINO IDE – Open Source Software	1

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DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS

N – SCHEME

(To be implemented for the students admitted from the year 2020-21 onwards)

Course Name : 1042 INSTRUMENTATION AND CONTROL ENGG

Subject Code : **4042660**

Semester : VI

Subject Title : **PROJECT WORK AND INTERNSHIP**

TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per semester: 16

Subject	Instructions		Examination			
	Hours/ Week	Hours/ Semester	Internal Assessment	Board Examinations	Total	Duration
Project Work	6	96	25	100*	100	3 Hours

***Examinations will be conducted for 100 marks and it will be reduced to 75 marks.**

OBJECTIVES

- Implement the theoretical and practical knowledge gained through the curriculum into an application suitable for a real practical working environment preferably in an industrial environment
- Get exposure on industrial environment and its work ethics.
- Learn and understand the gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.
- Carry out cooperative learning through synchronous guided discussions within the class in key dates, asynchronous document sharing and discussions, as well as to prepare collaborative edition of the final project report.

INTERNAL ASSESSMENT

The internal assessment should be calculated based on the review of the progress of the work done by the student periodically as follows.

Detail of assessment	Period of	Max. Marks
First Review	6th week	10
Second Review	14th week	10
Attendance	Entire semester	5
Total		**25**

EVALUATION FOR BOARD EXAMINATION

Details of Mark allocation	Max Marks
Demonstration / Presentation	25
Report	25
Viva-Voce	30
Internship report	20
Total	**100**