DIPLOMA

IN

INSTRUMENTATION AND CONTROL ENGINEERING

SYLLABUS

G-SCHEME

(WITH EFFECT FROM JUNE 2023)

DCUR01

Dr. DHARMAMBAL GOVERNMENT POLYTECHNIC COLLEGE FOR WOMEN
(AUTONOMOUS)
THARAMANI, CHENNAI - 600113

CONTENTS

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RULES AND REGULATIONS

Dr. DHARMAMBAL GOVERNMENT POLYTECHNIC COLLEGE FOR WOMEN

(Autonomous)

THARAMANI, CHENNAI-113

(Implemented from 2022 – 2023)

G – SCHEME

R U L E S   &   R E G U L A T I O N S

(APPLICABLE TO THE THREE YEARS REGULAR DIPLOMA PROGRAMME IN ENGINEERING/COMMERCIAL PRACTICE, 3½ YEARS SANDWICH DIPLOMA PROGRAMME IN ARCHITECTURAL ASSISTANTSHIP AND ONE YEAR DIPLOMA PROGRAMME IN COSMETOLOGY)

(For the batches of students admitted during 2022-2023 and subsequently)

INTRODUCTION:

Dr. Dharmambal Government Polytechnic College for Women, Chennai-113, was established in 1962. As many as 10 (ten) diploma programmes are offered in this Polytechnic College. Semester system is followed during the entire course of study.

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 except commercial practice.

    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*.The Architecture department subjects are starting from First Year onwards.

During 7ᵗʰ semester the students undergo industrial training for six months. Industrial training examination will be conducted after completion of 7ᵗʰ semester.

c. Full Time(1 year)

The Course for the one year Full Time Diploma in Cosmetology shall extend over a period of one academic year, consisting of 2 semester*. The department subjects are starting from f irst year onwards.

* **Each Semester will have 16 weeks duration of study with 35 hrs./Week for regular Diploma Courses.**

The Curriculum for all the 6 Semesters of Diploma courses (for three years regular diploma programme in Engineering, Commercial practice, 3½ years sandwich Diploma programme in Architectural Assistantship and one year diploma programme in Cosmetology) have been revised and revised curriculum is applicable for the candidates admitted from 2022 – 2023 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 ofSecondary 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 and should have studied the following subjects.

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

Sl. No	Courses	H.Sc Academic Subjects Studied	H.Sc Vocational Subjects Studied		Industrial Training Institutes Courses
			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	English & Accountancy Economics English & Elements of Commerce	English & Accountancy, Economics, English & Management Principles & Techniques,	Accountancy & Auditing, Banking. Business Management, Co-operative Management, International Trade, Marketing & Salesmanship, Insurance & Material Management, Office Secretary ship	-
3	Sandwich Diploma Courses	On par with council of architecture norms			

- 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 Commercial Practice Diploma course the candidates studied the related subjects will be given first preference.

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

- Cosmetology Diploma Course: Minimum requirement for eligibility to admit in cosmetology diploma course is Higher Secondary pass whereas S.S.L.C is not eligible.

4. Age Limit: No Age limit.

5. Medium of Instruction: English

6. BRANCHES OF STUDY:

Candidates may be offered at the time of admission, one of the following

branches of study.

S.No.	BRANCHES	TYPE OF DIPLOMA PROGRAMME
1	Architectural Assistantship	Sandwich
2	Civil Engineering	Regular
3	Computer Engineering	Regular
4	Electronics & Communication Engineering	Regular
5	Environmental Engineering	Regular
6	Interior Decoration	Regular
7	Instrumentation & Control Engineering	Regular
8	Garment Technology	Regular
9	Commercial Practice	Regular
10	Cosmetology	Regular (one year)

7. Eligibility for the Award of Diploma:

No candidate shall be eligible for the award of 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
Full Time (one year)	1 year	2 Year

This will come into effect from G Scheme onwards i.e. from the academic year 2022-2023.

8. 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.

9. Examinations:

An Autonomous Examinations in all subjects of all the semesters under the scheme of examinations will be conducted at the end of each semester.

The internal assessment marks for all the subjects will be awarded on the basis of continuous internal assessment earned during the semester concerned. For each subject 25 marks are allotted for internal assessment. Autonomous examinations are conducted for 75 marks.

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

10. 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

Two Tests: Test - I and Test - II each of 2 hours duration for a total of 50 marks are to be conducted. Average of these two test marks will be taken and the marks to be reduced to **5 Marks.**

Test – III is the Model Examination covering all the five units and the marks obtained will be reduced to **5 Marks**.

Test	Units	When to conduct	Marks	Duration
Test I	Unit – I & II	End of 6th week	50	2 Hrs
Test II	Unit – III & IV	End of 12th week	50	2 Hrs
Test III	**Model Examination:** Covering all the 5 units. (Autonomous Examination question paper pattern)	End of 16th week	75	3 Hrs

From the Academic Year 2022 - 2023 onwards.

Question Paper Pattern for 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.

Test mark allocation:

Without Choice:

Part A type questions:	3 Questions * 5 mark	15 Marks
Part B type questions:	5 Questions * 7 marks	35 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 / free 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 Autonomous Examination results and produced to the flying squad and the inspection team at the time of inspection/verification.

B. For Practical Subjects:

    The Internal Assessment mark for 25 is 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 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 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 Autonomous Examinations.

All the marks awarded for assignments, test, 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.

11. 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 (two hours) is introduced to encourage students to remain healthy and fit by including physical activities and sports. Two hours are allotted to all first year students for physical activities and sports.

12. Attendance:

Minimum attendance of 80% is prescribed for each courses of study (includes lecture hours, tutorial hours, assignment and test hours). Students failing to get 80% attendance will not be allowed to appear for the examination under any circumstances. However, a candidate who has secured attendance between 70% and 79% in the current semester due to medical reasons (hospitalization/ accident/ specific illness) or due to participation in College/District/State/National/International level sports events with prior permission from the Principal shall be given exemption from the prescribed attendance requirements and he/she shall be permitted to appear for the current semester examinations, if her progress and conduct has been satisfactory.

Candidates who do not qualify to appear for final examinations of any semester from second to sixth for want of attendance and/or progress, must get readmitted at the immediate available opportunity and redo that semester courses. Candidates who do not qualify to appear for the final examinations of first semester have to discontinue the programme.

13. Entrepreneurship and Startup:

In V semester, Entrepreneurship and Startup subject is mandatory and common subject for all the departments except cosmetology department. The Autonomous examination mark for this subject is 75 marks.

Theory		**35 Marks**
Part A Type questions:	10 questions × 2 marks	20 Marks
Part B Type questions:	3 questions × 5 marks (Either or pattern)	15 Marks
Practical		**30 Marks**
Submission on Business Plan / Feasibility Report on Unit IV & V		30 Marks
Viva Voce		10 Marks
	Total	**75 Marks**

Internal Assessment Mark

Assignment (Unit I & II)	10
Seminar (Unit III)	10
Attendance	5
Total	**25**

14. Project work and Internship (except sandwich 3½ years and one year programme):

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 and Internship:**

Project Review I	:	**10 marks**
Project Review II	:	**10 marks**
Attendance	:	**05 marks** (Award of marks same as theory subjects)
Total	:	**25 marks**

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

b) Allocation of marks for Project work and Internship in end examinations:

Demonstration / Presentation	: 20 marks
Report	: 20 marks
Viva Voce	: 15 marks
Internship Report	: 20 marks
Total	: 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 and internship" for 20 marks. The internship shall be undertaken in any Industry / Government / Private certified agencies which are in social sector / Govt. Skill Centers / Institutions / Schemes.

A neatly prepared PROJECT REPORT as per the format has to be submitted by individual student during the Project work and internship Board examination.

Diploma in Cosmetology students should undergo internship training for a period of two weeks at the end of I/II Semester vacation. The certificate shall be produced and no mark for internship training.

15. Scheme of Examination:

The Scheme of Examination for subjects are given in Annexure II.

16. 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 passes 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 Autonomous Examinations marks put together, subject to the condition that he/she secures atleast a minimum of 30 *marks out of 75 marks in the Autonomous End Theory/Drawing/Short hand/Typewriting Examinations and a minimum of 35 marks out of 75 marks in the Autonomous End Practical Examinations.*

17. Classification of successful candidates:

Classification of candidates who will pass out the final examinations from April 2025 onwards (joined first year in 2022 - 2023) 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 years [Full time/ Full time (Lateral entry)/ Sandwich] 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 years [Full time/ Full time (Lateral entry)/ Sandwich] 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 years [Full time/ Full time (Lateral entry)/ Sandwich] without any break in study.

Second Class:

All other successful candidates will be declared to have passed in Second Class who are all pass out in Autonomous End Examination from April 2025 / October 2025 onwards which is applicable for all regular and sandwich students.

18. 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 and Practical).

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CATEGORIES

DEPARTMENT OF
INSTRUMENTATION AND CONTROL ENGINEERING

CORE COURSES

COURSE CODE	COURSE NAME	THEORY	PRACTICAL /TUTORIAL	DRAWING	CONTACT HOURS
BEG105	ENGINEERING GRAPHICS I	-	-	6	6
BEG205	ENGINEERING GRAPHICS II	-	-	5	5
BEG277	WORKSHOP PRACTICE	2	3	-	5
ICG301	BASICS OF INSTRUMENTATION	5	-	-	5
ICG302	ELECTRICAL CIRCUITS AND ELECTRONIC DEVICES	6	-	-	6
ICG371	BASICS OF INSTRUMENTATION LAB	-	4	-	4
ICG372	ELECTRICAL CIRCUITS PRACTICAL	-	4	-	4
ICG373	ELECTRONIC DEVICES PRACTICAL	-	4	-	4
	TOTAL	13	15	11	39

DEPARTMENT OF

INSTRUMENTATION AND CONTROL ENGINEERING

APPLIED COURSES

COURSE CODE	COURSE NAME	THEORY	PRACTICAL/ TUTORIAL	DRAWING	CONTACT HOURS
ICG303	C PROGRAMMING	5	-	-	5
ICG374	C PROGRAMMING LAB	-	4	-	4
ICG401	ANALOG AND DIGITAL ELECTRONICS	6	-	-	6
ICG402	MEASUREMENT OF PROCESS VARIABLES	5	-	-	5
ICG403	MEASUREMENTS AND INSTRUMENTS	5	-	-	5
ICG404	E-VEHICLE TECHNOLOGY AND POLICY	4	-	-	4
ICE471	ANALOG AND DIGITAL ELECTRONICS PRACTICAL	-	4	-	4
ICE472	MI AND MPV PRACTICAL	-	4	-	4
ICE473	VIRTUAL INSTRUMENTATION PRACTICAL	-	4	-	4
ICG501	PROCESS CONTROL INSTRUMENTATION	5	-	-	5
ICG502	CONTROL ENGINEERING	6	-	-	6
ICG571	PROCESS CONTROL INSTRUMENTATION PRACTICAL	-	4	-	4
ICG572	CONTROL ENGINEERING SIMULATION PRACTICAL	-	4	-	4
ICG573	ENTREPRENEURSHIP AND STARTUP	-	4	-	4
ICG601	MICROCONTROLLER AND INTERFACING	5	-	-	5
ICG602	BIOMEDICAL INSTRUMENTATION	5	-	-	5
ICG603	COMPUTER COMMUNICATION NETWORKS	5	-	-	5
ICG671	MICROCONTROLLER AND INTERFACING PRACTICAL	-	4	-	4
ICG672	PROJECT WORK & ENTREPRENEURSHIP	-	4	-	4
	TOTAL	51	37	-	88

DEPARTMENT OF

INSTRUMENTATION AND CONTROL ENGINEERING
DIVERSIFIED COURSES

ELECTIVE THEORY AND PRACTICAL - I:

COURSE CODE	COURSE NAME	THEORY	PRACTICAL/ TUTORIAL	DRAWING	CONTACT HOURS
ICG581	INDUSTRIAL INSTRUMENTATION	5	-	-	5
ICG582	INDUSTRIAL POWER ELECTRONICS		-	-	
ICG583	INDUSTRIAL AUTOMATION AND DRIVES		-	-	
ICG584	INDUSTRIAL INSTRUMENTATION PRACTICAL	-	4	-	4
ICG585	INDUSTRIAL POWER ELECTRONICS PRACTICAL	-		-	
ICG586	INDUSTRIAL AUTOMATION PRACTICAL	-		-	
	TOTAL	5	4	-	9

ELECTIVE THEORY AND PRACTICAL - II:

COURSE CODE	COURSE NAME	THEORY	PRACTICAL/ TUTORIAL	DRAWING	CONTACT HOURS
ICG681	EMBEDDED SYSTEM DESIGN WITH ARDUINO	5	-	-	5
ICG682	POWER PLANT INSTRUMENTATION		-	-	
ICG683	PROGRAMMABLE LOGIC CONTROLLER		-	-	
ICG684	EMBEDDED SYSTEM DESIGN WITH ARDUINO PRACTICAL	-	4	-	4
ICG685	P&ID USING CAD PRACTICAL	-		-	
ICG686	PROGRAMMABLE LOGIC CONTROLLER PRACTICAL	-		-	
	TOTAL	5	4	-	9

CURRICULUM OUTLINE

CORE SUBJECTS

ANNEXURE – I

DEPARTMENT OF
INSTRUMENTATION AND CONTROL ENGINEERING
CURRICULUM OUTLINE

III SEMESTER

COURSE CODE	COURSE NAME	THEORY	PRACTICAL/ TUTORIAL	DRAWING	CONTACT HOURS
ICG301	BASICS OF INSTRUMENTATION	5	-	-	5
ICG302	ELECTRICAL CIRCUITS AND ELECTRONIC DEVICES	6	-	-	6
ICG303	C PROGRAMMING	5	-	-	5
ICG371	BASICS OF INSTRUMENTATION LAB	-	4	-	4
ICG372	ELECTRICAL AND ELECTRONICCIRCUITS PRACTICAL	-	4	-	4
ICG373	ELECTRONIC DEVICES PRACTICAL	-	4	-	4
ICG374	C PROGRAMMING PRACTICAL	-	4	-	4
	TOTAL	16	16	-	32
EXTRA/CO-CURRICULAR ACTIVITIES	PHYSICAL EDUCATION	-	2	-	2
	LIBRARY	-	1	-	1
	TOTAL	16	19	-	35

DEPARTMENT OF
INSTRUMENTATION AND CONTROL ENGINEERING
CURRICULUM OUTLINE

IV SEMESTER

COURSE CODE	COURSE NAME	THEORY	PRACTICAL/ TUTORIAL	DRAWING	CONTACT HOURS
ICG401	ANALOG AND DIGITAL ELECTRONICS	6	-	-	6
ICG402	MEASUREMENT OF PROCESS VARIABLES	5	-	-	5
ICG403	MEASUREMENTS AND INSTRUMENTS	5	-	-	5
ICG404	E-VEHICLE TECHNOLOGY AND POLICY	4	-	-	4
ICG471	ANALOG AND DIGITAL ELECTRONICS PRACTICAL	-	4	-	4
ICG472	MI AND MPV PRACTICAL	-	4	-	4
ICG473	VIRTUAL INSTRUMENTATION PRACTICAL	-	4	-	4
	TOTAL	20	12	-	32
EXTRA/CO-CURRICULAR ACTIVITIES	PHYSICAL EDUCATION	-	2	-	2
	LIBRARY	-	1	-	1
	TOTAL	20	15	-	35

DEPARTMENT OF
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CURRICULUM OUTLINE

V SEMESTER

COURSE CODE	COURSE NAME	THEORY	PRACTICAL/ TUTORIAL	DRAWING	CONTACT HOURS
ICG501	PROCESS CONTROL INSTRUMENTATION	5	–	–	5
ICG502	CONTROL ENGINEERING	6	–	–	6
ICG58*	ELECTIVE THEORY - I	5			5
ICG571	PROCESS CONTROL INSTRUMENTATION PRACTICAL	–	4	–	4
ICG572	CONTROL ENGINEERING SIMULATION PRACTICAL	–	4	–	4
ICG58*	ELECTIVE PRACTICAL - I	–	4	–	4
ICGE573	ENTREPRENEURSHIP AND STARTUP	–	4	–	4
	TOTAL	16	16	–	32
EXTRA/CO-CURRICULAR ACTIVITIES	PHYSICAL EDUCATION	–	2	–	2
	LIBRARY	–	1	–	1
	TOTAL	16	19	–	35

*Diversified Course

DEPARTMENT OF
INSTRUMENTATION AND CONTROL ENGINEERING
CURRICULUM OUTLINE

VI SEMESTER

COURSE CODE	COURSE NAME	THEORY	PRACTICAL /TUTORIAL	DRAWING	CONTACT HOURS
ICG601	MICROCONTROLLERS AND INTERFACING	5	–	–	5
ICG602	BIOMEDICAL INSTRUMENTATION	5	–	–	5
ICG603	COMPUTER COMMUNICATION NETWORKS	5	–	–	5
ICG68*	ELECTIVE THEORY - II	5	–	–	5
ICG671	MICROCONTROLLER AND INTERFACING LAB	–	4	–	4
ICG672	PROJECT WORK AND INTERNSHIP	–	4	–	4
ICG68*	ELECTIVEPRACTICAL - II	–	4	–	4
	TOTAL	20	12	–	32
EXTRA/CO-CURRICULAR ACTIVITIES	PHYSICAL EDUCATION	–	2	–	2
	LIBRARY	–	1	–	1
	TOTAL	20	15	–	35

*Diversified Course

ELECTIVE SUBJECTS

DEPARTMENT OF
INSTRUMENTATION AND CONTROL ENGINEERING
CURRICULUM OUTLINE

ELECTIVE THEORY- I

COURSE CODE	COURSE NAME	THEORY	PR/ TU	DRAWING	CONTACT HOURS
ICG581	INDUSTRIAL INSTRUMENTATION	5	–	–	5
ICG582	INDUSTRIAL POWER ELECTRONICS	5	–	–	5
ICG583	INDUSTRIAL AUTOMATION AND DRIVES	5	–	–	5

ELECTIVE PRACTICAL- I

COURSE CODE	COURSE NAME	THEORY	PR/ TU	DRAWING	CONTACT HOURS
ICG584	INDUSTRIAL INSTRUMENTATION PRACTICAL	–	4	–	4
ICG585	INDUSTRIAL POWER ELECTRONICS PRACTICAL	–	4	–	4
ICG586	INDUSTRIAL AUTOMATION PRACTICAL	–	4	–	4

DEPARTMENT OF
INSTRUMENTATION AND CONTROL ENGINEERING
CURRICULUM OUTLINE

ELECTIVE THEORY- II

COURSE CODE	COURSE NAME	THEORY	PR/ TU	DRAWING	CONTACT HOURS
ICG681	EMBEDDED SYSTEM DESIGN WITH ARDUINO	5	–	–	5
ICG682	POWER PLANT INSTRUMENTATION	5	–	–	5
ICG683	PROGRAMMABLE LOGIC CONTROLLER	5	–	–	5

ELECTIVE PRACTICAL- II

COURSE CODE	COURSE NAME	THEORY	PR/ TU	DRAWING	CONTACT HOURS
ICG684	EMBEDDED SYSTEM DESIGN WITH ARDUINO PRACTICAL	–	4	–	4
ICG685	P & ID USING CAD PRACTICAL	–	4	–	4
ICG686	PROGRAMMABLE LOGIC CONTROLLER PRACTICAL	–	4	–	4

SCHEME OF EXAMINATION

ANNEXURE –II

DEPARTMENT OF
INSTRUMENTATION AND CONTROL ENGINEERING
SCHEME OF EXAMINATION

III SEMESTER

SL. NO.	COURSE CODE	COURSE NAME	HRS. PER WEEK	EXAMINATION				
				Exam Duration	Int. Marks (a)	Exam Marks (b)	Max. Marks (a+b)	Min. for pass
1	ICG301	BASICS OF INSTRUMENTATION	5	3	25	75	100	40
2	ICG302	ELECTRICAL CIRCUITS AND ELECTRONICDEVICES	6	3	25	75	100	40
3	ICG303	C PROGRAMMING	5	3	25	75	100	40
4	ICG371	BASICS OF INSTRUMENTATION PRACTICAL	4	3	25	75	100	50
5	ICG372	ELECTRICAL AND ELECTRONIC CIRCUITS PRACTICAL	4	3	25	75	100	50
6	ICG373	ELECTRONIC DEVICES PRACTICAL	4	3	25	75	100	50
7	ICG374	C PROGRAMMING PRACTICAL	4	3	25	75	100	50

 # Minimum of 30 marks out of 75 in Autonomous End Theory Examination
 # Minimum of 35 marks out of 75 in Autonomous End Practical Examination

DEPARTMENT OF

INSTRUMENTATION AND CONTROL ENGINEERING

SCHEME OF EXAMINATION

IV SEMESTER

SL. NO.	COURSE CODE	COURSE NAME	HRS. PER WEEK	EXAMINATION				
				Exam Duration	Int. Marks (a)	Exam Marks (b)	Max. Marks (a+b)	Min. for pass
1	ICG401	ANALOG AND DIGITAL ELECTRONICS	6	3	25	75	100	40
2	ICG402	MEASUREMENT OF PROCESS VARIABLES	5	3	25	75	100	40
3	ICG403	MEASUREMENTS AND INSTRUMENTS	5	3	25	75	100	40
4	ICG404	E-VEHICLE TECHNOLOGY AND POLICY	4	3	25	75	100	40
5	ICG471	ANALOG AND DIGITAL ELECTRONICS PRACTICAL	4	3	25	75	100	50
6	ICG472	MI AND MPV PRACTICAL	4	3	25	75	100	50
7	ICG473	VIRTUAL INSTRUMENTATION PRACTICAL	4	3	25	75	100	50

Minimum of 30 marks out of 75 in Autonomous End Theory Examination
Minimum of 35 marks out of 75 in Autonomous End Practical Examination

DEPARTMENT OF
INSTRUMENTATION AND CONTROL ENGINEERING
SCHEME OF EXAMINATION

V SEMESTER

SL. NO.	COURSE CODE	COURSE NAME	HRS. PER WEEK	EXAMINATION				
				Exam Duration	Int. Marks (a)	Exam Marks (b)	Max. Marks (a+b)	Min. for pass
1	ICG501	PROCESS CONTROL INSTRUMENTATION	5	3	25	75	100	40
2	ICG502	CONTROL ENGINEERING	6	3	25	75	100	40
3	ICG58*	ELECTIVE THEORY – I	5	3	25	75	100	40
4	ICG571	PROCESS CONTROL INSTRUMENTATION PRACTICAL	4	3	25	75	100	50
5	ICG572	CONTROL ENGINEERING SIMULATION PRACTICAL	4	3	25	75	100	50
6	ICG58*	ELECTIVE PRACTICAL – I	4	3	25	75	100	50
7	ICG573	ENTREPRENEURSHIP AND STARTUP	4	3	25	75	100	50

*Diversified courses

Minimum of 30 marks out of 75 in Autonomous End Theory Examination
Minimum of 35 marks out of 75 in Autonomous End Practical Examination

DEPARTMENT OF
INSTRUMENTATION AND CONTROL ENGINEERING
<u>SCHEME OF EXAMINATION</u>

VI SEMESTER

SL. NO.	COURSE CODE	COURSE NAME	HRS. PER WEEK	EXAMINATION					
				Exam Duration	Int. Marks (a)	Exam Marks (b)	Max. Marks (a+b)	Min. for pass
1	ICG601	MICROCONTROLLER AND INTERFACING	5	3	25	75	100	40
2	ICG602	BIOMEDICAL INSRUMENTATION	5	3	25	75	100	40
3	ICG603	COMPUTER COMMUNICATION NETWORKS	5	3	25	75	100	40
3	ICG68*	ELECTIVE THEORY - II	5	3	25	75	100	40
4	ICG671	MICROCONTROLLER AND INTERFACING PRACTICAL	4	3	25	75	100	50
5	ICG68*	ELECTIVE PRACTICAL – II	4	3	25	75	100	50
6	ICG672	PROJECT WORK &INTERNSHIP	4	3	25	75	100	50

* **Diversified courses**

Minimum of 30 marks out of 75 in Autonomous End Theory Examination
Minimum of 35 marks out of 75 in Autonomous End Practical Examination

DISCIPLINE WISE TASK FORCE MEETING

Held On: 07.01.22

PARTICIPANTS

External Experts

1. Tmt. Uma Chelliah
    HoD / ICE,
    BCMWPT,
    Ettayapuram– 628902.

2. Dr. G.A.Rathy
    Associate Professor,
    HOD i/c EE & CE,
    NITTTR, Chennai– 600113.

3. Dr. M. Vijayakarthick
    Associate Professor,
    Dept. of Instrumentation Engineering,
    MIT Campus,
    Anna University,
    Chennai - 600044.

4. Thiru. Sai Ram Mannar
    Director,
    Green Ocean Research Lab Pvt. Ltd.,
    Chennai –600082.

5. Thiru. J. John Wesily
    Proprietor,
    J-Tech Instruments,
    Perungudi,
    Chennai – 600096.

6. Selvi I. Deborah
    Test Engineer Grade I,
    Jasmine InfoTech,
    Pallikarani,
    Chennai - 600100.
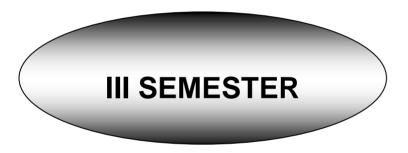
Internal Experts

1. Tmt.G.A.Fatima Rani
    HoD/ ICE,
    DDGPCW,Tharamani,
    Chennai -600113.

2. Dr.L. Thillai Rani
    Lecturer/ICE,
    DDGPCW, Tharamani,
    Chennai - 600113.

APEX BODY MEETING

Held On: 14.02.22

PARTICIPANTS

External Experts

1. **Tmt. B.JareenaBanu**
   HoD/ ICE,
   GPCW,
   Coimbatore –641004.

2. **Dr. N. Vinoth**
   Associate Professor,
   Dept. of Instrumentation Engineering,
   MIT Campus,
   Anna University,
   Chennai –600044.

Internal Experts

1. **Tmt.G.A.Fatima Rani**
   HoD/ ICE,
   DDGPCW,Tharamani,
   Chennai -600113.

2. **Dr. L. Thillai Rani**
   Lecturer/ICE,
   DDGPCW, Tharamani,
   Chennai -600113.

DEPARTMENT OF
INSTRUMENTATION AND CONTROL ENGINEERING

Internal Experts:

1. **Thiru. R. Selvakumar**
   Lecturer/ ICE
   DDGPCW, Tharamani
   Chennai -600113.

2. **Thiru. N.Senthil Kumar**
   Lecturer/ICE,
   DDGPCW, Tharamani,
   Chennai -600113.

3. **Dr. N.N. Praboo**
   Lecturer/ICE,
   DDGPCW, Tharamani,
   Chennai -600113.

4. **Dr. R. Selvaraj**
   Lecturer/ICE,
   DDGPCW, Tharamani,
   Chennai -600113.

III SEMESTER

COURSE: DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SUBJECT CODE: ICG301   **SEMESTER: III Semester**

SUBJECT TITLE: BASICS OF INSTRUMENTATION

<div align="center">

Topics and Allocation of Hours

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UNIT	TOPIC	Hrs.
I	**Basics of Instrumentation**	**14**
II	**Characteristics of Instruments**	**13**
III	**Sensors and Transducers**	**15**
IV	**Mechanical Transducer and Telemetry**	**15**
V	**Electrical Transducer**	**13**
	Revision, Test and Model Examination	**10**
	Total	**80**

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

- Define Instrument and types of Instrumentation system
- Know about functional elements of an instrument and Instrument classification
- Explain the classification of errors and the concept of statistical analysis of data
- Know about the static characteristics, dynamic characteristics and the effect of each on the performance
- Define sensors and transducers and classify the types of sensors and transducers
- Explain the differences between primary and secondary transducers, active and passive transducers, analog and digital transducers
- Describe the principle of working, construction and applications of mechanical transducers and thermal detectors
- Know about the basic concepts of telemetry
- Explain the types of electrical transducer and its characteristics
- Explain resistive transducer and their types
- Explain variable inductance and capacitance transducer
- Know about the advantages of electrical transducer over mechanical transducer

BASICS OF INSTRUMENTATION

CODE NO:ICG301   **TOTAL HOURS:80**

DETAILED SYLLABUS

Unit	Name of the Topics	Hrs
I	**BASICS OF INSTRUMENTATION** Block diagram of instrumentation system - Types of instrumentation system: Intelligent–dumb-virtual instrumentation system; Functional elements of an instrument-Instrument classification: Null - deflecting-monitoring - control - analog - digital - absolute - secondary instrument. Types of errors: Zero error - gross error - systematic error - instrumental - environmental - observational errors -limiting error - relative error - calibration error - random error; Statistical analysis of data: Arithmetic mean -mode- deviation - average deviation - standard deviation - variance- simple problems.	14
II	**CHARACTERISTICS OF INSTRUMENTS** Static characteristics: True value - static error -range-span - accuracy - precision -simple problems - range of doubt - significant of figure - dead time - hysteresis - dead zone - resolution -sensitivity - linearity - zero drift - span drift - zonal drift - reproducibility - stability – tolerance – threshold- loading effect. Dynamic characteristics: Speed of response -fidelity - measuring lag-retardation lag - dynamic error; Standard test input signals-Dynamic response: Steady state - transient response.	13
III	**SENSORS AND TRANSDUCERS** Sensors: Definition - pressure sensor - proximity sensor - displacement sensor - magnetic sensor - bio sensor - hall effect sensor - optical sensor - MEMS sensor. Transducer: Definition - Classification: Primary and secondary - active and passive - analog and digital -transducer and inverse transducer; Examples for transducer classification: Bourdon tube - LVDT - photovoltaic transducer -resistive transducer - thermocouple - optical encoder -thermistor - piezoelectric transducer - piezoelectric effect; Characteristics of transducer: Input and output characteristics - factors considered in the selection of transducer.	15

IV	**MECHANICAL TRANSDUCER AND TELEMETRY**	**15**
	Mechanical Transducer: Introduction - bourdon tube- bellows-diaphragms - U tube manometer -well type manometer-barometer-inclined tube manometer -ring balance manometer - micro manometer - construction -working -applications; Manometric fluids. Thermal detectors: Liquid in glass thermometer- filled system thermometer - bi-metallic thermometer - construction -working - applications. Telemetry: Definition - pneumatic telemetry system - electrical telemetry system - digital telemetry system.	
V	**ELECTRICAL TRANSDUCER** Definition - Resistive transducer: Linear potentiometer-angular potentiometer- resistance temperature detector -thermocouple - thermistor - thermo-diodes - thermo-transistors - Strain gauge: Piezo resistive effect - bonded -unbonded - semiconductor strain gauge - construction - working -applications. Variable inductance transducer: LVDT; Variable capacitance transducer -construction -working -applications; Advantages of electrical transducer over mechanical transducer.	**13**
	Revision, Test and Model Examination	**10**

TEXT BOOKS

1. U.A.Bakshi and A.V.Bakshi:Measurements and Instrumentation Systems.
2. C.S.Rangan and G.R.Sharma: Instrumentation Devices and Systems.
3. B.C.Nakraand K.K.Choudry: Instrumentation Measurement and Analysis.
4. S.K.Singh: Industrial Instrumentation and Control,Tata McGraw Hill.
5. A.K.Sawhney: Electricaland Electronic Measurements and Instrumentation

REFERENCE BOOKS

1. A.K.Sawhney: Mechanical & Industrial Measurements, Dhanpat Rai & Sons
2. Umesh Sinha: Electrical& Electronics Measurements and Instrumentation
3. H.S.Kalsi:Electronic Instrumentation,Tata McGraw Hill & Co.

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COURSE: DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SUBJECT CODE: ICG302   **SEMESTER: III Semester**

SUBJECT TITLE: ELECTRICAL CIRCUITS AND ELECTRONIC DEVICES

Topics and Allocation of Hours

UNIT	TOPIC	Hrs.
I	DC circuits and DC machines	17
II	AC fundamentals, AC machines and Transformer	18
III	Diodes and Transistors	17
IV	FET, UJT, Thyristor and Opto Electronic Devices	17
V	Oscillators, Waveform Shaping Circuits and Waveform Generators	17
	Revision, Test and Model Examination	10
	Total	96

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

- Define voltage, current, resistance, resistivity, power, energy and their units
- State and explain ohm's law, Kirchhoff's law and solve simple problems
- Derive equivalent resistance of series and parallel circuits
- State and explain Super position, Thevenin's, Norton's, Maximum power transfer theorems and solve problems using theorems
- Explain the construction and working of DC machines
- Define period, frequency, amplitude, average value, RMS value, form and peak factor
- Derive energy stored in an inductor and capacitor
- Draw vector diagram of RL, RC and RLC series and parallel circuits
- Explain the construction and working of AC machines and Transformer
- Study the working principle of PN junction diode and transistor
- Understand the different transistor configurations
- Differentiate various types of amplifiers
- Study the performance of special devices like FET and UJT
- Study the performance of SCR and DIAC
- Study the construction and working principle of optoelectronic devices and performance of solar cell
- Study the performance of different transistor oscillators
- Study the working principle of clippers and clampers
- Explain about different waveform generators and IC555 timer

ELECTRICAL CIRCUITS AND ELECTRONIC DEVICES

CODE NO:ICG302   **TOTAL HOURS:96**

DETAILED SYLLABUS

Unit	Name of the Topics	Hrs
I	**DC CIRCUITS AND DC MACHINES** DC circuits: Concept of electrical quantities - voltage - current - resistance - power - energy - Ohm's law - Resistances in series - Resistances in parallel - series parallel circuits - Kirchoff's laws - Thevenin's theorem - Norton's theorem - Superposition theorem and Maximum power transfer theorem - Statement and explanations - Simple problems [Two loops only]. DC machines: Construction, working and emf equation: DC generator - DC motor (Basic principles only).	17
II	**AC FUNDAMENTALS, AC MACHINES AND TRANSFORMER** AC fundamentals: AC waveform - sinusoidal and non-sinusoidal - period - frequency - cycle - amplitude - phase - peak value - average value - RMS value (effective value) - form factor - peak factor - energy stored in 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. AC machines: Construction and working: 1ϕ and 3ϕ Induction motor - Stepper motor (basic principles only). Transformer: Ideal transformer - principle of working - constructional details - emf equation - efficiency – auto transformer.	18
III	**DIODES AND TRANSISTORS** Diodes: PN junction diode - Forward and Reverse bias characteristics - Half wave rectifier - Full wave rectifier (Center tapped, Bridge); Zener diode: Working principle-characteristics - zener diode as voltage regulator. Transistor: 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 applications.	17

IV	**FET, UJT, THYRISTOR AND OPTOELECTRONIC DEVICES**	**17**
	Field Effect Transistor: Construction - working principle of FET - Difference between FET and BJT; UJT: Construction, working, characteristic.	
	Thyristors:Introduction –SCR - working - characteristics - comparison between SCR and Transistor - SCR as single phase half wave controlled rectifier with R and RL load; DIAC: Introduction - working-characteristic.	
	Classification of opto electronic devices - working - characteristics and applications of LDR - LED - Seven segment LED - LCD - photo transistor - solar cell.	
V	**OSCILLATORS, WAVE SHAPING CIRCUITS AND WAVEFORM GENERATORS**	**17**
	Oscillators: Condition for oscillation (Barkhausen criterion – formula only) - Hartley oscillator - Colpitts oscillator - RC Phase shift oscillator.	
	Wave shaping circuits: Positive clipper - negative clipper - biased; Clamper: Positive clamper - negative clamper.	
	Waveform generators: Standard signal generator - Function generator - 555 Timer: Block diagram - Astable and Monostable Multivibrators.	
	Revision, Test and Model Examination	**10**

TEXT BOOKS

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

REFERENCE BOOKS

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

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COURSE: DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SUBJECT CODE: ICG303 **SEMESTER: III Semester**

SUBJECT TITLE: C PROGRAMMING

Topics and Allocation of Hours

UNIT	TOPIC	Hrs.
I	Basics of Programming and Introduction to C	13
II	Operators, I/O Statements, Branching	14
III	Looping Statements, Arrays and Strings	14
IV	Functions and Structures	14
V	Pointers and Introduction to Python Language	15
	Revision, Test and Model Examination	10
	Total	80

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

- Define program.
- List down and explain various program development steps.
- Define algorithm and flowchart.
- Draw flow chart for simple problems.
- Describe the concepts of constants, variables, datatypes and operators.
- Understand I/O statements.
- Understand the structure and usage of different looping and branching statements.
- Define arrays and string handling functions.
- Explain built-in functions, user-defined functions and structures.
- Explain concepts of pointers and memory management.
- Understand the concepts of Python language.

C PROGRAMMING

CODE NO:ICG303   **TOTAL HOURS:80**

DETAILED SYLLABUS

Unit	Name of the Topic	Hrs.
I	**BASICS OF PROGRAMMING AND INTRODUCTION TO C** Program: Program definition - machine Language -assembly language - high level language -assembler - Interpreter - compiler - editor -flowchart and algorithm - definition - flow chart symbols - advantages of flow chart - flow chart examples - addition of two numbers - largest of two numbers - sum of first n natural number- finding odd or even number - product of first n natural number. Introduction to C: History of C - basic structure of C program - executing a C program - character set - constants and variables - keywords -identifiers - data types - storage classes -preprocessor directives -header files - comment statement; Declaration of variables -assigning values to variables - defining symbolic constants - escape sequences.	13
II	**OPERATORS, I/O STATEMENTS, BRANCHING** C operators: Arithmetic operators - relational operators - logical operators -assignment operator - Increment and decrement operators -conditional operator - bitwise operators - special operators- precedence and associativity of operators. I/O statements: Formatted input - formatted output - unformatted I/O statements. Branching: Introduction -conditional and unconditional - if statement - if…else statement –else if ladder - nested if…else - switch statement - goto statement. C Program: Simple and compound interest - equivalent resistance of three resistances connected in series and parallel - largest of three numbers - perform addition, subtraction, multiplication and division according to user's choice.	14

III	**LOOPING STATEMENTS, ARRAYS AND STRINGS** Looping statements: while statement - do…while statement - difference between while and do…while - for loop - break and continue statements- C program to generate Fibonacci series. Arrays: Declaration and initialization of one dimensional array - two dimensional array - character array - accessing array elements - C program to implement matrix addition and transpose. Strings: Declaration and initialization of string variables - reading string - writing string - string handling functions from standard library: strlen() - strcpy() - strcat() - strcmp(); C program to determine whether the given string is palindrome or not.	**14**
IV	**FUNCTIONS AND STRUCTURES** Functions: Math functions - console I/O function - standard I/O function - character oriented functions; User defined functions - declaration of functions - defining functions - function call(call by value, call by reference) - Category of function: No argument No return value, No argument with return value, argument with return value – recursion - C Program to find the factorial of a given number using recursion. Structures: Definition - Initialization - arrays of structures - arrays within structures - structures within structures- C program to prepare the total marks for N students by reading the reg.no, name, marks by using array of structures.	**14**
V	**POINTERS AND INTRODUCTION TO PYTHON LANGUAGE** Pointers: Introduction - difference between pointers and variables - advantages of pointers - accessing the address of a variable - declaring and initializing pointers - accessing a variable through its pointers. Dynamic Memory Management: Introduction - allocating a block of memory malloc() - allocating of multiple blocks of memory calloc() - releasing the used space free() - altering the size of the block realloc(). Introduction to Python language: Overview - Features; Variables and Strings: Data types - Operators - Decision control - Conditional statements - loops; Program on Python to perform string concatenation.	**15**
	Revision, Test and Model Examination	**10**

TEXT BOOK

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

REFERENCE BOOKS

1. ISRD Group: Programming and Problem Solving using C Lucknow, Tata McGraw Hill, New Delhi, 6th Reprint, 2010.
2. Yeswanth Kanetkar: Let Us C, BPB Publications, 4th Revised Edition.
3. E. Karthikeyan: A Text Book on C, PHI, New Delhi, 2008.
4. D. Ravichandran: Programming in C, New Age International Publishers, First Edition.
5.Dr S SKhandare: Computer Concepts and Programming in C, S.Chand & Company, New Delhi, 2010.
6. Alan Gauld: Learning to Program: A free Python web book.

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BASICS OF INSTRUMENTATIONPRACTICAL

CODE NO:ICG371   **TOTAL HOURS:64**

LIST OF EXPERIMENTS

1. Statistical analysis of simple DC circuit.

2. Basic static characteristics of given voltmeter.

3. Time response of a thermometer for a step input.

4. Calibration of given thermometer against the standard thermometer.

5. Effect of liquid capacity.

6. Measurement of pressure using U-tube manometer.

7. Linearity characteristic of potentiometer.

8. Characteristics of Strain gauge.

9. Characteristics of LVDT.

10. Level measurement using capacitive Transducer.

11. Characteristics of Thermistor.

12. Characteristics of Resistance Temperature Detector

EQUIPMENT REQUIRED

Sl.No.	Name of the Equipment	Qty
1	Ammeter (0 - 50) mA	2
2	Voltmeter (0 – 10V), (0-5V)	2
3	Regulated Power Supply (0-30V)	2
4	Thermometer and Rheostat	2 each
5	Pressure measuring setup using U tube manometer	1
6	Digital Multimeter	2
8	Strain measurement module using Strain gauge	2
9	Displacement measurement module using LVDT	2
10	Thermistor and RTD with industrial standard	2
11	Level measurement using capacitive transducer setup	1
12	Furnace/Oven	1

ELECTRICALAND ELECTRONIC CIRCUITS PRACTICAL

CODE NO:ICG372   **TOTAL HOURS:64**
LIST OF EXPERIMENTS

1.   Ohm's Law.

2.   Kirchoff's Voltage and Current Laws.

3.   Thevenin's Theorem for a DC circuit.

4.   Norton's Theorem for a DC circuit.

5.   Superposition Theorem for a DC circuit.

6.   Maximum Power Transfer Theorem for a DC circuit.

7.   Characteristics of Bridge rectifier.

8.   Frequency response of RC coupled amplifier.

9.   Performance of Hartley and Colpitts oscillator.

10.   Performance of RC phase shift oscillator.

11.   Performance of clipper and clamper circuit.

12.   Performance of Astable Multivibrator using IC555 Timer.

EQUIPMENT REQUIRED

Sl.No	Name of the Equipment	Range	Qty
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	Regulated Power Supply	(0 - 30) V	5 nos.
6	Function generator	-	4
7	Thevenin's theorem trainer kit	-	2
8	Norton's theorem trainer kit	-	2
9	Maximum power transfer theorem trainer kit	-	2
10	Super position theorem trainer kit	-	2
11	Bridge rectifier trainer kit	-	2
12	RC coupled amplifier trainer kit	-	2
13	Hartley and Colpitts oscillator trainer kit	-	2 each
14	RC phase shift oscillator kit	-	2
15	CRO Dual trace 20MHz/30MHz	-	1
16	Clipper and Clamper trainer kit	-	2
17	Resistors, IC555 Timer	as required	

ELECTRONIC DEVICES PRACTICAL

CODE NO:ICG373   **TOTAL HOURS:64**

LIST OF EXPERIMENTS

1. V-I characteristic of PN junction diode.

2. V-I characteristic of Zener diode.

3. Input and output characteristics of CB transistor configuration.

4. Input and output characteristics of CE transistor configuration.

5. Drain and Transfer characteristics of FET.

6. Emitter Characteristic of UJT.

7. V-I characteristic of SCR.

8. V-I characteristic of DIAC.

9. Characteristic of LDR.

10. Forward characteristic of Light Emitting Diode

11. Testing of LCD display.

12. Characteristic of photo transistor.

EQUIPMENT REQUIRED

Sl. No.	Name of the Equipment	Qty
1	Ammeter (0-50) mA, (0-100) mA, (0-500) μA, (0-100) μA	2 each
2	Voltmeter (0-5) V, (0-10)V, (0-30) V	2 each
3	Regulated Power Supply (0-30)V	5
4	Digital Multimeter	2
5	Diode, Zener diode, Transistor, FET, UJT, SCR,DIAC, LDR, LED, LCD	as required
6	Photo Transistor Trainer Kit	1

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C PROGRAMMING PRACTICAL
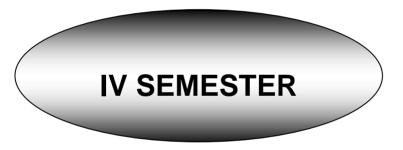
CODE NO:ICG374   **TOTAL HOURS:64**

LIST OF EXPERIMENTS

1. Write a C Program to calculate Simple and Compound interest.

2. Read an integer number. Find the number of digits and sum of all individual digits and also print the above number in reverse order.

3. Write a program to generate Fibonacci series.

4. Accept two numbers and based on user's choice perform addition, subtraction multiplication and division.

5. Program to check whether the given string is palindrome or not.

6. Write a program to arrange the given N names in alphabetical order

7. Program to implement matrix addition, and transpose

8. Program to prepare the total marks for N students by reading the Reg.no, Name, Mark1 to Mark6 by using array of structures. .

9. Write a function to calculate the sum and average of given N numbers. Write a main function to call the above function

10. Write a program to find the factorial of a given number (i) Without recursion (ii) With recursion.

11. Using pointers, find the length of the given string.

12. Using Python language perform string concatenation.

EQUIPMENT REQUIRED

SI.No.	Name of the Equipment	Qty
1	Desktop computer	30
2	C compiler and editor	-
3	Python open source software	-
4	Laser Printer	1
5	5KVA UPS (one hour backup)	1

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IV SEMESTER

COURSE: DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SUBJECT CODE: ICG401   **SEMESTER: IV Semester**

SUBJECT TITLE: ANALOG AND DIGITAL ELECTRONICS

Topics and Allocation of Hours

UNIT	TOPIC	Hrs.
I	**Linear ICs: Op-amp and Applications**	**17**
II	**Boolean Algebra and Logic Gates**	**18**
III	**Combinational Logic Circuits**	**17**
IV	**Sequential Logic Circuits**	**17**
V	**A/D,D/A Converters And Memory Devices**	**17**
	Revision, Test and Model Examination	**10**
	Total	**96**

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

- State the ideal characteristics and applications of operational amplifier
- Recognize the different number systems such as binary, BCD, Octal, Hexadecimal
- Understand the truth table and symbol of logic gates
- Learn the operation of adder and subtractor
- Distinguish between combinational logic and sequential logic circuits
- Know the reduction technique using Karnaugh map(upto to 4 variables)
- Familiarize with 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
- Learn about various types of memory

ANALOG AND DIGITAL ELECTRONICS

CODE NO:ICG401   **TOTAL HOURS:96**

DETAILED SYLLABUS

Unit	Name of the Topics	Hrs
I	**OP-AMP AND APPLICATIONS** Operational amplifier: Definition - Block diagram - ideal 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 – ramp – triangular -, square wave generator - low pass - high pass filter - circuit diagram and working.	17
II	**BOOLEAN ALGEBRA AND LOGIC GATES** Number system**:** Binary - octal - decimal - hexadecimal - BCD - 8421 -excess 3 - gray code -code conversion – 1's complement – 2's complement –addition and subtraction of binary numbers. Boolean algebra: Basic laws - De Morgan's theorems - Logic gates: AND, OR,NOT, NAND, NOR, EX-OR, EX-NOR -symbol, expression and truth table -. Realization of basic gates using universal gates-simplification of logic functions using Karnaugh map (upto 4 variables)–simple problems - constructing logic circuits for the Boolean expressions.	18
III	**COMBINATIONAL LOGIC CIRCUITS** Arithmetic Circuits: Half adder - full adder - half subtractor - full subtractor- four bit serial adder - four bit parallel ripple carry adder - digital comparator - parity checker- parity generator - multiplexer -demultiplexer- decoder – encoder - BCD to seven segment decoder. Digital IC families**:** Characteristics: Fan in - Fan out - Propagation delay - figure of merit - NAND using TTL and CMOS.	17

IV	**SEQUENTIAL LOGIC CIRCUITS**	**17**
	Flip Flop: RS flip-flop - clocked RS flip-flop - JK flip-flop –T flip-flop - D flip-flop - master slave JK flip-flop; Counters: Asynchronous ripple counter: Up, down and up / down counter - divide by N counter - decade counter; Synchronous counter: Up and down counter - ring counter **–** twisted ring (Johnson's) counter; Shift registers: SIPO - SISO - PISO - PIPO.	
V	**A/D,D/A CONVERTERS AND MEMORY DEVICES**	**17**
	Analog to Digital converter: Basics of A/D conversion: Sampling - sample and hold circuit - quantization; Types of A/D converter: Block diagram of flash type ADC - successive approximation ADC - ramp type ADC - dual slope ADC. Digital to analog converter: Types of D/A conversion - weighted resistor D/A converter - R-2R ladder D/A converter. Memory: Classification of memories - RAM organization -static RAM - bipolar RAM cell - dynamic RAM -ROM organization - ROM types: PROM - EPROM – EEPROM - flash memory - expanding memory.	
	Revision, Test and Model Examination	**10**

TEXT BOOK

1. Roy Chaudri: Linear Integrated Circuits, PHI publications
2. Morris Mano: Digital Design.

REFERENCE BOOKS

1. Albert Paul Malvino & Leach :Digital principles and applications.
2. R.P.Jain : Modern Digital Electronics
3. Ramesh S. Goankar: Microprocessors Architecture Programming and applications.
4. B.P.Singh: Microprocessors and Microcontrollers.

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COURSE: DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SUBJECT CODE: ICG402   SEMESTER: IV Semester

SUBJECT TITLE: MEASUREMENT OF PROCESS VARIABLES

Topics and Allocation of Hours

UNIT	TOPIC	Hrs.
I	**Measurement of Temperature**	**15**
II	**Measurement of Pressure**	**14**
III	**Measurement of Level**	**14**
IV	**Measurement of Flow**	**15**
V	**Measurement of Humidity and Moisture**	**12**
	Revision, Test and Model Examination	**10**
	Total	**80**

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

- Know what is temperature and its unit
- Know the concepts of non-electrical methods of temperature measurement
- Know the concept of electrical methods of temperature measurement
- Know the cold junction compensation of thermocouples
- Know the concepts of high temperature measurement
- Know what is pressure, types of pressure and its units
- Know the concepts of mechanical and electrical methods of pressure measurements
- Know the concepts of pressure transmitters
- Know the concepts of non-electrical methods of level measurement
- Know the concepts of electrical methods of level measurement
- Know about the types of flow and 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 moisture and humidity
- Know about different types of moisture measurement
- Know about different types of humidity measurement
- Understand the definition of density and specific gravity

MEASUREMENT OF PROCESS VARIABLES

CODE NO:ICG402   **TOTAL HOURS:80**

DETAILED SYLLABUS

Unit	Name of the Topic	Hrs
I	**MEASUREMENT OF TEMPERATURE** Introduction - temperature scales –nonelectrical methods: liquid filled thermometers: mercury in glass - mercury in steel thermometers - gas filled thermometer - vapour filled thermometer -bimetallic thermometer-construction– working - applications. Electrical methods: RTD: Two wire - three wire - four wire configuration - construction- working - applications; Thermistor: types - construction – working. Thermocouple: Thermoelectric laws - types - construction - working principle – measurement of output using potentiometer and milli voltmeter-cold junction compensation. Pyrometry: concept of black body radiation - Stephen Boltzman law - Plank's law - optical pyrometers - photo electric pyrometer - total radiation pyrometer – construction– working - applications - features of smart transducers.	15
II	**MEASUREMENT OF PRESSURE** Types and units of pressure - mechanical methods: U-tube manometer - inclined manometer - well type manometer; Elastic elements: Bellows - Diaphragms - Bourdon Tube. Electrical methods: Pressure measurements using strain gauge - capacitive transducer - piezo electric transducers - McLeod gauge - pirani gauge - ionization gauge - differential pressure transmitters - dead weight tester.	14
III	**MEASUREMENT OF LEVEL** Measurement of differential pressure to indicate level - Non electrical methods: sight glass - bubbler - float - displacement - solid level - bin type and diaphragm type - level in closed and open vessel. Electrical methods: Change in conductance - Change in capacitance- radiation method- ultrasonic method - solid level measurement.	14

IV	**MEASUREMENT OF FLOW**	**15**
	Mechanical methods: Bernoulli's theorem -continuity equation - Reynolds's number - Types of flow: Inferential flow meters - differential pressure type meters -orifice plates - venturi tube -flow nozzle -positive displacement type meters -working principle - advantages - disadvantages.	
	Electrical Methods: Electromagnetic flow meter - Ultrasonic flow meter - Doppler and Transit time method - Thermal mass flow meter - Turbine flow - Target flow meter; Solid flow measurement using conveyor belt method - hot wire anemometer – working principle.	
V	**MEASUREMENT OF HUMIDITY AND MOISTURE**	**12**
	Humidity: Measurement of humidity - Absolute humidity - Relative humidity - Psychrometer - Hair hygrometer.	
	Density and specific gravity: Definition -measurement using weighing tube type.	
	Moisture: Moisture in granular materials - solid penetrable material in paper and textiles - electrical conduction - electrical capacitance method.	
	Revision, Test and Model Examination	**10**

TEXT BOOK:

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

REFERENCE BOOKS:

1. C.S. Rangan, G.R. Sarma & V.S.V.Mani:Instrumentation - Devices & Systems.
2. Umesh Sinha: Electrical & Electronics - Measurements and Instrumentation.
3. G.K. Mithal:Electronic Instrumentation.
4. S.K.Bhattacharya: Electrical Machines,Tata McGraw Hill.

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COURSE: DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SUBJECT CODE: ICG403   SEMESTER: IV Semester

SUBJECT TITLE: MEASUREMENTS AND INSTRUMENTS

Topics and Allocation of Hours

UNIT	TOPIC	Hrs.
I	**Measuring Instruments**	16
II	**Bridges and Oscilloscope**	16
III	**Power Supplies and Analog Instruments**	15
IV	**Digital Instruments - I**	12
V	**Digital Instruments - II**	11
	Revision, Test and Model Examination	10
	Total	80

OBJECTIVES: On completion of the following unite of syllabus contents, the students will be able to:

- Explain the construction and working of indicating instruments for measurement of D.C and A.C voltage, current, power and energy
- Understand the extending of range of ammeter and voltmeter
- Understand the resistance measurement with voltmeter, ammeter and ohmmeter
- Understand the dynamometer type wattmeter, single phase energy meter and DC potentiometer
- Explain the construction, working and application of Wheatstone Bridge
- 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 supplies
- Understand the use of Megger for testing leakage resistance
- Explain the working and use of CT and PT
- Know about different types of recorders and to compare digital and analog Instruments
- Explain the block diagram of DFM
- Explain the block diagram of Digital Panel meter using LCD
- Explain the working of DSO and MSO and different types of DVM
- Explain the working of digital multimeter and digital LCR meter

MEASUREMENTS AND INSTRUMENTS

CODE NO:ICG403   **TOTAL HOURS:80**

DETAILED SYLLABUS

Unit	Name of the Topic	Hrs
I	**MEASURING INSTRUMENTS** Construction, working and torque equation of Permanent Magnet Moving Coil (PMMC) instrument - Attraction and Repulsion type of Permanent Magnet Moving Iron (PMMI) instrument - comparison of PMMC and PMMI- Electro static Instrument-Electro dynamic instrument- comparison - Ballistic Galvanometer. Ammeter: 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 series and shunt type ohm meter - rectifier type ac volt meter. Single phase induction type energy meter, electrodynamometer type wattmeter; DC potentiometer: Kelvin Varley potential divider.	16
II	**BRIDGES AND OSCILLOSCOPE** DC Bridge: Construction, working, derivation of balance equation and its application; Measurement of resistance: Wheatstone bridge - Kelvin bridge; AC Bridge: Balance equation of AC bridge in ratio form and product form - measurement of unknown lossy inductance: Maxwell's Bridge - Hay's bridge; Measurement of unknown capacitance: Schering bridge; Measurement of frequency: Wien bridge - simple problems. Oscilloscope: Block diagram of Cathode Ray Oscilloscope - construction and working of CRT - horizontal deflection and vertical deflection - time base generator - CRO probes: Voltage - current - active - passive probes; Applications of CRO - Dual trace oscilloscope.	16

III	**POWER SUPPLIES AND ANALOG INSTRUMENTS**	15
	Power Supplies: Block diagram and operation of DC power supply - IC regulated power supply - online and offline Uninterrupted Power Supply (UPS) - comparison of online and offline UPS - inverter. Analog Instruments: Megger - working and applications -Instrument transformer: Current Transformer (CT) - Potential Transformer (PT) - simple problems; Recorders: Diagram and working of strip chart recorders - XY recorder - ultra violet recorder - analog tape recorder - digital tape recorder- applications - advantages - disadvantages.	
IV	**DIGITAL INSTRUMENTS - I**	12
	Comparison of analog and digital instruments - inverting and noninverting Schmitt trigger circuit -Digital Frequency Meter -Block diagram - frequency measurement – period measurement - digital tachometer -digital panel meter using LCD - Digital Storage Oscilloscope - Mixed Storage Oscilloscope - applications.	
V	**DIGITAL INSTRUMENTS - II**	11
	Digital voltmeter : Linear ramp type voltmeter - digital ramp type voltmeter - successive approximation type voltmeter - dual slope voltmeter - digital multimeter: working - auto ranging - auto zeroing - auto polarity - simple problems - digital LCR Meter.	
	Revision, Test and Model Examination	10

TEXT BOOKS

1. A. K. Sawhney: A Course in Electrical and electronic measurements and instrumentation,Dhanpat Rai & Sons. 1986.
2. David A. Bell: Electronic Instrumentation and Measurements.

REFERENCE BOOKS

1. Albert D.Herfrick: Modern Electronics Instrumentation and Measurement techniques.
2. Umesh Sinhaand Satya Prakashan: Electrical and Electronics Measurements and Instrumentation Tech India Publication, 1992.

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COURSE: DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SUBJECT CODE: ICG404   SEMESTER: IV Semester

SUBJECT TITLE: E-VEHICLE TECHNOLOGY AND POLICY

Topics and Allocation of Hours

UNIT	TOPIC	Hrs.
I	**Environmental Impact and History and Electric Vehicle Types**	**10**
II	**Electric Vehicle and Drive System**	**12**
III	**Energy Storages, Charging System, Effects and Impacts**	**11**
IV	**Electric Mobility Policy Framework India**	**11**
V	**Tamil Nadu E-Vehicle Policy 2019**	**10**
	Revision, Test and Model Examination	**10**
	Total	**64**

OBJECTIVES: On completion of the following unite of syllabus contents, the students will be able to:

- 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

E-VEHICLE TECHNOLOGY AND POLICY

CODE NO:ICG404   **TOTAL HOURS:64**

DETAILED SYLLABUS

Unit	Name of the Topics	Hrs
I	**ENVIRONMENTAL IMPACT, HISTORY AND 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.	10
II	**ELECTRIC VEHICLE AND 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; Communication protocols for EV - modbus - profibus - CAN bus. Electric Propulsion Systems: Drive systems: DC motor drives - principle of operation - Induction motor drives - basic operation principles - permanent magnetic brushless DC motor drives - principles –construction - 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 ecosystem - 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 -basic concepts of drone technology.	10
	Revision, Test and Model Examination	10

REFERENCE BOOKS

1. MehrdadEhsani, YiminGao, Sebastien E.Gay, Ali Emadi: Modern Electric, Hybrid Electric and Fuel Cell Vehicles: CR Press, London, New York.

2. Akshat Bansal, Akriti Agarwal: Comparison of Electric and Conventional Vehicles in Indian Market: Total Cost of Ownership,Consumer Preference and Best Segment for ElectricVehicle (IJSR).

3. Fuad Un-Noor, Sanjeevikumar Padmanaban, Lucian Mihet-Popa, Mohammad Nurunnabi Mollahand Eklas Hossain: A Comprehensive Study of Key Electric Vehicle (EV)Components, Technologies,   Challenges, Impacts, and Future Direction of Development (MDPI),.

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.

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ANALOG AND DIGITAL ELECTRONICS PRACTICAL

CODE NO:ICG471   TOTAL HOURS:64

List of Experiments

1. Inverting amplifier and Non inverting amplifier

2. Integrator and Differentiator circuit using operational amplifier

3. V to I and I to V converter circuits.

4. Realization of logic gates AND, OR, NOT, NAND, NOR and Ex-OR.

5. Realization of AND, OR, NOT using NAND and NOR gates.

6. Realization of Half Adder and Full adder.

7. Realization of Half subtractor and Full subtractor.

8. Performance of 8 to 1 Multiplexer using IC74151.

9. Performance of 1 to 8 Demultiplexer using IC74155..

10. Performance of JK, D, T Flip–flops usingIC7474,IC7473,IC7476.

11. Performance of shift register using D FF.

12. Performance of R-2R ladder D/A converter.

EQUIPMENT REQUIRED

SI.No.	Name of the Equipment	Qty
1	Analog trainer kit	5
2	Digital trainer kit	5
3	I/V and I/V trainer kit	2 each
4	Op-amp IC741	10
5	Digital Gate IC's 7404,7408,7432,7486,7402,7410,7400	10 each
6	Digital Flip Flop IC 7473,7474, 7476	10 each
7	IC74151 and IC74155	5 each
8	Resistors	as required
9	Bread board	10

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MI AND MPV PRACTICAL

CODE NO:ICG472   **TOTAL HOURS:64**

LIST OF EXPERIMENTS

MI Experiments:

1. Extending the range and calibration of an ammeter and voltmeter.
2. Construct and test series and shunt type ohm meter.
3. Measurement of unknown frequency and phase angle using Lissajous pattern.
4. Measurement of resistance using Wheatstone bridge.
5. Measurement of unknown capacitance using Schering bridge.
6. Load regulation characteristics of IC7805 and IC7912.

MPV Experiments:

1. Measurement of level through electrical method.
2. Measurement of level through non electrical method.
3. Characteristics of thermocouple.
4. Measurement of flow through orifice meter.
5. Measurement of flow through venturimeter.
6. Measurement of pressure using pressure gauge.

EQUIPMENT REQUIRED

Sl.No	Name of the Equipment	Qty
1	Ammeters (Any range in mA)	6
2	Voltmeters (0-1V), (0-5V),(0-10V),(0-30V),(0-50V)	5
3	Cathode Ray Oscilloscope	6
4	Function generators	6
5	Regulated Power supply(0-30V)	6
6	DRB, DCB	2 each
7	Schering bridge kit	2
8	Any two types of thermocouple	3
9	Venturimeter setup	1
10	Orifice meter setup	1
11	Non electrical level measurement kit	1
12	Electrical level measurement kit	1
13	Compressor with bourdon pressure gauge	1`
14	IC7805 and IC7912	5 each

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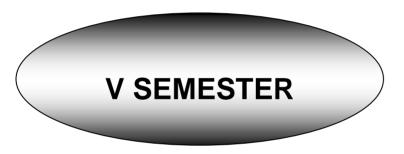# VIRTUAL INSTRUMENTATION PRACTICAL

CODE NO:ICG473   **TOTAL HOURS:64**
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 and 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 integers as input and displays its remainder and quotient.
7. Design a VI to convert industrial standard pressure to current and current to pressure
8. Design a VI to generate and measure various types of signals.
9. Design virtual CRO capable of addition of two waveforms.
10. Design front panel and block diagram to simulate logic gate functions: AND, OR, NOT, NAND, NOR, EX-OR and EX-NOR.
11. Design front panel and block diagram to simulate temperature control system.
12. Design front panel and block diagram to simulate tank control system (PI Controller).

EQUIPMENT REQUIRED

Sl. No	Name of the Equipment / Software	Qty
1	Computer	10
2	LABVIEW Licensed Software (Multiuser)	10 users
3	Laser Printer	1

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V SEMESTER

COURSE: DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SUBJECT CODE: ICG501   **SEMESTER: V Semester**

SUBJECT TITLE: PROCESS CONTROL INSTRUMENTATION

Topics and Allocation of Hours

UNIT	TOPIC	Hrs.
I	**Basics of Process Control**	**14**
II	**Control Action Modes**	**15**
III	**Tuning of Controllers and Final Control Elements**	**15**
IV	**Complex and Digital Control Systems**	**14**
V	**PLC and Distributed Control System**	**12**
	Revision, Test and Model Examination	**10**
	Total	**80**

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

- Understand the process for a single loop feedback control system
- Learn the single loop feedback control system for temperature and level
- Draw the P&I diagrams for the single loop level control system
- Know the concepts of reverse and direct action controller
- Know about P,I,D, PI,PD,PID controller action
- Explain pneumatic and electronic controllers with all control actions
- Compare electronic and pneumatic controller
- Explain the Time Integral criteria for controller tuning
- Understand the different methods of tuning
- Explain the characteristics, types and selection of control valve
- Concept of cavitation, flashing, P to I and I to P converter
- Know feed forward and feedback control, ratio and cascade control system
- Explain about the computer process interface for data acquisition control
- Know about DDC of single, multiple control loops and supervisory computer control
- Explain the architecture of PLC
- Know the ladder programming techniques, applications and advantages of PLC
- Explain the architecture and components of DCS
- Know the advantages and applications of DCS
- Gain knowledge about communication protocols in DCS

PROCESS CONTROL INSTRUMENTATION

CODE NO:ICG501   TOTAL HOURS:80

DETAILED SYLLABUS

Unit	Name of the Topic	Hours
I	**BASICS OF PROCESS CONTROL** Process: Continuous - batch process -variables- functional block diagram of an automatic process control system - automatic control terminology - simple liquid level control system - flow control system – temperature control system with transportation lag - Introduction to Piping and Instrumentation diagram- symbols-piping and Instruments - P&ID diagram for simple liquid level control system.	**14**
II	**CONTROL ACTION MODES** Controller - reverse and direct action - controller modes; Discontinuous control: ON-OFF Control with differential gap - without differential gap; Continuous control: Proportional controller - Proportional Band (PB) - effect of PB on a controller output - offset - integral control- reset time -derivative control- rate time - PI - PD - PID definition - salient features - applications and limitations of controllers - selection of control action; Electronic controllers: error detector - two position controller; Single Mode: P-I-D; Combined mode: PI - PD - PID controllers; Pneumatic controllers for PID action - flapper nozzle mechanism - pneumatic relay-comparison of electronics and pneumatic controller.	**15**
III	**TUNING OF CONTROLLERS AND FINAL CONTROL ELEMENTS** Concept of tuning: Criteria for controller tuning-time integral criteria; Methods of tuning: Open loop response method- process reaction curve; Closed loop response method- ultimate cycle method; Control valve: Types -gate -butterfly - ball -globe - knife-characteristics of control valve- control valve sizing- selection of control valves- flashing and cavitation- solenoid valve; Accessories: Signal converters - P to I converters-I to P converters; Positioner.	**15**

IV	**COMPLEX AND DIGITAL CONTROL SYSTEMS**	**14**
	Feed forward control system - comparison of feedback and feed forward control system -ratio control - ratio control of flow control system - cascade control - cascade control of heat exchanger.	
	Computer process interface for data acquisition control: Sample and hold elements - ADC - DAC; Digital I/O; Direct Digital control (DDC) of single control loop - multiple control loops -supervisory computer control.	
V	**PLC AND DISTRIBUTED CONTROL SYSTEM**	**12**
	Programmable Logic Controller (PLC):Architecture-operation - components - ladder programming- application- advantages.	
	Distributed Control System(DCS):Architecture -operation - components - application – advantages.	
	Communication Protocols in DCS: Fieldbus -Profibus – Modbus-HART.	
	Revision, Test and Model Examination	**10**

TEXT / REFERENCE BOOKS

1. C.D. Johnson: Process control instrumentation technology.
2. S B Thakore and B I Bhatt: Introduction to Process Engineering and Design, Tata McGraw-Hill publishing company Limited, New Delhi.
3. R.P. Vyas: Process Control and Instrumentation, Central Techno Publications, Nagpur, Second Edition.
4. C.L.Smith: Digital computer process control.
5. George Stephanopoulos: Chemical process control, An introduction to theory and practice. Automatic instruments and measuring system.

REFERENCE WEBSITES

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

VIDEO LECTURES

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

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COURSE: DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SUBJECT CODE: ICG502   **SEMESTER: V Semester**

SUBJECT TITLE: CONTROL ENGINEERING

Topics and Allocation of Hours

UNIT	TOPIC	Hrs.
I	Basics of Control Systems, Laplace Transform and Transfer Function	18
II	Block Diagram and Signal Flow Graph Representation	18
III	Time Response Analysis	17
IV	Frequency Response Analysis	17
V	Stability Analysis	16
	Revision, Test and Model Examination	10
	Total	96

OBJECTIVES: On completion of the following units of syllabus contents, the students will be able to:
- Understand a system, control system and its types
- Solve the Laplace transform and Inverse Laplace transform for given function
- Understand the transfer function of mechanical and electrical system
- Understand the block diagram of a system and rules to reduce the block diagram and to solve simple problems
- Understand the signal flow graph and solve using Masons gain formula
- Study the time domain specifications of a I order and II order system and its specifications (definition and formulae only)
- Study the Frequency domain specifications (definition and formulae only)
- Draw the bode plot for the given transfer function
- Draw the polar plot for the given transfer function
- Understand the stability of the system and analyze the stability of the system using Routh stability criterion
- Analyze the stability using root locus method

CONTROL ENGINEERING

CODE NO:ICG502   **TOTAL HOURS:96**

DETAILED SYLLABUS

Unit	Name of the Topics	Hrs
I	**BASICS OF CONTROL SYSTEMS, LAPLACE TRANSFORM AND TRANSFER FUNCTION** System: Types - linear and non-Linear - continuous and 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 - elements - 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 ANALYSIS** Standard test signals: Step - ramp - sine- parabolic- impulse; Order -type number of system - I order - II order system - derivation - step response of I order - II order system with undamped and critical damp; Time domain specifications (definition & formulas only) - steady state error, static error constants - problems.	17
IV	**FREQUENCY RESPONSE ANALYSIS** Frequency response of linear system: Advantages - frequency domain specifications(definitions only) - bode plot - gain margin - phase margin - problems - polar plot- problems.	17
V	**STABILITY ANALYSIS** Definition -absolute stability - relative stability - location of roots on the s-plane for stability - characteristic equation - Routh's stability criterion technique - construction of root locus – problems(only for real values).	16
	Revision, Test and Model Examination	10

TEXT BOOKS

1. A.Nagoorkani: Control systems, RBA publishers, 2006.

REFERENCE BOOKS

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

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COURSE: DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SUBJECT CODE: ICG581   SEMESTER: V Semester

SUBJECT TITLE: INDUSTRIAL INSTRUMENTATION

Topics and Allocation of Hours

UNIT	TOPIC	Hrs.
I	**Measurement of Displacement**	**14**
II	**Measurement of Speed and Acceleration**	**14**
III	**Measurement of Force and Torque**	**14**
IV	**Measurement of pH and Analyzers**	**14**
V	**Analytical Instruments**	**14**
	Revision, Test and Model Examination	**10**
	Total	**80**

OBJECTIVES: On completion of the following units of syllabus contents, the students will be able to:
- Know about the various mechanical, optical, electronic and pneumatic comparators
- Know how to measure displacement using different methods
- Explain the working principle of fiber optic displacement transducers, encoders and ultrasonic displacement sensors
- Study the different methods of measurement of linear and angular speedy
- Study about the different types of accelerometer
- Study about the optical encoder
- Study the different methods of force, torque measurement
- Study about pH, its measuring electrode and methods of pH measurement
- Study about various gas analyzer
- Study about chromatography and detectors
- Know about spectral methods of analysis, Beer's law and monochromators
- Know about spectrophotometer and its types

INDUSTRIAL INSTRUMENTATION

CODE NO:ICG581   **TOTAL HOURS:80**

DETAILED SYLLABUS

Unit	Name of the Topics	Hrs
I	**MEASUREMENTOFDISPLACEMENT** Length standards - comparators: Mechanical-optical-pneumatic -electrical and electronic -dial gauge indicator. Measurement of displacement: Resistive potentiometer transducer - types of resistive elements - potentiometer loading effect - resolution of wire wound potentiometer - differential transducer. Inductive transducer - LVDT-differential capacitive transducer and its equivalent circuits -fiber optic displacement transducer - encoders for displacement measurement - ultrasonic displacement sensors.	14
II	**MEASUREMENT OF SPEED AND ACCELERATION** Measurement of linear speed: Electromagnetic transducer - seismic type transducer -digital transducer - fly ball tachometer. Measurement of angular speed: Digital method - electric tachometer - toothed rotor variable reluctance tachometer - stroboscopic method - eddy current drag cup tachometer. Measurement of acceleration: Types of accelerometers - seismic type and deflection type - displacement pickups - velocity pickups - acceleration pickups - optical encoder.	14
III	**MEASUREMENT OF FORCE AND TORQUE** Force measurement: Unequal arm balance - multiple lever system - pendulum scale - characteristics of elastic force transducer -proven rings -load cells - pneumatic hydraulic load cell - strain gauge load cell. Torque measurement: Strain gauge torque transducer - digital method torque transducer using toothed flanges - magnetostrictive transducer.	14

IV	**MEASUREMENT OF pH AND ANALYZERS**	**14**
	Review of acids - bases - ion concentration - acidity alkalinity - definition of pH - pH scale - electrolytes - neutralization - hydrolysis electrode potential - buffer solutions - selection of buffer solution - redox potential - Types of electrodes - Measuring electrodes: Glass - hydrogen electrode; Reference electrode: Calomel electrode –working - merits and demerits of electrodes;	
	Errors in pH measurement - temperature compensation - methods of pH measurement: Electrometer type - direct type - indirect type; Application of pH	
	Flue gas analyzer using thermal conductivity principle - oxygen analyzers using zirconium oxide electrode - carbon monoxide detector - smoke density detector - working principle - applications.	
V	**ANALYTICAL INSTRUMENTS**	**14**
	Introduction to chromatography - types of chromatography - chromatogram -band broadening in chromatography - gas chromatography - liquid chromatography - HPLC.	
	Detectors: Thermal conductivity detector - flame thermal detector - flame ionization detector - electron capture detector - temperature programming - spectral methods of analysis; Beer's law - causes of deviation - filters - absorption - interference filters - monochromators - prisms - diffraction grating - radiative sources and wavelength selectors - ultra violet and visible spectrophotometer - flame photometer.	
	Revision, Test and Model Examination	**10**

REFERENCE BOOKS

1. A.K.Sawhney: A Course in Electrical and Electronic: Measurements and Instrumentation.
2. R.K. Jain: Mechanical and industrial measurement.
3. D. Patranabis: Principle of industrial instrumentation.
4. R.K. Jain: Engineering Metrology.
5. Doeblin: Measurement and systems.

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COURSE: DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SUBJECT CODE: ICG582   SEMESTER: V Semester

SUBJECT TITLE: INDUSTRIAL POWERELECTRONICS

Topics and Allocation of Hours

UNIT	TOPIC	Hrs.
I	Power Devices and Trigger Circuits	18
II	Converters (Qualitative Treatment Only)	18
III	Choppers	14
IV	Inverters and Applications	10
V	AC Voltage Regulators	10
	Revision, Test and Model Examination	10
	Total	80

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

- Study working principle of power devices.
- Study the methods of triggering
- Know about use of pulse transformer and opto isolator.
- Learn about converters and its types
- Understand commutation concepts
- Learn about choppers and its types
- Study about inverters and types.
- Learn about AC voltage controller with PWM control
- Learn about AC single phase controller with Rand RL load
- Learn about Three phase full wave controller
- Learn single phase cyclo converter and matrix converter

INDUSTRIAL POWER ELECTRONICS

CODE NO:ICG582   **TOTAL HOURS:80**

DETAILED SYLLABUS

Unit	Name of the Topic	Hrs
I	**POWER DEVICES AND TRIGGER CIRCUITS** Thyristor family: Working principle - VI characteristics - Applications of SCR; Definitions: Holding current - latching current - dv/dt rating - di/dt rating; IGBT, MOSFET and GTO: Symbol - principle of working - VI characteristics - applications. Triggering of SCR: Types of triggering -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.	18
II	**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 - SEPIC converter. Commutation: Natural commutation - forced commutation - Types of forced commutation (mention the types only) -three phase half controlled bridge converter with resistive load - current and voltage waveform - three phase fully controlled bridge with resistive load - current and voltage waveforms -dual converter - modes of dual converter.	18
III	**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	**INVERTERS AND APPLICATIONS**	**10**
	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 inverter - McMurray inverter – advantages - basic three phase bridge inverter with 120 conduction mode - circuit - trigger sequence - waveform - pass through inverter- parallel inverter using IGBT.	
V	**AC VOLTAGE REGULATORS**	**10**
	Introduction to AC voltage controller: Principle of on-off control - principle of phase control - single phase voltage controller with resistive load - single phase voltage controller with RL load - three phase full wave controller - AC voltage controllers with PWM control. Cycloconverters: Single phase cyclo converter -matrix Converter.	
	Revision, Test and Model Examination	**10**

TEXT / REFERENCE BOOKS

1. Harish C. Rai: Industrial and Power Electronics, Umesh Publication, Fifth Edition,1994
2. Dr.P.S. Bimbhra: Power Electronics, Khanna publishers, Second Edition, 1998.
3. M.H.Rashid: Power Electronics, PHI Publications, Third edition, 2005.
4. Vedam Subrahmanyam: Power Electronics, New Age International Publishers, Second Edition, 2006 .
5. Dr. P.S. Bimbhra: Power Electronics, Khanna Publishers.

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COURSE: DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SUBJECT CODE: ICG583 **SEMESTER: V Semester**

SUBJECT TITLE: INDUSTRIAL AUTOMATION AND DRIVES

Topics and Allocation of Hours

UNIT	TOPIC	Hrs.
I	**Industrial Drives**	**18**
II	**Pneumatic and Hydraulic Systems**	**18**
III	**Pumps and Compressors**	**14**
IV	**Distributed Control System (DCS)**	**10**
V	**Robotics**	**10**
	Revision, Test and Model Examination	**10**
	Total	**80**

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

- Know the different types of stepper motors and their control
- Understand the AC and DC servo motors and their control
- Study the elements of Hydraulic system
- Discuss the elements of Pneumatic systems
- Know the directional control valve, single acting and double acting cylinder
- Explain the different types of pumps
- Brief the different types of compressors
- Describe the architecture and components of Distributed Control System
- Learn the anatomy of Robot and Sensors needed for Robot
- Understand the Robot programming languages
- Know the automated guided vehicle system

INDUSTRIAL AUTOMATION AND DRIVES

CODE NO:ICG583   **TOTAL HOURS:80**

DETAILED SYLLABUS

Unit	Name of the Topic	Hrs
I	**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 - optical encoder. Servo motor: Definition - types - DC servo motor - permanent magnet DC motor - brushless motor - AC servo motor - working of an AC servo motor in control system; Induction motor: Eddy current drive for speed control of induction motor.	18
II	**HYDRAULIC ANDPNEUMATIC SYSTEMS** Hydraulic system: Elements - operation - hydraulic power supply - 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 - double acting cylinder; Comparison between hydraulics and pneumatics.	18
III	**PUMPS AND COMPRESSORS** Pumps: Introduction - Comparison between pumps and compressors - comparison between positive displacement and 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. Compressors: Air Compressors - Types: Positive displacement compressors - rotary compressors - reciprocating compressors - piston compressors - diaphragm compressors - dynamic compressors; Comparison of different compressors -specifications of compressors.	14

IV	**DISTRIBUTED CONTROL SYSTEM (DCS)**	**10**
	Evolution of distributed control system - definition of DCS - block diagram - functional elements of DCS - operator interfaces - engineering interfaces - types of Human Machine Interface (HMI) - architecture of anyone commercial DCS - advantages of DCS - selection of DCS - list of various DCS and their manufactures.	
V	**ROBOTICS**	**10**
	Definition - robot anatomy - classification of robots -Sensors: contact and non-contact - touch– tactile - range - proximity -linear - rotation 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.	
	Revision, Test and Model Examination	**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. R.Srinivasan: Special electrical Machines, Lakshmi publication, 2012.
4. V.Jayakumar: Applied hydraulics and pneumatics,Lakshmi publication, 2010.
5. R.Srinivasan: Hydraulic and pneumatic controls, McGraw-hill Education(india) pvt. Ltd second edition 2010.
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, McGrawHill,1987
11. Michel P.Groover: Industrial Robots-Technology, Programming and Applications, McGraw Hill.2012.
12. P.Jaganathan:Robotics,Lakshmi publication.2012.

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PROCESS CONTROL INSTRUMENTATION PRACTICAL

CODE NO:ICG571   **TOTAL HOURS:64**

LIST OF EXPERIMENTS

1. Dynamic response of thermocouple for a step and ramp input.

2. Immersion effect of thermometers.

3. Current to pressure convertor.

4. Pressure to current convertor.

5. On–Off control characteristics of a pressure process.

6. Response of Digital PID control of temperature process.

7. Characteristics of Analog P, PI Controller.

8. Characteristics of Analog PD, PID Controller.

9. Control valve characteristics.

10. Control of liquid level system.

11. On/Off motor control using ladder logic program.

12. Count the number of students in a classroom using ladder logic program.

EQUIPMENTS REQUIRED

Sl. No	Name of the Equipment	Qty
1	Furnace	2
2	Thermocouple(J,K,T types)	2 each
3	Thermometer(Alcohol)	2
4	Glass mercury type thermometer	2
5	On-off control kit using pressure process	2
6	Digital PID controller trainer kit	2
7	Analog PID controller trainer kit	2
8	PLC Unit	1
9	PLC I/O interface Kit	1
10	Compressor	2
11	P to I and I to P converter kits	2 each
12	Control valve setup	1
13	Liquid level control setup	1

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CONTROL ENGINEERING SIMULATION PRACTICAL

CODE NO:ICG572   **TOTAL HOURS:64**

LIST OF EXPERIMENTS

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

2. 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. Matlab/Scilab/octave code to determine
    a) step response of first order system.
    b) impulse response of first order system

4. Matlab/Scilab/octave code to determine
    a) step response of 2nd order system
    b) impulse response of 2nd order system

5. Matlab/Scilab/octave code to find time domain specifications for atypical second order system.

6. 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. Matlab/Scilab/octave code to obtain transfer function using signal flow graph.

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

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

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

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

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

EQUIPMENT / SOFTWARE REQUIRED

S.No.	Name of the Equipment / Software	Qty
1.	Desktop / Laptop Computer	15
2.	Laser Printer	1
3.	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	

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COURSE: DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SUBJECT CODE: ICG573   SEMESTER: V Semester

SUBJECT TITLE: ENTREPRENEURSHIP AND STARTUP

Topics and Allocation of Hours

UNIT	TOPIC	Hrs.
I	**Entrepreneurship – Introduction and Process**	**13**
II	**Business Idea and Banking**	**13**
III	**Start up, E-cell and Success Stories**	**13**
IV	**Pricing and Cost Analysis**	**13**
V	**Business Plan Preparation**	**12**
	Total	**64**

OBJECTIVES: On completion of the following units of syllabus contents, the students must 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 and role in the growth and development of individual and the nation
- Understand the formation of E-cell
- Aware the concept of incubation and starts ups
- 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

ENTREPRENEURSHIP AND STARTUP

CODE NO:ICG573   **TOTAL HOURS:64**

DETAILED SYLLABUS

Unit	Name of the Topic	Hrs
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 • Mind set 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, consumers and Competitors • E- commerce Business Models • Types of Resources: Human, capital, Entrepreneurial tools and resources • Selection, 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 system • Incentive schemes for State Government • Incentive schemes for Central Government	13

III	**START UP, E-CELL AND SUCCESS STORIES**	**13**
	• 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 startup • Learn to earn • Startup and its stages • Role of Technology – E-commerce and Social Media • Role of E-Cell • E-Cell to Entrepreneurship	
IV	**PRICING AND COST ANALYSIS**	**13**
	• 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	

V	BUSINESS PLAN PREPARATION	12
	- 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, tagline - Promotion strategy - Business Plan Preparation - Social Entrepreneurship as Problem - Solving - Concept and Importance - Risk Taking-Concept - Types of business risks - Execution of Business Plan	

REFERENCE 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., NewDelhi-110044.

8. Prasanna Chandra: Financial Management, Tata McGraw Hill Education Private Limited, NewDelhi.

9. I.V. Trivedi, Renu Jatana: Indian Banking System, RBSA Publishers, Rajasthan

10. Simon Daniel: HOW TO START A BUSINESS IN INDIA, BUUKS, Chennai – 600018.

11. Ramani Sarada: The Business Plan Write -Up Simplified - A practitioner's guide to writing the Business Plan, Notion Press Media Pvt. Ltd., Chennai 600095.

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INDUSTRIAL INSTRUMENTATION PRACTICAL

CODE NO:ICG584   **TOTAL HOURS:64**
LIST OF EXPERIMENTS

1. Measurement of displacement using Ultrasonic method
2. Measurement of pH.
3. Calibration of pressure gauge using dead weight tester.
4. Measurement of acceleration using piezoelectric accelerometer.
5. Measurement of force using strain gauge.
6. Measurement of load using load cell.
7. Measurement of torque.
8. Measurement of speed using digital tachometer.
9. Measurement of weight using electronic balance.
10. Measurement of vibration.
11. Measurement of humidity.
12. Measurement of speed using stroboscope.

EQUIPMENT REQUIRED

Sl. No	Name of the Equipment	Qty
1	Ultrasonic sensor	2
2	pH measurement trainer kit	2
3	Dead weight tester	1
4	Piezoelectric accelerometer setup	1
5	Strain measurement trainer kit	2
6	Load cell trainer kit	2
7	Torque measurement trainer kit	2
8	Digital Tachometer	2
9	Electronic balance	1
10	Vibration measurement setup	1
11	Humidity measurement setup	2
12	Stroboscope	1

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INDUSTRIAL POWER ELECTRONICS PRACTICAL

CODE NO:ICG585   **TOTAL HOURS:64**

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 single phase voltage controller with R load.
12. Simulate the three phase full wave controller with R load.

EQUIPMENT REQUIRED

Sl. No.	Name of the Equipment / Software	Qty
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.	Step up Chopper Trainer Kit	1
7.	SCR Commutation Circuit 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

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INDUSTRIAL AUTOMATION PRACTICAL

CODE NO:ICG586   **TOTAL HOURS:64**
LIST OF EXPERIMENTS

1.   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.   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.   Experiment to operate single acting cylinder using PLC

a) using OR Logic

b) using AND logic

4.   Experiment to operate single acting cylinder using PLC

a) using on-delay timer

b) using off-delay timer

5.   Experiment to operate single acting cylinder using PLC for fixed number of cycles using counter instruction and electrical switches

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

7.   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.   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.   Experiment to control the Speed of hydraulic motor using metering in   and metering out control.

10.   Experiment to control the speed of DC motor using SCR.

11.   Experiment to obtain the Load characteristics of 1-phase induction motor.

12.   Experiment to control the speed of stepper motor.

EQUIPMENT REQUIRED

SI.No.	Name of the Equipment / Software	Qty
1.	Pneumatic control Station with accessories	1
2.	Speed control set up of hydraulic motor with accessories	1
3	PLC based Electro Pneumatic Kit	1
4	Hydraulic control station with accessories	1
5	SCR method of speed control of DC motor setup with accessories	1
6	Load characteristics of single phase induction motor setup with accessories	1
7	Speed control set up of stepper motor	1

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VI SEMESTER

COURSE: DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SUBJECT CODE: ICG601   SEMESTER: VI Semester

SUBJECT TITLE: MICROCONTROLLER AND INTERFACING

Topics and Allocation of Hours

UNIT	TOPIC	Hrs.
I	**8051 Microcontroller**	**14**
II	**Programming of 8051**	**14**
III	**8051 Interrupts**	**14**
IV	**Interfacing Techniques**	**14**
V	**Advanced Microcontrollers**	**14**
	Revision, Test and Model Examination	**10**
	Total	**80**

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

- Explain the architecture of 8051 microcontroller
- Explain the functions of various registers
- Understand the memory organization of 8051
- Understand the different timer operation modes
- Explain the various addressing modes of 8051
- Classify the instruction set of 8051
- Understand the programming techniques and write programmes using 8051 instructions
- Understand interrupt structure of 8051
- Understand the programming of timer, serial communication and external interrupts
- Understand serial data communication concepts
- Understand the block diagram and control word format of 8255
- Understand the interfacing of 8051 with RS232C, LED, stepper motor, keyboard and memory
- Understand the features and block diagram of PIC microcontroller
- Understand the memory organization of PIC controller
- Explain the block diagram of LPC2148 ARM controller
- Know about block diagram of Arduino, Raspberry pi and IoT.

MICROCONTROLLER AND INTERFACING

CODE NO:ICG601   **TOTAL HOURS:80**

DETAILED SYLLABUS

Unit	Name of the Topics	Hrs
I	**8051 MICROCONTROLLER** Introduction to microcontroller -comparison of Microprocessor and microcontroller - overview of 51 family - features of 8051 - 8051 block diagram - I/O ports - pin details; Memory organization: Internal RAM and ROM - special function registers - bit pattern of PSW and PCON ; Timers and counters: timer 0 and timer 1 registers - structure of TCON and TMOD registers - timer operation modes -oscillator and clock reset.	14
II	**PROGRAMMING of 8051** Instruction set of 8051: format of assembly language statement - Types of addressing modes - classification of 8051 Instruction: Data transfer- arithmetic-logical - bit manipulation -branch instructions. Simple programs: 8 bit addition and subtraction - 16 bit addition and subtraction - 8 bit multiplication and division - square and cube of 8 bit number - sum of elements in an array - finding largest and smallest number in an array - arranging an array of elements in ascending and descending order, conversion between BCD and hex - conversion between BCD and ASCII values.	14
III	**8051 INTERRUPTS** Interrupt concept - interrupt vs polling - steps involved in executing an interrupt - 8051 interrupts: Interrupt Enable and Interrupt Priority registers (IE and IP) - timer overflow interrupts - programming of 8051 timers/counters in mode 0 - mode 1 - mode 2 operation -programming external hardware interrupts. Serial communication: Basics of serial communication: RS232 standards - Interfacing of 8051 to RS232C - serial communication modes - SCON and SBUF registers - importance of RI and TI flags - programming 8051 to transmit data serially and to receive data serially.	14

IV	**INTERFACING TECHNIQUES**	**14**
	Programmable peripheral Interface chip 8255 - Pin diagram (only) - control words of 8255 - Interfacing of 8051 with LED - Stepper Motor - 4x4 Keyboard; External memory: ROM (IC2764) - RAM (IC6264) - ADC - DAC.	
V	**ADVANCED MICROCONTROLLERS**	**14**
	PIC microcontroller**:** 16F877A - General block diagram-features-applications. ARM controller**:** LPC2148- General block diagram- features-applications. Arduino: General block diagram-features-applications. Raspberry pi: General block diagram– features -applications. IoT: Introduction - block diagram of home automation system using IoT.	
	Revision, Test and Model Examination	**10**

TEXT BOOKS

1. Mohammed Ali Mazidi:The 8051 Micro controllers and Embedded systems

2. Kenneth J Ayala: 8051 Micro controller Architecture, Programming and Applications.

3. Microchip PIC 16F877A data sheet, Raspberry pi datasheet, LPC2148 datasheet.

REFERENCE BOOKS

1. Tammy Neorgaard: Embedded system architecture.

2. David Seal: ARM architecture reference manual.

3.https://www.tutorialspoint.com/embedded_systems/es_microcontroller.html

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

5. https://www.tutorialspoint.com/raspberry_pi/index.html

6.https://www.tutorialspoint.com/internet_of_things/index.html

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COURSE: DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SUBJECT CODE: ICG602   **SEMESTER: VI Semester**

SUBJECT TITLE: BIOMEDICAL INSTRUMENTATION

Topics and Allocation of Hours

UNIT	TOPIC	Hrs.
I	**Physiological Measurements**	14
II	**Measuring Instruments and Biomedical Recorders**	14
III	**Patient Care and Supporting Sources**	14
IV	**Bio Telemetry and Patient Safety**	15
V	**Modern Imaging Techniques**	13
	Revision, Test and Model Examination	10
	Total	80

OBJECTIVES: On completion of the following units of syllabus contents, the students will be able to:
- Understand the generation of bio-potential and its measurement using various electrodes
- Know the measurement of blood pressure
- Understand the measurement of lung volume
- Understand the measurement of respiration rate
- Acquire knowledge to measure of body temperature and skin temperature
- Study the operating principle of ECG recorder
- Gain knowledge about the operating principle of EEG recorder.
- Study the principles of operations of EMG, ERG and EOG recorder
- Know the principle of operation of pacemaker and power sources of implantable pacemakers
- Learn the basic principle of dialysis
- Learn the working principles of telemetry
- Describe the basic principle of telemedicine
- Acquire knowledge about patient safety
- Understand the various methods of accident prevention.
- Brief about the applications of laser in medicine.
- Know about X-ray apparatus.
- Know the basic principle of CT and MRI techniques

BIOMEDICAL INSTRUMENTATION

CODE NO:ICG602   **TOTAL HOURS:80**

DETAILED SYLLABUS

Unit	Name of the Topics	Hrs
I	**PHYSIOLOGICAL MEASUREMENTS** Bio-potential and their generation - resting and action potential - Electrodes: micro - skin surface - needle electrodes; Measurement of Blood pressure: Direct method and indirect method; Measurement of blood flow: Electromagnetic flow meter -ultrasonic blood flow meter - measurement of blood pH -. Measurement of respiration rate - lung volume -heart rate–body temperature -skin temperature- cardiac output measurement techniques.	14
II	**MEASURING INSTRUMENTS AND BIOMEDICAL RECORDERS** Electro cardio graph (ECG): lead system - ECG electrodes - ECG amplifiers - ECG recording units - analysis of ECG curves; Electroencephalogram(EEG):Central nervous system -10 to 20 lead system - EEG recorder - recording techniques - EEG wave types - clinical use of EEG -brain tumor; Electromyography (EMG): EMG waves - EMG recording techniques; Electroretinography(ERG) - Electrooculography(EOG) – phonocardiogram.	14
III	**PATIENT CARE AND SUPPORTING SOURCES** Cardiac pacemaker: Classification -external pacemaker - Implantable pacemaker - programmable pacemaker -power sources of implantable pacemakers: Hg batteries - nuclear batteries - lithium cells; Cardiac defibrillators: AC defibrillators -DC defibrillators -automatic external defibrillator. Heart lung machine– oxygenators - Blood pumps: peristaltic pump –infusion pump; Dialysis: hemodialysis - peritoneal dialysis; Endoscopy: Principle of working - applications; Heart valves - problems of artificial heart valves - Anesthesia machine.	14

IV	**BIO TELEMETRY AND PATIENT SAFETY**	**15**
	BioTelemetry: Physiological adaptable to biotelemetry - components of a bio telemetry system -application of telemetry in patient care; Elements of biotelemetry: AM -FM transmitter and receiver; Requirements for biotelemetry system - radio telemetry with sub carrier single channel - multi channel telemetry; Telemedicine: Introduction -applications.	
	Patient safety**:** Physiological effects of electric current -micro and macro shock - leakage current - shock hazards from electrical equipment; Methods of accident prevention: Grounding - Isolated power distribution system; Safety aspects in electro surgical units: Burns - high frequency current hazards -explosion hazards.	
V	**MODERN IMAGING TECHNIQUES**	**13**
	Laser beam properties - application of laser in medicine - Ultrasonic imaging techniques and its application in medical field - modes of display - recording devices - X-ray apparatus: block diagram - operation - X-ray generation; Tomogram - Computerized Axial tomography - Axial Echo Cardiography; Infrared imaging and their applications in medical field - Magnetic Resonance Imaging Techniques.	
	Revision, Test and Model Examination	**10**

REFERENCE BOOKS

1. Lesile Cromwell, Fred. J. Weibell, Erich, A. Pfeiffer: Bio-medical Instrumentation and Measurement, Edition II.

2. B. R. Klin: Introduction to Medical Electronics.

3. Kumaradoss: Medical Electronics.

4. Jacobson and Webster: Medicine and Clinical engineering.

5. R.S. Khanpur: Handbook of biomedical instrumentation.

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COURSE: DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SUBJECT CODE: ICG603   **SEMESTER: VI Semester**

SUBJECT TITLE: COMPUTER COMMUNICATION NETWORKS

Topics and Allocation of Hours

UNIT	TOPIC	TIME (Hrs)
I	Data Communication	14
II	Computer Networks	14
III	Network Devices and Layers	14
IV	Network Protocols and Security Systems	14
V	Introduction to Wireless Networks	14
	Revision, Test and Model Examination	10
	Total	80

OBJECTIVES: On completion of the following unite of syllabus contents, the students will be able to:

- Explain the components of data communication
- Explain about the guided media and unguided media of transmission
- Explain the different types of transmission
- Explain the different network categories
- Know about different network topologies
- Explain the basic concepts of network devices like hub, bridge and router
- Know the OSI reference model of network layers
- Explain the functions of seven layers of OSI model
- Explain the types of network protocols like MAC, TCP and TCP/IP
- Know the concept of IP addressing and subnet masking
- Know the fundamentals of transmission theory
- Study about the single mode and multimode fibers
- Know about different types of security systems in computer networks
- Get introduce to Adhoc networks and cellular networks
- Get introduced to FDD, TDD, FDMA and TDMA
- Explain cell splitting and cell handover

COMPUTER COMMUNICATION NETWORKS

CODE NO:ICG603   **TOTAL HOURS:80**

DETAILED SYLLABUS

Unit	Name of the Topics	Hrs
I	**DATA COMMUNICATION** Data communication: Introduction - components of data communication - data communication system - ASCII standard - units of measure - Communication rate - analog and digital communication - parallel and serial communication - asynchronous and synchronous communication - protocols and buffers - detecting errors - data transmission modes: Simplex - half duplex - full duplex communication. Transmission media: Guided media: Twisted pair cables - shielded and unshielded - co–axial cables; Optical fiber: Single mode - multi mode fibers; Unguided media: Radio transmission - microwave transmission - satellite communication - infrared and light wave transmission.	14
II	**COMPUTER NETWORKS** Networks categories: Peer to peer Network - intranet – internet; Geographical based networks: LAN - WAN - MAN – CAN; Network Topologies: Linear bus topology - circular or ring topology -star topology – tree topology; Hybrid topologies: Star bus topology – star ring topology.	14
III	**NETWORK DEVICES AND LAYERS** Network devices**:** Basic concept of hubs - bridges - switches – routers ; Network Layers**:** OSI reference model: Networks layer and their functions - physical layer -data link layer -network layer -transport layer - session layer -presentation layer -application layer.	14
IV	**NETWORK PROTOCOLS AND SECURITY SYSTEMS** Protocols: Introduction - accessing and using TCP/IP - configuring client - TCP/IP suite utilities -remote access; Internet Protocol: Introduction - IP addressing -characteristics of IP Addressing -interior and exterior gateway protocol –subnetting - Supernetting. Security system: Introduction- types of threats; Levels of security: physical - access control - personal identification - data encryption - diskless PC - protection against cable radiation - call back security - firewalls and proxy server - system fault tolerance - backing up data.	15

V	**INTRODUCTION TO WIRELESS NETWORKS**	**13**
	Types of wireless networks: Infrastructure and Adhoc networks - operation principle of Adhoc networks - general concept of TDD – FDD - FDMA – TDMA; Network architecture: Distributed - centralized - slotted systems Cellular Networks: Cellular network organization - shape of cell - frequency reuse- directional antenna - movement from cell to cell and handover - cell splitting.	
	Revision, Test and Model Examination	**10**

TEXT BOOKS

1. William Stallings: Wireless communication and networks, Pearson education
2. Andrew S. Tanenbaum: Computer networks, PHI publications.
3. Prashant Krishnamurthy and Kaveh Pahlavan: Principles of wireless networks: A Unified Approach, Prentice Hall communications Engineering and Emerging Technologies series.

REFERENCE BOOKS

1. Computer Communication networks: Achyut S. Godbole, Atul Kahate, Tata Mcgraw Hill & Co.
2. Windows XP Bible: Alian Simpson, Brian Underdahi.
3. Microsoft A+ Certification for networking.
4. Andrew S. Tanenbaum: Computer networks, PHI Publications.
5. Dr. Madhulika Jain: Computer Networks.
6. Gerd E.Keiser: Local Area Networks, Tata McGraw Hill & CO.

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COURSE: DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SUBJECT CODE: ICG681   SEMESTER: VI Semester

SUBJECT TITLE: EMBEDDED SYSTEM DESIGN WITH ARDUINO

Topics and Allocation of Hours

UNIT	TOPIC	Hrs.
I	**Introduction to Embedded Systems**	**14**
II	**Arduino Hardware**	**14**
III	**Arduino Software and Library Functions**	**14**
IV	**Arduino Interface With Devices, Sensors and Actuators**	**15**
V	**Embedded Application Development with Arduino**	**13**
	Revision, Test and Model Examination	**10**
	Total	**80**

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

- Define what is embedded system
- Know the classification, characteristics and applications of embedded system
- Describe the different types of ARDUINO Boards
- Write embedded C program
- Learn the structure of ARDUINO sketch
- Know about ARDUINO built-in library functions
- Interface with input and output devices like switches and LED's
- Interface different kind of sensors with ARDUINO board
- Interface with Actuators like stepper motor, DC motor and servo motor
- Build applications like digital ohmmeter, digital thermometer
- Build applications like measuring distance and sending data through internet
- Build applications with wireless communication interface like Bluetooth
- Build applications to measure humidity
- Build application to interface with internet

EMBEDDED SYSTEM DESIGN WITH ARDUINO

CODE NO:ICG681   **TOTAL HOURS:80**
DETAILED SYLLABUS

Unit	Name of the Topics	Hrs
I	**INTRODUCTION TO EMBEDDED SYSTEM** Definition of embedded system - comparison between embedded system and general computing system; Classification: Small scale - medium scale -sophisticated; Major application areas - purpose of embedded system - characteristics and quality attributes of embedded system.	14
II	**ARDUINO HARDWARE** Arduino: History –advantages; Arduino Family: Arduino Uno - Arduino Mega - Arduino Nano; Arduino Uno board description - Arduino Mega board description - Arduino Nano board description - Arduino Due board description; Arduino board installation - digital and analog peripherals - Arduino Mega ports - pins - communication models - communication interface.	14
III	**ARDUINO SOFTWARE AND LIBRARY FUNCTIONS** Embedded C - Difference between C and Embedded C; Data types: constants- variables; Variable scope: Local- global; Operators for Arduino: Arithmetic - logical - boolean- bitwise –compound; Control statements: if–If…else- elseif- switch case - while - do while - for loop - infinite loop; Function declaration - time manipulation functions - declaring array - Arduino Function Libraries: pinMode() - digitalRead() - digitalWrite()- analogRead() - analogReference(); Familiarizing with Arduino IDE -sketch designing for Arduino.	14
IV	**ARDUINO INTERFACE WITH DEVICES,SENSORS AND ACTUATORS** **Hardware and Arduino Sketch for Interfacing Devices** Arduino hardware and sketch: 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.	15

	Hardware and Arduino Sketch for Interfacing Sensors Arduino Hardware and Sketch: Temperature sensor LM35 - humidity sensor DHT22 - IR motion sensor PIR - ultrasonic sensor HC_SR04 - LDR. **Hardware and Arduino Sketch for Interfacing Actuators** Arduino hardware and sketch for DC Motor -servo motor - stepper motor.	
V	**EMBEDDED APPLICATION DEVELOPMENT WITH ARDUINO** Arduino Hardware and Sketch: Measure unknown resistance - measure temperature - measure light intensity - measure distance in cm - measure angle of rotation using potentiometer - measure humidity - communicate with android phone through bluetooth- use Wi-Fi and local area network - send data through internet - control the switches and LED using I^2C protocol.	**13**
	Revision, Test and Model Examination	**10**

TEXT BOOKS / REFERENCE BOOKS / WEBSITES

1. K V Shibu:Introduction to Embedded Systems, 2nd Edition, McGrawHill India.
2. Raj Kamal: Embedded Systems Architecture, Programming and Design, Tata McGraw-Hill Publishing.
3. Rajesh Singh, Anita Gehlot, Bhupendra Singh, Sushaban Choudhury:Arduino Based Embedded Systems Interfacing, Simulation and LabView GUI, CRC Press.
4. Richard Blu:Sams Teach Yourself Arduino Programming in 24 Hours.
5. John Nussey:Arduino for Dummies.
6. Michael Margolis, Brian Jepson and Nicholas Robert Weldin, O'reilly:Arduino Cookbook, 3rd edition.
7. Ashwin Pajankar: Arduino Made Simple with Interactive Projects, BPB Publications.
8.https://arduino.cc and https://www.tutorialspoint.com/arduino.

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COURSE: DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SUBJECT CODE: ICG682   **SEMESTER: VI Semester**

SUBJECT TITLE: POWER PLANT INSTRUMENTATION

<u>**Topics and Allocation of Hours**</u>

UNIT	TOPIC	Hrs.
I	**Conventional Power Generation**	14
II	**Non-Conventional Power Generation**	14
III	**Measurements in Power Plant**	14
IV	**Control Loops in Boiler**	15
V	**Instrumentation and Control System used for Turbine and Safety Aspects of Boiler**	13
	Revision, Test and Model Examination	10
	Total	80

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

- Understand the methods of power generation
- Explain the operation of hydro, thermal, wind and nuclear power plants
- Know the operation of solar power generation methods
- Understand boiler control objectives and to calculate the efficiency of the boiler
- Understand the measurement of airflow and oil flow.
- The measurement of steam flow, steam pressure and steam temperature
- The measurement of dust and smoke
- Understand various types of drum level control
- The types of boilers and its classification
- The furnace draft control using feed forward and feedback control
- The Boiler feed water pumping and heating system
- The Instrumentation and control system used for turbines
- Understand intrinsic and electrical safety

POWER PLANT INSTRUMENTATION

CODE NO:ICG682   **TOTAL HOURS:96**

DETAILED SYLLABUS

Unit	Name of the Topic	Hrs
I	**CONVENTIONAL POWER GENERATION** Hydroelectric power plant: Working -classification- components used in hydroelectric power plant; Thermal power plant: Working -components used in thermal power plant; Coal handling system - ash and dust handling system-draft system - economizer- air pre heater - Nuclear power plant: Principle- pressurized water reactor-boiling water reactor- components used in nuclear power plant.	14
II	**NON-CONVENTIONAL POWER GENERATION** Solar power plant: Principle- flat plate collector- solar thermal power generation- photo voltaic power generation; Wind power plant: Principles- basic components of wind energy conversion system-co- generation system-topping cycle - bottoming cycle. Boiler combustion process and its efficiency calculation: Boiler control objectives- combustion of fuels(gaseous, liquid and solid) - excess air requirement - combustion chemistry and products of combustion - requirement for excess combustion air; Calculation of efficiency of boilers: Input/output method - heat loss method.	14
III	**MEASUREMENTS IN POWER PLANT** Air flow measurements -oil flow measurements- steam flow measurement- steam pressure measurement- steam temperature measurement- drum level measurement - dust measurement- smoke measurement- radiation detectors.	14
IV	**CONTROL LOOPS IN BOILER** Boiler types and 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.	15

V	INSTRUMENTATION AND CONTROL SYSTEM USED FOR TURBINE AND SAFETY ASPECTS OF BOILER Turbine monitoring and control: Speed - vibration - shell temperature monitoring- lubrication for turbo-alternator–turbo-alternator cooling system; Intrinsic and electrical safety-interlocks for boiler operation- computer based control and data logging systems.	13
	Revision, Test and Model Examination	**10**

TEXT BOOKS

1.K.Krishnaswamy and M.Ponnibala:Power plant instrumentation, PHI.

2.Tamilmani:Power plant instrumentation, sam's Publisher.

3. G.Liptak: Instrumentation in Process industries, Vol. I and II, Chilton Book Co.,1973.

REFERENCE BOOKS

1. Sam.G.Dukelow:, The control of boilers, Instrument society of America Press,1986.

2. Swapanbasu and Ajay debnath: Power Plant Instrumentation and Control Handbook: A Guide to Thermal Power Plants, Academic press, 2014.

3. Duncan Richardson: Plant Equipment and Maintenance Engineering Handbook, McGraw-Hill Education, 2014.

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COURSE: DIPLOMA IN INSTRUMENTATION AND CONTROL ENGINEERING

SUBJECT CODE: ICG683   **SEMESTER: VI Semester**

SUBJECT TITLE: PROGRAMMABLE LOGIC CONTROLLER

Topics and Allocation of Hours

UNIT	TOPIC	Hrs.
I	**Architecture and Operation Of PLC**	**15**
II	**PLC Programming – I**	**15**
III	**PLC Programming - II**	**15**
IV	**PLC Programming - III**	**10**
V	**SCADA and HMI**	**15**
	Revision, Test and Model Examination	**10**
	Total	**80**

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

- Understand the detailed Hardware of PLC and its parts
- Understand the working of PLC and scan cycle
- Understand the program and data memory organization
- Know the logical and timer instructions
- Know the different counters of PLC and its parameters
- Understand the Ladder logic programming of PLC
- Develop simple ladder programs
- Study the data manipulation and branching instructions of PLC
- Understand the different modes of PLC
- Know about the communication module of PLC
- Understand different editors and features and applications of SCADA
- Understand the features of HMI

PROGRAMMABLE LOGIC CONTROLLER

CODE NO:ICG683   **TOTAL HOURS:96**

DETAILED SYLLABUS

Unit	Name of the Topics	Hrs
I	**ARCHITECTURE AND OPERATION OF PLC**	**15**
	Automation - needs and benefits – PLC: Definition -functional block diagram - CPU - power supply; Memory: ROM - RAM - EPROM - EEPROM; I/O Modules: Discrete -analog - DC - 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.	
	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 Size: Pico/Nano PLC.	
	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	**PLC PROGRAMMING – I**	**15**
	Types of PLC programming languages: Ladder Diagram (LD) - Functional Block Diagram (FBD) - Structured Text (ST) - Instruction List (IL) - Sequential Function Chart (SFC).	
	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).	
	Logical Instructions: AND - OR - NAND - NOR - XOR - NOT - Clear (CLR); Timer Instructions: ON Delay(TON) - OFF Delay(TOF) - Retentive(RTO) - Non-retentive(RES); Counter Instructions: CountUp(CTU) – CountDown(CTD) - Reset (RST) – High Speed Counter(HSC) -program to implement ON and OFF delay timer and to count an event.	

III	**PLC PROGRAMMING - II**	**15**
	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 and 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.	
IV	**PLC PROGRAMMING - III**	**10**
	Ladder logic program - latch circuit - logical functions - On delay and Off delay timer functions - count an event - toggle an output - sequence control of four outputs repetitively - On/Off Control of a motor - On/Off Level Control - Conveyor control - Lift control.	
V	**SCADA AND HMI**	**15**
	SCADA: Introduction - Typical SCADA architecture/block diagram - benefits - 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.	
	Applications of SCADA - traffic light control - water distribution - pipeline Control	
	HMI Features: Graphical representation - operator Inputs - interaction with control process - OPC UA server and client - storing data in cloud. .	
	Revision, Test and Model Examination	**10**

TEXT / REFERENCE BOOKS

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

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

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

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

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

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

7. Pradeep Kumar Srivastava: Exploring Programmable Logic Controller with applications, BPB Publication.

8. W. Bolton: Programmable logic controller,4thEdition, Reed Elsevier India Pvt Ltd.

9. Gary Dunning: Introduction to PLC, 3rdedition, Thomson Delmar learning

10.Jon Stenerson: Industrial Automation and Process Control, PHI Learning, New Delhi.

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MICROCONTROLLER AND INTERFACING PRACTICAL

CODE NO: ICG671   **TOTAL HOURS:64**

LIST OF EXPERIMENTS

I. Executing the following programs using 8051microcontroller

1. Addition and Subtraction of two 8 bit data.

2. Addition of an array of n elements.

3. Block movement of data.

4. Multiplication and division of two 8 bit data.

5. Largest and smallest element in an array.

6. Arranging the given numbers in ascending and descending order.

7. Conversion of hexadecimal into BCD number and vice versa.

8. Conversion of ASCII to decimal and vice versa.

II. Interfacing Programs

9. Interfacing LED display with 8051.

10. Interfacing stepper motor with8051.

11. Interfacing ADC with8051.

12. Interfacing DAC with 8051 to generate square wave and triangular wave.

EQUIPMENT REQUIRED

SI.No.	Name of the Equipment	Qty
1	Microcontroller Trainer kits	15
2	LED interface board	2
3	Stepper motor interface board	2
4	ADC Interface Board	2
5	DAC interface Board	2

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EMBEDDED SYSTEM DESIGN WITH ARDUINO PRACTICAL

CODE NO: ICG684   **TOTAL HOURS: 64**
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 humidity using Humidity sensor and test it.

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

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

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

11. 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).

12. Construct circuit using ARDUINO hardware and develop C program to use Wi-Fi and local area network.

EQUIPMENT / SOFTWARE REQUIRED

SI.No	Name of the Equipment / Software	Qty
1	ARDUINO/ESP8266/ESP32 Development Kit With switches, sensors, LCD, LED's, POT, LDR etc.,	10
2	ARDUINO IDE - Open Source Software	1
3	Pentium PC (Dual Core)	10

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P&ID USING CAD PRACTICAL

CODE NO: ICG685   **TOTAL HOURS:64**

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 in a chemical reactor for the control of temperature and pressure.

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

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

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

7. Draw the P&ID of a ratio control 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 desalting of crude oil in refinery

12. Draw the P&ID of industrial spray dryers.

EQUIPMENT REQUIRED

SI.No	Name of the Equipment's / Software	Qty
1	Pentium PC (Dual Core)	10
2	Laser Printer	1
3	AUTOCAD / CAD P&ID 2021 / Edraw Max Software (Multiuser)	1

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PROGRAMMABLE LOGIC CONTROLLER PRACTICAL

CODE NO: ICG686   **TOTAL HOURS:64**

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.
8. Implement traffic light control using SCADA.

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

9. Write and implement a Ladder Logic program for the On/Off Control of a motor.
10. Write and implement a Ladder logic program for the On/Off Level Control.
11. Write and implement a Ladder logic program for Conveyor control.
12. Write and implement a Ladder logic program for Lift control.

EQUIPMENT REQUIRED

Sl.No	Name of the Equipment / Software	Qty
1.	Programmable Logic Controller (PLC) with battery	4
2.	PC Pentium Dual Core	4
3.	PC to PLC interface cable	4
Modules required for PLC Interfacing		
4.	On / Off Motor module with provision for PLC interface	1
5.	On / Off Level Control System with provision for PLC interface	1
6.	Conveyor Control System with provision for PLC interface	1
7.	Lift Control System with provision for PLC interface	1

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PROJECT WORK AND INTERNSHIP

CODE NO: ICG672   **TOTAL HOURS:64**

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	Max. Marks
First Review	6thweek	10
Second Review	14th week	10
Attendance	Entire semester	5
	Total	25

EVALUATION FOR BOARD EXAMINATION

Details of Mark allocation	Max Marks
Demonstration / Presentation	20
Report	20
Viva-Voce	15
Internship report	20
Total	**75**

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ANNEXURE - III

DEPARTMENT OFINSTRUMENTATION AND CONTROL ENGINEERING
COMPARISON OF SYLLABUS

Sem.	Name of the Subject	Equivalent Code		
		2015	2018	2023
III	Basics of Instrumentation	IC302	ICE301	ICG301
	Electronic Devices	IC303	ICE302	ICG302
	Electrical and Electronic circuits	IC 304	ICE303	
	Basics of Instrumentation Lab	IC 371	ICE371	ICG371
	Electronic Devices Lab	IC 372	ICE372	ICG372
	Electrical and Electronic Circuits Lab	IC 373	ICE373	ICG373
	Computer Aided Drafting Lab	IC 374	ICE374	-
IV	Instruments and Equipment	IC 401	ICE401	ICG403
	Measurement of Process Variables	IC 402	ICE402	ICG402
	Control Engineering	IC 403	ICE403	ICG502
	C Programming	IC 404	ICE404	ICG303
	IE and MPV Lab	IC 471	ICE471	ICG472
	C Programming Lab	IC 474	ICE472	ICG374
	Communication Skills Practical	*BE 183	*BEE184	BEG278
V	Digital Electronics	IC 501	ICE501	ICG401
	Process Control Instrumentation	IC 502	ICE502	ICG501
	Industrial Instrumentation	IC 504	ICE503	ICG581
	Elective Theory - I	IC 50*	ICE50*	ICG58*
	Digital Electronics Lab	IC 571	ICE571	ICG471
	Process Control Instrumentation Lab	IC 572	ICE572	ICG571
	Industrial Instrumentation Lab	IC 573	ICE573	ICG584
VI	Microcontrollers and Interfacing	IC 602	ICE601	ICG601
	Advanced Process Control	IC 603	ICE602	ICG501
	Elective Theory II	IC 60*	ICE60*	ICG68*
	Microcontroller and Interfacing Lab	IC 671	ICE671	ICG671
	PLC and MATLAB Practical	IC 675	ICE672	-
	Simulation Lab	IC 673	ICE673	ICG473
	Project work and Entrepreneurship	IC 674	ICE674	-
ELECTIVES	Industrial Safety Instrumentation	IC 505	ICE504	-
	Industrial Automation	IC 507	ICE505	ICG583
	Computer Communication Networks	IC 509	ICE506	ICG603
	Biomedical Instrumentation	IC 675	ICE603	ICG602
	Embedded Systems	IC 605	ICE604	-
	Fiber Optic and Laser Instrumentation	IC 606	ICE605	-

COURSE CODE: TIME: 3Hrs.

COURSE NAME: MAX MARKS: 75

PART - A (5 * 3= 15)

Answer any **FIVE** from the following Questions.

1.

2.

3.

4.

5.

6.

7.

8.

PART - B (5 * 12= 60)

Answer **ALL**questions choosing any one sub division from each question.

9.   A

                                        OR

     B

10. A

                                        OR

     B

11. A

                                        OR

     B

12. A

                                        OR

     B

13. A

                                        OR

     B

SCHEME OF EVALUATION (Circuit practical)

S.No.	Description	Allocation of Marks
1	Circuit Diagram	20
2	Connection & Procedure	20
3	Tabulation& Graph	20
4	Result	10
5	Viva Voce	5
	TOTAL	**75**

SCHEME OF EVALUATION (Computer related practical)

S.No.	Description	Allocation of Marks
1	Program/Drawing	25
2	Flowchart/Procedure	10
3	Execution	25
4	Result	10
5	Viva Voce	5
	TOTAL	**75**

COMPARISON OF SYLLABUS
III Semester

G Scheme	NScheme (DoTE)	E Scheme (Previous Autonomous Syllabus)
ICG301 Basics of Instrumentation	**Deletion:** Hydro-pneumatic elements, Venturi and orifice, construction, principle, working and application only. (Topics available in MPV syllabus) **Addition:** instrumental – environmental – observational errors – zero drift – span drift – zonal drift – retardation lag. MEMS sensor Telemetry: Definition – pneumatic telemetry system – electrical telemetry system - digital telemetry system	**Addition:** Limiting error. Relative error, calibration error, True value, static error, Significant of figure, Dead time, hysteresis, Resolution, dead zone, span drift , zonal drift, loading effect , retardation lag. Mechanical transducer topics-unit IV Electrical transducer topics-unit V **Deletion:** Calibration methodology First Order and Second order response with respect to step input**.** Signal conditioners - unit IV (Available in Analog and Digital electronics theory) Recording devices -unit V (Available in Measurements and Instruments theory)
ICG302 Electronic Devices and Circuits	**Addition:** Clipper and clamper Signal generator function generator 555 Timer block diagram **Deletion:** Crystal oscillator Optocoupler SCR as a switch concept of 3 phase supply Auto transformer	**Merged** Electronic Devices and Electrical and Electronic circuits

G Scheme	N-Scheme (BEEE)	E Scheme
ICG303 **C Programming**	**Addition:** Strings, File Management, Introduction to Python Language **Deletion:** Basics of Computers Programs for selected problems	**Addition:** Introduction to Python Language **Modification:** Flowchart examples **Deletion:** Unions Command line arguments, Preprocessors

IV Semester

G Scheme	N-Scheme (BEEE)	E Scheme
ICG401 **Analog and** **Digital** **Electronics**	**Deletion:** 555Timer, Functional block diagram, Astable, Monostable and Schmitt Trigger-Sequential timer,555 Timer can be used as PWM	**Addition:** Linear ICs: Op-amps and Applications **Deletion:** Specifications of ADC: Accuracy, resolution, conversion time , functional block diagram of IC ADC 0808.
ICG402 **Measurement of** **Process** **Variables**	Same as N scheme	Same as N scheme
ICG403 **Measurements** **and Instruments**	**Addition:** Kelvin bridge, Dual trace oscilloscope IC regulated power supply Online and offline Uninterrupted Power Supply (UPS) comparison of online and offline UPS Inverter Digital LCR Meter Electrodynamometer wattmeter.	**Addition:** Digital ramp type voltmeter successive approximation type voltmeter auto polarity Digital LCR Meter **Deletion:** Dual beam oscilloscope Sampling oscilloscope Analog multimeter OC and SC test losses of transformer

ICG404 E-Vehicle Technology	Same as N scheme	No such subject in E scheme

V Semester

G Scheme	N-Scheme	E Scheme
ICG501 Process Control Instrumentation	**Addition:** Data acquisition control, Supervisory computer control, PLC, DCS and communication protocols in DCS	Three Units from Process control Instrumentation and Two units from Advanced process control are merged together
ICG502 Control Engineering	Same as N scheme	Same as E scheme
ICG581 Industrial Instrumentation	**Addition:** Measurement of displacement – resistive potentiometer transducer - types of resistive elements - potentiometer loading effect - resolution of wire wound potentiometer – differential transducer - LVDT-Differential Capacitive transducer and its equivalent circuits - Fiber Optic Displacement transducer , Encoders for displacement measurement, Ultrasonic displacement sensors **Deletion:** Shaft Power Measurement: Definition- Principle of operation and construction of - Prony brake Dynamometer - Rope Brake Dynamometer - Fluid Friction (Hydraulic) Dynamometer - Eddy current Dynamometer **Deletion:** Quinhydrone electrode - Antimony electrode	**Addition:** Ultrasonic displacement sensors

G Scheme	N Scheme	E Scheme
ICG582 Industrial Power Electronics	Same as N Scheme	No such subject in E Scheme
ICG583 Industrial Automation and Drives	Same as N scheme	**Addition**: AC servometer Logic sequencer Optical encoder Centrifugal pump Distributed Control Sytem **Deletion:** Vacuum pump Heat exchanger Safety

VI Semester

G Scheme	N-Scheme	E Scheme
ICG601 Microcontroller and Interfacing	<u>**Addition:**</u> **Advanced Microcontrollers** Arduino- General Block diagram-Variants-Features-Applications. Raspberry pi-General Block diagram-Features-Applications-Comparison of microcontrollers. IoT-Introduction to IoT-Block diagram of home automation using IoT. <u>**Deletion:**</u> Embedded system, Characteristic of embedded system , structure of embedded system, Processors in embedded system,Microprocessor, Microcontroller , Compiler , cross compiler, Assembler, Simulator, Emulator, Criteria for choosing microcontroller for embedded applications.	<u>**Addition:**</u> square and cube of 8 bit number program **Advanced Microcontrollers** Arduino- General Block diagram-Variants-Features-Applications. Raspberry pi-General Block diagram-Features-Applications-Comparison of microcontrollers. IoT-Introduction to IoT-Block diagram of home automation using IoT.

ICG602 Bio Medical Instrumentation	<u>Addition:</u> Power sources of implantable pacemakers <u>Deletion:</u> Chromatography, Photometry, Flurometry, Physiotheraphy equipment, short wave diathermy – micro wave diathermy, Ultrasonic therapy unit(block/circuit), Ventilators, types, modern ventilator block diagram. Double insulation, Protection by low voltage, Ground fault circuit interrupter, isolation of patient connected parts	<u>Addition:</u> Methods of Accident prevention Grounding--isolated power distribution system. <u>Deletion:</u> Galvanic skin resistance(GSR),.Einthoven triangle system,Electrode placement in Frank Lead system, Telemetry of ECG's from extended coronary care patients, telemetry for ECG measurements during exercise, Telemetry for emergency patient monitoring, Health level 7 standards, Digital Imaging and Communication in Medicine(DICOM).Artifacts due to mal functioning of equipment. Artifacts due to improper operating techniques. SPECT-PET Advantage and applications.
ICG603 Computer Communication Networks	No such subject in N Scheme	Same as E- Scheme
ICG681 Embedded System Design with Arduino	Same as N Scheme	No such subject in E Scheme
ICG682 Power Plant Instrumentation	**ADDITION:** **Boiler combustion process and its efficiency calculation** Boiler control objectives- combustion of fuels (gaseous, liquid and solid), excess air requirement, combustion chemistry and products of combustion, requirement for excess	No such subject in E-Scheme

	combustion air – calculation of efficiency of boilers: input/output method, heat loss method. **Safety Aspects Of Boiler:** Intrinsic and Electrical safety-Interlocks for Boiler operation-Computer based control and data logging systems- Application of DCS in thermal power plant.	
ICG683 Programmable Logic Controller	**ADDITION:** Simple ladder logic programs **DELETION** Communication Protocols	No such subject in E Scheme