

**DR.BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY**



**CIRCULAR NO.SU/Sci.& Tech./B.Voc./33/2018**

It is hereby inform to all concerned that, on the recommendation of the Dean, Faculty of Science & Technology, the Hon'ble Vice-Chancellor has accepted the **following curriculum under B.Voc. programme viz: Certificate, Diploma, Advanced Diploma and B.Voc. Degree** in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith:

|     |                                                         |
|-----|---------------------------------------------------------|
| 1.  | B.Voc. Industrial Automation,                           |
| 2.  | B.Voc. Automobile Technology,                           |
| 3.  | B.Voc. Farm Equipment and Machinery,                    |
| 4.  | B.Voc. I.T.Skills and Software Development,             |
| 5.  | B.Voc. Architectural Planning and Interior Design,      |
| 6.  | B.Voc. Dairy Products,                                  |
| 7.  | B.Voc. Drill Technology,                                |
| 8.  | B.Voc. Plant Tissue Culture and Green House Technology, |
| 9.  | B.Voc. Renewable Energy Source,                         |
| 10. | B.Voc. Computer Hardware & Networking Maintenance.      |
| 11. | B.Voc.Food Processing and Preservation.                 |
| 12. | B.Voc. Sustainable Agriculture.                         |
| 13. | B.Voc. Bioproducts technician                           |

This is effective from the Academic Year 2018-2019 and onwards.

This curriculum are also available on the university website  
[www.bamu.ac.in](http://www.bamu.ac.in)

All concerned are requested to note the contents of this circular and bring notice to the students, teachers and staff for their information and necessary action.

University Campus,  
Aurangabad-431 004.  
Ref.No.  
SU/B.Voc/2018/21709-22148  
Date:- 12-12-2018

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**Deputy Registrar,**  
**Syllabus Section.**

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**Copy forwarded with compliments to :-**

- 1] **The Principals, affiliated concerned Colleges,  
Dr. Babasaheb Ambedkar Marathwada University.**
- 2] **The Director, University Network & Information Centre, UNIC,  
with a request to upload this Circular on University Website.**

Copy to :-

- 1] The Director, Board of Examinations & Evaluation, Dr.BAMU,A'bad.
- 2] The Section Officer, [BCS Unit] Examination Branch,
- 3] The Section officer, [Eligibility Unit], Dr.BAMU,A'bad.
- 4] The Programmer [Computer Unit-1] Examinations, Dr.BAMU,A'bad.
- 5] The Programmer [Computer Unit-2] Examinations, Dr.BAMU,A'bad.
- 6] The In-charge, [E-Suvidha Kendra], Rajarshi Shahu Maharaj  
Pariksha Bhavan, Dr. Babasaheb Ambekar Marathwada University.
- 7] The Public Relation Officer, Dr.BAMU,A'bad.
- 8] The Record Keeper. Dr.BAMU,A'bad.

**DR. BABASAHEB AMBEDKAR  
MARATHWADA UNIVERSITY,  
AURANGABAD.**



**Curriculum of  
Certificate/Diploma/Advanced Diploma and  
B.Voc. Industrial Automation.  
  
UNDER THE FACULTY OF SCIENCE & TECHNOLOGY.  
  
[ Effective from 2018-19 & onwards ]**

## **Objectives**

- 1) To provide judicious mix of skills relating to a profession and appropriate content of General Education.
- 2) To ensure that the students have adequate knowledge and skills, so that they are work ready at each exit point of the programme.
- 3) To provide flexibility to the students by means of pre-defined entry and multiple exit points.
- 4) To integrate NSQF within the undergraduate level of higher education in order to enhance employability of the graduates and meet industry requirements. Such graduates apart from meeting the needs of local and national industry are also expected to be equipped to become part of the global workforce.
- 5) To provide vertical mobility to students coming out of 10+2 with vocational subjects.

The B.Voc (Industrial Automation) programmed is divided into six semesters having 180 credits (72 for general education component and 108 credit for skill component) (2400 marks). There are 24 general education component and 22 skill component. Forth and six semesters consist of Implant training of minimum 75 hours each.

## **Eligibility:**

Category – 1: students who have already acquired NSQF certification Level 4 in a particular industry sector and opted for admission in the B.Voc degree courses under NSQF in same sector for which he / she was previously certified at school level.

Category – 2: students who have acquired NSQF certification Level 4 but may like to change their sector and may enter in B.Voc course in a different sector.

Category – 3: students who have passed 10+2 examination with science or M.C.V.C.(electronics) or equivalent from any recognized Board with conventional schooling without any background of vocational training.

All above students are eligible for registration subject to the rules and regulations laid down by Dr. Babasaheb Ambedkar Marathwada University, Aurangabad and UGC, New Delhi

## **Admission / Promotion Process:**

In response to the advertisement for registration, interested students will have to register themselves. Admission will be done on the basis of performance of students at their qualifying examination. Once the student is admitted he/she will be promoted to the next semester with full carryon, however students have to register themselves for every consecutive semester. Dropout students will be allowed to register for respective semester as and when the concerned courses are offered by the department, however he / she should not exceed more than twice the duration of the course from the date of first registration at parent department.

## **Award of diploma, advance diploma and B.Voc degree**

Awards could be given at each stage below for cumulative credits awarded to the learners in skill based vocational courses.

| NSQF Level | Skill Component Credits | General Education Credits | Total Credits for Award | Normal Duration | Exit Points / Awards |
|------------|-------------------------|---------------------------|-------------------------|-----------------|----------------------|
| Level – 4  | 18                      | 12                        | 30                      | One Semester    | Certificate          |
| Level – 5  | 36                      | 24                        | 60                      | Two Semester    | Diploma              |
| Level – 6  | 72                      | 48                        | 120                     | Four Semester   | Advanced Diploma     |
| Level – 7  | 108                     | 72                        | 180                     | Six Semester    | B.Voc Degree         |

The students will have the option to exit with a Certificate, Diploma or Advanced Diploma after acquiring requisite no of credits.

**Course Structure:**

**B.Voc(Industrial Automation) In Choice Based Credit System under Academic Flexibility.**

(180 Credits against 2400 Marks)

**First Year: Semester I**

| Course                                         | Course Title                             | Teaching time/week                 | Internal |        | External |        | Total |        |
|------------------------------------------------|------------------------------------------|------------------------------------|----------|--------|----------|--------|-------|--------|
|                                                |                                          |                                    | Marks    | Credit | Marks    | Credit | Marks | Credit |
| General Education component (Total Credits 12) |                                          |                                    |          |        |          |        |       |        |
| E.I.A. 1.1                                     | Introduction to PLC                      | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 1.2                                     | Basics of Electrical wiring techniques   | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 1.3                                     | Introduction to sensors                  | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 1.4                                     | Computer Fundamental                     | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| Skill Component (Total Credits 18)             |                                          |                                    |          |        |          |        |       |        |
| S.I.A. 1.1                                     | PLC programming applications in industry | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 4      | 50    | 5      |
| S.I.A. 1.2                                     | Electrical wiring used in industry       | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 3      | 50    | 4      |

|                                                                                                                                                                                                                                                                                                                                        |                                                     |                                    |    |   |    |   |    |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|------------------------------------|----|---|----|---|----|---|
| S.I.A. 1.3                                                                                                                                                                                                                                                                                                                             | Sensor applications in industry                     | 4.5 hours (6 period of 45 minutes) | 10 | 1 | 40 | 3 | 50 | 4 |
| S.I.A. 1.4                                                                                                                                                                                                                                                                                                                             | Basic skills, soft skills & personality development | 4.5 hours (6 period of 45 minutes) | 10 | 1 | 40 | 4 | 50 | 5 |
| An internal mark consists of test, Tutorials, Seminars, Attendance, performance, Assignment of student, while External marks are for theory Examination or practical examination (conducted by skill sector or industrial partner). Practical marks include, practical performance, oral, regular completion of record books, project. |                                                     |                                    |    |   |    |   |    |   |

### First Year: Semester II

| Course                                                                                                                                                                                                                                                                                                                                 | Course Title                                                | Teaching time/week                 | Internal |        | External |        | Total |        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|------------------------------------|----------|--------|----------|--------|-------|--------|
|                                                                                                                                                                                                                                                                                                                                        |                                                             |                                    | Marks    | Credit | Marks    | Credit | Marks | Credit |
| General Education component (Total Credits 12)                                                                                                                                                                                                                                                                                         |                                                             |                                    |          |        |          |        |       |        |
| E.I.A. 2.1                                                                                                                                                                                                                                                                                                                             | Mathematics -I                                              | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 2.2                                                                                                                                                                                                                                                                                                                             | Electronics                                                 | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 2.3                                                                                                                                                                                                                                                                                                                             | Instrumentation                                             | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 2.4                                                                                                                                                                                                                                                                                                                             | Computer networking                                         | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| Skill Component (Total Credits 18)                                                                                                                                                                                                                                                                                                     |                                                             |                                    |          |        |          |        |       |        |
| S.I.A. 2.1                                                                                                                                                                                                                                                                                                                             | Computer hardware & networking applications in industry     | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 4      | 50    | 5      |
| S.I.A. 2.2                                                                                                                                                                                                                                                                                                                             | Electronics applications in industry                        | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 3      | 50    | 4      |
| S.I.A. 2.3                                                                                                                                                                                                                                                                                                                             | Instrumentation applications in industry                    | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 3      | 50    | 4      |
| S.I.A. 2.4                                                                                                                                                                                                                                                                                                                             | Linguistic Proficiency (English) with Language lab training | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 4      | 50    | 5      |
| An internal mark consists of test, Tutorials, Seminars, Attendance, performance, Assignment of student, while External marks are for theory Examination or practical examination (conducted by skill sector or industrial partner). Practical marks include, practical performance, oral, regular completion of record books, project. |                                                             |                                    |          |        |          |        |       |        |

**Second Year: Semester III**

| Course                                                                                                                                                                                                                                                                                                                                 | Course Title                                  | Teaching time/week                 | Internal |        | External |        | Total |        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|------------------------------------|----------|--------|----------|--------|-------|--------|
|                                                                                                                                                                                                                                                                                                                                        |                                               |                                    | Marks    | Credit | Marks    | Credit | Marks | Credit |
| General Education component (Total Credits 12)                                                                                                                                                                                                                                                                                         |                                               |                                    |          |        |          |        |       |        |
| E.I.A.3.1                                                                                                                                                                                                                                                                                                                              | Hydraulics                                    | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A.3.2                                                                                                                                                                                                                                                                                                                              | Pneumatics                                    | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A.3.3                                                                                                                                                                                                                                                                                                                              | HMI & MMI                                     | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A.3.4                                                                                                                                                                                                                                                                                                                              | Environmental science                         | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| Skill Component (Total Credits 18)                                                                                                                                                                                                                                                                                                     |                                               |                                    |          |        |          |        |       |        |
| S.I.A.3.1                                                                                                                                                                                                                                                                                                                              | Hydraulics applications in industry           | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 4      | 50    | 5      |
| S.I.A.3.2                                                                                                                                                                                                                                                                                                                              | Pneumatics applications in industry           | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 3      | 50    | 4      |
| S.I.A. 3.3                                                                                                                                                                                                                                                                                                                             | HMI & applications                            | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 3      | 50    | 4      |
| S.I.A. 3.4                                                                                                                                                                                                                                                                                                                             | Environmental Awareness and Industrial Safety | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 4      | 50    | 5      |
| An internal mark consists of test, Tutorials, Seminars, Attendance, performance, Assignment of student, while External marks are for theory Examination or practical examination (conducted by skill sector or industrial partner). Practical marks include, practical performance, oral, regular completion of record books, project. |                                               |                                    |          |        |          |        |       |        |

**Second Year: Semester IV**

| Course                                         | Course Title              | Teaching time/week               | Internal |        | External |        | Total |        |
|------------------------------------------------|---------------------------|----------------------------------|----------|--------|----------|--------|-------|--------|
|                                                |                           |                                  | Marks    | Credit | Marks    | Credit | Marks | Credit |
| General Education component (Total Credits 12) |                           |                                  |          |        |          |        |       |        |
| E.I.A. 4.1                                     | Study of embedded systems | 3 hours (4 period of 45 minutes) | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 4.2                                     | SCADA                     | 3 hours (4 period of 45 minutes) | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 4.3                                     | Human Resource Management | 3 hours (4 period of 45 minutes) | 10       | 1      | 40       | 2      | 50    | 3      |

|                                                                                                                                                                                                                                                                                                                                        |                                     |                                    |    |   |    |   |    |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|------------------------------------|----|---|----|---|----|---|
| E.I.A. 4.4                                                                                                                                                                                                                                                                                                                             | Study of CAD-CAM                    | 3 hours (4 period of 45 minutes)   | 10 | 1 | 40 | 2 | 50 | 3 |
| <b>Skill Component (Total Credits 18)</b>                                                                                                                                                                                                                                                                                              |                                     |                                    |    |   |    |   |    |   |
| S.I.A. 4.1                                                                                                                                                                                                                                                                                                                             | Microcontroller programming         | 4.5 hours (6 period of 45 minutes) | 10 | 1 | 40 | 4 | 50 | 5 |
| S.I.A. 4.2                                                                                                                                                                                                                                                                                                                             | SCADA programming                   | 4.5 hours (6 period of 45 minutes) | 10 | 1 | 40 | 3 | 50 | 4 |
| S.I.A. 4.3                                                                                                                                                                                                                                                                                                                             | Implant training (minimum 75 hrs.)  | 4.5 hours (6 period of 45 minutes) | 10 | 1 | 40 | 3 | 50 | 4 |
| S.I.A. 4.4                                                                                                                                                                                                                                                                                                                             | visual basic or CAD-CAM programming | 4.5 hours (6 period of 45 minutes) | 10 | 1 | 40 | 4 | 50 | 5 |
| An internal mark consists of test, Tutorials, Seminars, Attendance, performance, Assignment of student, while External marks are for theory Examination or practical examination (conducted by skill sector or industrial partner). Practical marks include, practical performance, oral, regular completion of record books, project. |                                     |                                    |    |   |    |   |    |   |
| During Implant training student should present at least 75 hours in the company and he/she will have to produce attendance cum performance certificate to college.                                                                                                                                                                     |                                     |                                    |    |   |    |   |    |   |

### Third Year: Semester V

| Course                                         | Course Title                       | Teaching time/week                 | Internal |        | External |        | Total |        |
|------------------------------------------------|------------------------------------|------------------------------------|----------|--------|----------|--------|-------|--------|
|                                                |                                    |                                    | Marks    | Credit | Marks    | Credit | Marks | Credit |
| General Education component (Total Credits 12) |                                    |                                    |          |        |          |        |       |        |
| E.I.A. 5.1                                     | Mechatronics                       | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 5.2                                     | Mathematics-II                     | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 5.3                                     | Advance programming                | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 5.4                                     | Process Control                    | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| Skill Component (Total Credits 18)             |                                    |                                    |          |        |          |        |       |        |
| S.I.A. 5.1                                     | Mechatronics application           | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 4      | 50    | 5      |
| S.I.A. 5.2                                     | Industrial Mathematics and drawing | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 3      | 50    | 4      |

|                                                                                                                                                                                                                                                                                                                                        |                                        |                                    |    |   |    |   |    |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------|----|---|----|---|----|---|
| S.I.A. 5.3                                                                                                                                                                                                                                                                                                                             | Advance Ladder programming in industry | 4.5 hours (6 period of 45 minutes) | 10 | 1 | 40 | 3 | 50 | 4 |
| S.I.A. 5.4                                                                                                                                                                                                                                                                                                                             | Applications of Process control        | 4.5 hours (6 period of 45 minutes) | 10 | 1 | 40 | 4 | 50 | 5 |
| An internal mark consists of test, Tutorials, Seminars, Attendance, performance, Assignment of student, while External marks are for theory Examination or practical examination (conducted by skill sector or industrial partner). Practical marks include, practical performance, oral, regular completion of record books, project. |                                        |                                    |    |   |    |   |    |   |

### Third Year: Semester VI

| Third Year: Semester VI                                                                                                                                                                                                                                                                                                                |                                                  |                                    |          |        |          |        |       |        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|------------------------------------|----------|--------|----------|--------|-------|--------|
| Course                                                                                                                                                                                                                                                                                                                                 | Course Title                                     | Teaching time/week                 | Internal |        | External |        | Total |        |
|                                                                                                                                                                                                                                                                                                                                        |                                                  |                                    | Marks    | Credit | Marks    | Credit | Marks | Credit |
| General Education component (Total Credits 12)                                                                                                                                                                                                                                                                                         |                                                  |                                    |          |        |          |        |       |        |
| E.I.A. 6.1                                                                                                                                                                                                                                                                                                                             | Project Management                               | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 6.2                                                                                                                                                                                                                                                                                                                             | PID                                              | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 6.3                                                                                                                                                                                                                                                                                                                             | DCS                                              | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 6.4                                                                                                                                                                                                                                                                                                                             | Robotics                                         | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| Skill Component (Total Credits 18)                                                                                                                                                                                                                                                                                                     |                                                  |                                    |          |        |          |        |       |        |
| S.I.A. 6.1                                                                                                                                                                                                                                                                                                                             | Designing of Industrial Projects (Major project) | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 4      | 50    | 5      |
| S.I.A. 6.2                                                                                                                                                                                                                                                                                                                             | PID & DCS applications in industry               | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 3      | 50    | 4      |
| S.I.A. 6.3                                                                                                                                                                                                                                                                                                                             | Implant training (minimum 75 hrs.)               | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 3      | 50    | 4      |
| S.I.A. 6.4                                                                                                                                                                                                                                                                                                                             | Robotics applications in industry                | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 4      | 50    | 5      |
| An internal mark consists of test, Tutorials, Seminars, Attendance, performance, Assignment of student, while External marks are for theory Examination or practical examination (conducted by skill sector or industrial partner). Practical marks include, practical performance, oral, regular completion of record books, project. |                                                  |                                    |          |        |          |        |       |        |
| During Implant training student should present at least 75 hours in the company and he/she will have to produce attendance cum performance certificate to college.                                                                                                                                                                     |                                                  |                                    |          |        |          |        |       |        |

**Notes:**

- (1) Tutorials consist of conceptual as well as numerical problems / questions based the respective theory courses in the semester. Total marks assigned for test will be 5/per paper and total marks assigned for tutorials will be 05/per paper.
- (2) Each course / paper should be taught for 40 to 45 contact hours.
- (3) Teaching duration for LAB COURSES in each semester should be of 4.5 hours per week per batch
- (4) The content of theory course / paper as well laboratory (practical) course may be modified time to time ( with the approval DC) to keep pace with the recent developments and trends in the subject.

**Attendance:**

Students must have 75 % of attendance in each educational and laboratory (skill) course for appearing examination otherwise he / she will not be strictly allowed for appearing the examination of each course. However, students having 65 % attendance with medical certificate may request Principal for the condonation of attendance. Monthly attendance of the students for each course will be displayed on the notice board.

**Registration for Service Course:**

- Students will have to register themselves for the service course of his / her interest after the start of semester in the department on official registration form. The teacher in-charge of the respective course will keep the record of the students registered. Maximum fifteen days period will be given from the date of admission for completion of registration procedure. The departmental committee shall follow a selection procedure after counseling to the students to avoid the overcrowding to a particular course at the expense of some other courses.
- Students will have to pay the prescribed fees per course per semester / year for the registration as decided by the university.

**Departmental Committee:**

The existing Departmental Committee (DC) will monitor the smooth functioning of B.Voc. programme.

**Results Grievances / Redressal Committee**

Grievances / redressal committee will be constituted in the department to solve all grievances relating to the evaluation. The committee shall consist of Head of the department and the concerned teacher of a particular course.

**Evaluation Methods:**

- The grades for courses will be based on 20: 80 ratios of continuous internal assessment (CIA) and semester end examination (SEE).

**Internal Evaluation Method:**

- There will be two mid semester examinations (10 marks each) as a part of continuous internal assessment (CIA), first based on 40 percent of the syllabus taught and second based on 60 percent of the syllabus taught. The setting of the question paper and the assessment will be done by the concerned teacher who has taught the course. Average score obtained out of two mid semester examinations will be considered for the preparation of final sessional marks / grades.

**Term end Examination and Evaluation:**

- Semester end examination (SEE) time table will be declared by the Dr. Babasheb Ambedkar Marathwada University, Aurangabad. Conduct practical examination with external expert, evaluate, satisfy the objection / query of the students (if any) and submit the result to DC in one week time from the date of examination of that particular course / paper.
- The semester end theory examination in each theory course / paper will be of 40 marks. The total marks shall be 50 for each theory course / paper (40 marks semester end exam + 10 marks internal tests).
- Pattern of semester end question paper will be as below:
  - The semester end examination of theory course / paper will have two parts ( 10+30 = 40 Marks)
  - Part A will carry short questions of 2-3 marks ( answer in sentence / multiple choice questions) as compulsory question and it should cover entire syllabus ( 10 Marks)
  - Part B will carry 5 questions (10 marks each). Students will have to attempt any 3 questions (30 Marks).
  - 10 to 20% weightage can be given to problems wherein use of non-programmable scientific calculator may be allowed.
  - Number of sub questions (with allotment of marks) in a question may be decided by the examiner.
- Semester end practical (skill) examination will be of 50 marks each (semester end examination only). Student must perform at least 8 experiments from each lab course. The final practical / project examination will be conducted at the end of each semester along with the theory examination. Students will be examined by one external and one internal examiner.

## Detailed B.Voc (Industrial Automation) Syllabus

### First Year: Semester I

| Course                                                                                                                                                                                                                                                                                                                                 | Course Title                                        | Teaching time/week                 | Internal |        | External |        | Total |        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|------------------------------------|----------|--------|----------|--------|-------|--------|
|                                                                                                                                                                                                                                                                                                                                        |                                                     |                                    | Marks    | Credit | Marks    | Credit | Marks | Credit |
| General Education component (Total Credits 12)                                                                                                                                                                                                                                                                                         |                                                     |                                    |          |        |          |        |       |        |
| E.I.A. 1.1                                                                                                                                                                                                                                                                                                                             | Introduction to PLC                                 | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 1.2                                                                                                                                                                                                                                                                                                                             | Basics of Electrical wiring techniques              | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 1.3                                                                                                                                                                                                                                                                                                                             | Introduction to sensors                             | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 1.4                                                                                                                                                                                                                                                                                                                             | Computer Fundamental                                | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| Skill Component (Total Credits 18)                                                                                                                                                                                                                                                                                                     |                                                     |                                    |          |        |          |        |       |        |
| S.I.A. 1.1                                                                                                                                                                                                                                                                                                                             | PLC programming applications in industry            | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 4      | 50    | 5      |
| S.I.A. 1.2                                                                                                                                                                                                                                                                                                                             | Electrical wiring used in industry                  | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 3      | 50    | 4      |
| S.I.A. 1.3                                                                                                                                                                                                                                                                                                                             | Sensor applications in industry                     | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 3      | 50    | 4      |
| S.I.A. 1.4                                                                                                                                                                                                                                                                                                                             | Basic skills, soft skills & personality development | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 4      | 50    | 5      |
| An internal mark consists of test, Tutorials, Seminars, Attendance, performance, Assignment of student, while External marks are for theory Examination or practical examination (conducted by skill sector or industrial partner). Practical marks include, practical performance, oral, regular completion of record books, project. |                                                     |                                    |          |        |          |        |       |        |

**E.I.A. 1.1: Introduction to PLC**

**(Credit 3) (50 marks) (45 Periods)**

Unit 1. Conventional control systems, PLC based control panels, PLC verses Computers, PLC advantages and disadvantages, Manufacturing and Assembly process, Types of PLC (micro PLC, modular PLC), PLC processor (function, operating systems, parts)

Unit 2. PLC hardware components (Input modules and components, Output modules and components), PLC memory organization , PLC addressing methods and file types. PLC ladder logic, symbols used in ladder logic, basic instruction (relay, logical, program control)

Unit 3. Data control instructions (data comparison, computation, conversion, transfer), PLC arithmetic instructions, File manipulation instructions (FAL, FSC, COP, FLL), file transfer operation

Unit 4. Types of Timers (ON, OFF, RETENTATIVE), Timer Instruction, Types of Counters (UP, DOWN), Counter Instruction, Sequencer Instruction (SQO, SQI, SQL), Shift Register (Synchronous, Asynchronous),

Reference Books:

1. Introduction to programmable Logic Controller, Gary Dunning
  2. Programmable Logic Controllers (principles and applications), John W. Webb and Ronald A. Reis.
  3. Programmable Logic Control NIFT; Prentice Hall India
  4. Instant PLC Programming with RSLogix 5000, by Austin Scott
  5. Advanced Programming Concepts!: Volume 2 (Plc Programming Using Rslogix 500), by Gary D. Anderson
  6. Programmable Logic Controllers: Programming Methods and Applications, by HACKWORTH
- 

**E.I.A. 1.2: Basics of Electrical wiring techniques (Credit 3) (50 marks) (45 Periods)**

Unit 1 **Electric wirings**, I.E. rules. Types of wirings both domestic and industrial. Specifications for wiring. Grading of cables and current ratings. Principle of laying out in domestic wiring.

**Wiring system** - P.V.C., concealed system. Maintenance and Repairing data sheet preparation. Specifications, standards for conduits and accessories - Power Wiring - Control Wiring - Communication Wiring. Testing of wiring, installation by meggar.

Unit 2 **D.C. generator:** Use of Armature, Field Coil, Polarity, Yoke, Commutator, slip ring Brushes, Laminated core. **D.C. Generators**-types, parts, self excitation and separately excited, Efficiency of D.C. Generator, Application of D.C. generators, D.C. batteries, Types of D.C. Batteries, applications of Batteries

**DC Motors** – Terms used in D.C. motor-Torque, Brake Torque, speed, Back-e.m.f. etc. and their relations, Types of D.C.Motor, Starters used in D.C. motors, Characteristics of D.C. Motor, Losses & Efficiency, Application of D.C. motors. Types of speed control of DC motors in industry.

**Transformer:** Classification, Working principle, Components, Auxiliary parts i.e. breather, Conservator, other protective devices. C.T., P.T. Instrument and Auto Transformer (Variac), Construction, Single phase and Poly phase. E.M.F. equation, parallel operation of transformer, their connections. Regulation and efficiency. Type of Cooling for transformer. Specifications, turn ratio, Special transformers. Transformer oil testing and Tap changer (off load and on load). Dry type transformer.

Unit 3.**Basic Electrical Components:** Resistor, capacitor, inductor, diodes, transistor, Transformers, switches, types of wires, types of phases, capacitor, fuse, oscilloscope (CRO), AC motors, motor starter, LCB, MCB, home devices, Series and parallel circuits, insulating material, motor winding, earthing, measuring instruments. home and industrial wiring, electrical generators, Home electrical appliances, electrical safety

**Electrical Measuring Instruments** - -types, indicating types. Deflecting torque, Controlling torque and Damping torque, PMMC & MI meter (Ammeter, Voltmeter) -Range extension -Multimeter(Digital/Analog) -Wattmeter - P.F. meter - Energy meter (Digital/analog) -Insulation Tester (Megger), Earth tester. -Frequency meter -Phase Sequence meter -Multimeter Analog and Digital -Tong tester Techometer

Unit 4 **Electrical circuits:** D. C. Circuits (Only Independent sources) Kirchhoff's law, ideal and practical voltage and current sources. Mesh and Nodal analysis (Super node and super Mesh excluded). Source transformation. Star delta transformation. Superposition theorem, Thevenin's theorem Norton's theorem, maximum power transfer theorem

**A.C. Fundamentals:** Sinusoidal voltage and currents: their mathematical and graphical representation, concept of cycle period, frequency, instantaneous, peak, average, r.m.s. values, peak factor, form factor, phase difference, lagging, leading and in phase quantities and phasor representation. Study of A.C circuits of pure resistance, inductance and capacitance and corresponding, voltage – current and power waveforms.

**Polyphase AC circuits:** Concept of three phase supply and phase sequence. Balanced and unbalanced loads voltage current and power relations in three phase balance star and delta loads and their phasor diagrams.

#### Reference books

- 1) Engineering by A.K.Sawhany (Meerut)
- 2) AC Circuits and Power Systems in Practice by Graeme Vertigan
- 3) Introduction to Electronics: DC/AC Circuits by Stephen C. Harsa
- 4) Electrical Machines by Prithwiraj Purkait and Indrayudh Bandyopadhyay
- 5) Fundamentals of DC and Ac Circuits by Mark E. Hazen
- 6) Electric Wiring by S. Samaddar
- 7) Electrical Materials & Wiring Practice by Prof. Sushant M. Nagare

- 8) IET Wiring Regulations: Electric Wiring for Domestic Installers, by Brian Scaddan
  - 9) Electrical Wiring: Industrial by R. L. Smith and Ray C. Mullin
  - 10) Electric Machinery and Transformers by Guru, Oxford
  - 11) ELECTRICAL TRANSFORMERS AND ROTATING MACHINES, 3RD EDITION  
by Stephen L. Herman
  - 12) Design of Transformers by Indrajit Dasgupta
  - 13) Electrical Measurements and Measuring Instruments by Rajput R.K.
  - 14) Electrical Measurements and Measuring Instruments by S. Kamakshaiah and J. Amarnath
  - 15) Principles of Electrical Design; D. C. and A. C. Generators by Alfred Still
  - 16) Principles of Electrical Engineering and Electronics by Mehta V.K. & Mehta Rohit
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### E.I.A. 1.3: Introduction to sensors

(Credit 3) (50 marks) (45 Periods)

**Unit 1: Motional and Dimensional measurement:** Introduction, Roll of sensors in automation classification of transducers, Fundamental Standards, units. **Linear Displacement:** Resistive Potentiometers, strain gauge, LVDT, Capacitive Piezoelectric, Hall Effect sensors, magnetostrictive, magnetoresistive, Optical displacement sensor fiber optic sensor, Ultrasonic distance Sensor, Piezoresistive, Linear encoder, Proximity sensors. **Rotational Displacement:** Revolution counter, Resistive potentiometers, RVDT, DC tachometer, AC tachometer, optical tachometer, Rotary encoder, eddy current, magnetic, stroboscope, gyroscope.

**Unit 2: Force, Torque measurement:** **Force:** Basic methods of force measurement (Spring, beam, diaphragm) Strain gauge: basic principal, gauge factor, types of strain gauge, materials and their properties, bonding material compensation techniques, bridge configuration, Tactile sensors. **Torque:** Torsion Bar, Flat Spiral Spring, Magnetostrictive Torsion Transducer, Dynamometers.

**Pressure Measurement: Manometers** — U tube, Well type, inclined tube, Ring balance, Micro manometer. **Elastic** – Bourdon, Diaphragm, Bellows and their types. **Electronic** – , Capacitive, Piezoelectric, Thin film, Variable reluctance, Vibrating element (Diaphragm and Wire). **High Pressure Measurement** – Bulk modulus cell, Bridgeman type. **Vacuum measurement:** McLeod gauge, Thermal Conductivity (Pirani, Thermocouple), hot cathode ionization gauge, Molecular momentum (Knudsen) gauge, Cold Cathode ionization (Penning) gauge.

**Unit 3: Temperature measurement:** Temperature Scales, Standards and Units and relations, Classification of temperature sensors **Mechanical:** Bimetallic Thermometer – Working Principle, Various types, Filled system thermometers. **Electrical:** Resistance Temperature Detectors – Principle, materials and their properties, Types and ranges. **Thermistor:** Types (NTC, PTC), Measuring Circuits. **Thermocouple:** Terminology, Types (B, E, J, K, R, S, T), determination of polarity, Characteristics, Laws of thermoelectricity, Lead wire compensation, Cold junction compensation techniques, Protection (Thermo well), EMF Measurement methods, Thermopiles. **Non-contact Types:** Pyrometers: Total Optical, Infrared

**Unit 4: Flow Measurement:** Units, Newtonian and non-Newtonian Fluids, Reynolds number, Laminar and turbulent flows, Velocity profile, Density. **Head type flow meters :** Orifice ( Eccentric , segmental , concentric ) , Different pressure taps, Venturi, Flow nozzle, Dahl tube, Pitot tube, Annu bar, Characteristics of head type flow meters. **Variable area type:** Rotameter **Open channel flow measurement:** Notch, Weirs Turbine, Target, Electromagnetic , Ultrasonic ( Doppler), Vortex shedding , Positive displacement , Anemometers ( Hot wire, Laser)  
**Level Measurement:** Float, Displacer (Torque tube unit), Bubbler, Diaphragm box, DP cell, Ultrasonic, Capacitive, Radioactive, Resistance.  
**Density Measurement:** Chain-balanced float type, Hydrometer (Buoyancy type), U tube type, Hydrostatic Head (Air bubbler, DP Cell), Oscillating Coriolis.  
**Viscosity:** Saybolt, Searle's rotating cylinder, Cone and plate, Falling and rolling ball, Rotameter **pH:** Nernst equation, Temperature compensation, Reference electrode, Measuring electrodes, Combined electrode, Maintenance and cleaners, **Conductivity measurement:** Probes, Cell constant, measuring circuits.

**Reference Books:**

- 1) Electronic Instrumentation by H. S. Kalsi
  - 2) Transducers and Instrumentation by Murty D.V.S
  - 3) Principle of industrial Instrumentation – Patranabis.
  - 4) Process Control Instrumentation Technology - C.D. Johnson (5th Edition).
  - 5) Process Measurement & analysis - B.G. Liptak (Vol-I)
  - 6) Instrumentation and Measurement Principles – D.V.S. Murthi
  - 7) Instrumentation Measurements and Analysis – B.C.Nakra and K.K.Choudhari
  - 8) Electronic Instruments & Measurement - A. K. Sawhney
  - 9) Applied Instrumentation volume 2, William Andrews
  - 10) Instrument Technology, E. B. Jones, vol. III
  - 11) Instrumentation–Devices and Systems by C.S.Ragan, G.R.Sarma and V.S.V.Mani,TMH Public.
  - 12) Electronic Instruments and instrumentation Technology by M.M.S.Anand.,Prentice-Hall of India.
  - 13) Measurement Systems - E.O. Doebelin (4th Edition).
  - 14) Instrumentation and Measurement Principles – D.V.S. Murthi
  - 15) Alan S. Morris; Principle of Measurement & Instrumentation (2/e) , PHI
  - 16) Process Measurement & analysis - B.G. Liptak (Vol-I)
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**E.I.A. 1.4: Computer Fundamentals**

(Credit 3) (50 marks) (45 Periods)

**Unit 1.Computer Fundamentals:** Introduction to Computer, Computer System Hardware, Computer ports, its type, serial, parallel, USB. Computer Memory Input and Output Devices Interaction between User and Computer Introduction to Free and Open Source Software Definition of Computer Virus, Use of Antivirus software.

**Unit 2. Basics of Operating System:** Definition of Operating System Objectives, types, and functions of Operating Systems Working with Windows Operating System: Introduction,

The Desktop, Structure of Windows, Windows Explorer, File and Folder Operations, The Search, The Recycle Bin, Configuring the Screen, Adding or Removing New Programs using Control Panel, Applications in windows (Paint, Notepad, WordPad, Calculator), Introduction Linux

Unit 3. **Business Communication Tools** | MS-Word: Introduction, Starting MS-Word, MS-Word Screen and its Components, Elementary Working with MS-Word MS-Excel: Introduction, Starting MS-Excel, Basics of Spreadsheet, MS-Excel Screen and Its Components, Elementary Working with MS-Excel MS-Powerpoint: Introduction, Starting MS-PowerPoint, Basics of PowerPoint, MS-PowerPoint Screen and Its Components, Elementary Working with MSPowerPoint

Unit 4: **INTERNET(Word wide Web)**:Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and SeARCh Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT – ACT, types of cyber crimes.

Reference Books:

- 1) Computer Fundamentals by Nagpal D.P.
  - 2) Computer Fundamentals by R. S. Salaria
  - 3) Computer Fundamentals by P. K. Sinha
  - 4) Computer Fundamentals, by Anita Goel
  - 5) Operating System Concepts 8th Edition By Abraham Silberschatz, Peter B. Galvin, Greg Gagne
  - 6) Operating System Principles by Silberschatz and Galvin
  - 7) Learning Computer Fund, MS Office and Internet & Web Technology by Dinesh Maidasani
  - 8) My Office 2016 by Paul McFedries
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**S.I.A. 1.1** PLC programming applications in industry      (Credit 5)      (50 marks)      (45 Periods)

1. Understanding Ladder logic
2. Study of input /output switches
3. Combination series and parallel switches and outputs
4. Study of basic instructions
5. Study of timer instructions
6. Study of counter instructions
7. Study of all logical instructions
8. Study of all mathematical instructions

9. Study of latch and unlatch instruction
  10. Describe the operation of XIC and XIO input instructions
  11. Describe the operation of an OTE instruction
- 

**S.I.A. 1.2 Electrical wiring used in industry (Credit 4) (50 marks) (45 Periods)**

Before doing any experiment follow the rules

1. Apply safe working practices.
2. Comply environment regulation and housekeeping
3. Interpret & use Company terminology and technical communication
4. To make simple wiring circuit with common electrical accessories with domestic electrical appliances for a specified voltage and current.
5. To carry out the necessary test for charging secondary battery individually, installation and grouping of batteries, care and maintenance of batteries.
6. To make a job profile according to the drawing.
7. Able to carry out earthing installation

**Experiments**

- 1) Demonstration on elementary first aid. Artificial Respiration. Practice on use of fire extinguishers. Health, Safety and Environment guidelines, legislations & regulations as applicable. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Basic safety introduction, Personal protective Equipment(PPE):- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Preventive measures for electrical accidents & steps to be taken in such accidents. Use of Fire extinguishers.
- 2) Demonstration of Trade hand tools. Identification of simple types- screws, nuts & bolts, chassis, clamps, rivets etc. Use, care & maintenance of various hand tools. Familiarization with signs and symbols of Electrical accessories
- 3) Practice in using cutting pliers, screw drivers etc. skinning the cables, and joint practice on single strand. Demonstration & Practice on bare conductors joints--such as rat tail, Britannia, straight, Tee, Western union. Joints
- 4) Practice in soldering & brazing- Measurement of Resistant and Measurement of specific Resistant. Application of Wheatstone bridge in measurement of Resistance
- 5) Demonstration and identification of types of cables. Demonstration & practice on using standard wire gauge & micrometer. Practice on crimping thimbles, Lugs. Examination and checking of cables and conductors and verification of materials according to the span.
- 6) Verification of Ohm's Law, Verification of Kirchhoff's Laws. Verification of laws of series and parallel circuits. Verification of open circuit and closed circuit network. **Measuring unknown resistance using Wheatstone bridge, voltage drop method.** Experiment to demonstrate the variation of resistance of a metal with the change in temperature.

- 7) Practice on installation and overhauling common electrical accessories as per simple Electrical circuit / Layout. Fixing of switches, holder plugs etc. in T.W. boards. - Identification and use of wiring accessories concept of switching.
- 8) Assembly of a Dry cell- Electrodes-Electrolytes. Grouping of Dry cells for a specified voltage and current, Ni cadmium & Lithium cell. Practice on Battery Charging, Preparation of battery charging, Testing of cells, Installation of batteries, Charging of batteries by different methods. Practice on Electroplating and anodising, Cathodic protection. Routine care & maintenance of Batteries
- 9) Charging of a Lead acid cell, filling of electrolytes- Testing of charging checking of discharged and fully charged battery
- 10) Marking use of chisels and hacksaw on flats, sheet metal filing practice, filing true to line. Sawing and planing practice. Practice in using firmer chisel and preparing simple half lap joint.
- 11) Drilling practice in hand drilling & power drilling machines. Grinding of drill bits. Practice in using taps & dies, threading hexagonal & square nuts etc. cutting external threads on stud and on pipes, riveting practice.
- 12) Practice in using snips, marking & cutting of straight & curved pieces in sheet metals. Bending the edges of sheets metals. Riveting practice in sheet metal. Practice in making different joints in sheet metal in soldering the joints.
- 13) Trace the magnetic field. Assembly / winding of a simple electro magnet. Use of magnetic compass. Identification of different types of Capacitors. Charging and discharging of capacitor, Testing of Capacitors using DC voltage and lamp.
- 14) Determine the characteristics of RL, RC and RLC in A.C. Circuits both in series and parallel. Experiment on poly phase circuits. Current, voltage, power and power factor measurement in single & poly- phase circuits. Measurement of energy in single and poly-phase circuits. - Use of phase sequence meter.
- 15) **Practice on Earthing**- different methods of earthing. Measurement of Earth resistance by earth tester. Testing of Earth Leakage by ELCB and relay.
- 16) Determine the resistance by Colour coding Identification of active/passive components. **Diodes**-symbol - Tests - Construct & Test Half wave rectifier ckt. Full wave rectifier ckt. Bridge rectifier ckt.

#### Task II

1. Identify DC machines and measure the resistance.
  2. To build up voltage in a DC generator
  3. Able to connect, test and run a DC motor.
  4. To install and connect transformers, parallel connection, carryout necessary maintenance, able to connect and use CT and PT.
  5. Able to install different measuring instruments with electrical circuits.
- 
- 1) Different wave shapes of rectifiers and their values using C.R.O. Identification of terminals, **construction & Testing of transistor. Assembly and testing of a single stage Amplifier and checking using an oscilloscope.**
  - 2) Measure Voltage, current & wave shape of oscillator using CRO. Simple circuits containing U.J.T. for triggering, FET as an amplifier and Power control circuits by S.C.R. and Diac, triac, I.G.B.T. Logic gates and circuits.

- 3) Practice in casing, Capping. Conduit wiring with minimum to more number of points. Use of two way switches. Testing of wiring installation by meggar. -Fixing of calling bells/buzzers. -Making of test boards & extension boards Identification & demonstration on conduits and accessories & their uses, cutting , threading & laying Installation, Testing, Maintenance and Repairing of wiring.
  - 4) Application of fuses, relay, MCB, ELCB.
  - 5) Identification of the parts of a D.C. machine. Connection of shunt Generators Voltages build up in DC Shunt Generator (OCC) Measurement of voltages, Demonstration on field excitation.
  - 6) Connection of compound Generator, Voltage measurement, cumulative and differential – No Load and Load characteristics of Series, Shunt and Compound Generator. Controlling and protecting DC Generator. Practicing dismantling and assembling in D.C. Machine.
  - 7) Identification of parts and terminals of DC motors. Connection, starting, running of DC motors using Starters. Characteristics curve of DC motors. Practical application of D.C. motors.
  - 8) Speed control of DC motors by voltage , field, armature & Ward-Leonard system.
  - 9) Identification of types of transformers. Connection of transformers, Transformation ratio, OC (No-load) and SC (short circuit) tests, efficiencies of transformers, testing of transformer, parallel operation of transformer. Use of Current Transformer (C.T.) and Potential (Voltage) transformer (P.T.) Testing of single phase and Three Phase Transformers - Cleaning, maintenance, testing and changing of oil. Single and three phase connection.
  - 10) Identify the type of Instruments. Use of -PMMC , MI meter, Multi-meter(Digital/Analog) , Wattmeter, P F meter, Energy meter, Frequency meter, Calibration of - Multi-meter Phase sequence meter, Digital Instruments, etc Calibration of Energy meter.
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### S.I.A. 1.3 sensor applications in industry

(Credit 4) (50 marks) (45 Periods)

1. Study of temperature sensor (thermistor)
2. Study of temperature sensor (thermocouple)
  - Introduction to temperature measurement
  - Define Temperature, Heat and Energy ( Temperature scales)
  - Temperature measuring devices, their operation and Transmitters
  - Temperature calibrating instruments
  - Installs, calibrates and services temperature measuring devices
  - Characterization of Thermocouples (J/T/K/R/S)
  - Characterization of RTD (PT100)
3. Study of pressure sensors

- Introduction to pressure measurement
- Types of pressure measuring devices and transmitters
- Installation of pressure measuring devices
- Configure / calibrate pressure measuring devices
- Maintain device (Manufacturers' recommended maintenance procedures)
- Calibration of pressure gauge using dead weight pressure tester and preparation of report for the same.
- Measurement of Pressure using Bellows, Bourdon gauge, Diaphragm.
- Calibration of positive pressure gauges using Dead weight tester.
- 4. Study of level sensor
  - Introduction to level measurement
  - Level measuring devices, their operation and Transmitters
  - Calibration instruments used on level measuring devices
  - Install, calibrate and service level measuring devices
  - Level measurement using capacitive/ resistive/ air purge method.
- 5. Study of flow sensor
  - Measurement of flow using DP cell
  - Measurement of flow Orifice and Venturi.
  - Calibration of Rotameter.
- 6. Study of displacement sensor
  - Measurement of displacement using LVDT
  - Study of linear and rotary encoder as displacement sensor.
- 7. Study of position sensor
- 8. Study of proximity sensor
- 9. Study of limit switch
- 10. Study of photoemissive sensor
- 11. Study of photo detector
  - ( Photodiodes, Phototransistor, Photoresistors, photovoltaic cell, )
- 12. Study of magnetic sensor
- 13. Characterization of strain gauge indicator and weight measurement using load cell.
- 14. Calibration of vacuum gauge using vacuum gauge tester and preparation of the report.

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S.I.A.1.4 basic skills, soft skills & personality development  
(Credit 5) (50 marks) (45 Periods)

#### Unit 1 : Basic skills

- i. **Reading:** Locate, understand and interpret written information in prose **Arithmetic & Mathematical Operations:** Perform basic computations and approach practical problems by choosing appropriately from a variety of mathematical techniques.
- ii. **Listening:** Receive, attend to, interpret, and respond to verbal messages and other cues.

- iii. **Thinking Skills:** Creative Thinking, Decision Making, Problem solving, Visualize, Reasoning,
- iv. **Personal Qualities:** Responsibility, Self-Esteem, Sociability, Self-management, Integrity & Honesty

#### **UNIT 2: Communication Skill (06 hours)**

- a) Importance of communication, types, barriers of communication, effective communication
- b) **Speaking Skills** – Importance of Speaking, effectively, speech process, message, audience, speech style, feedback, conversation and oral skills, fluency and self expression, body language phonetics and spoken English, speaking techniques, word stress, voice quality, correct tone, types of tones
- c) **Presentation skills** - planning, preparation, organization, delivery.
- d) **Written Skills – Formal & Informal letter writing, Report writing, Resume writing** - Sentence structure, sentence coherence, emphasis. Paragraph writing, letter writing skills - form and structure, style and tone. Inquiry letters, Instruction letters, complaint letters, Routine business letters, Sales Letters etc.

#### **Unit 3 : soft skills**

##### **Interpersonal relationship (04 hours)**

- a) **Team work, Team effectiveness, Group discussion, Decision making** – Team Communication, Team, Conflict Resolution, Team Goal Setting, Team Motivation Understanding Team development
- b) **Group Discussion-** Preparation for a GD, Introduction and definitions of a GD, Purpose of a GD, Types of GD, Strategies in a GD

##### **Leadership skills (02 hours)**

**Leaders' role, responsibilities and skill required** - Understanding good Leadership behaviours. Learning the difference between Leadership and Management, Beliefs and Rules, Defining Qualities and Strengths of leadership, Making Key Decisions, Empowering, Motivating and Inspiring Others. Leading by example.

#### **UNIT 4: Other skills (02 hours)**

- a) **Time management-** The Time management matrix, apply the Pareto Principle (80/20 Rule) to time management issues, to prioritise using decision matrices, to beat the most common time wasters, how to plan ahead, how to handle interruptions, to maximise your personal effectiveness, how to say “no” to time wasters, develop your own individualised plan of action
- b) **Stress management-** understanding the stress & its impact, techniques of handling stress
- c) Problem solving skill, Confidence building Problem solving skill, Confidence building
- d) Facing Interviews: Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview, Behavioral Skills: Problem Solving Confidence Building Attitude

#### **Term Work/Assignments**

**Term work will consist the record of any 8 assignments of following exercises**

1. SWOT analysis
2. Personal & Career Goal setting – Short term & Long term
- 3 Presentation Skill
4. Letter/Application writing
5. Report writing

6. Listening skills
  7. Group discussion
  8. Resume writing
  9. Public Speaking
  10. Stress management
  11. Team Activity-- Use of Language laboratory
- \* Perform any 8 exercises out of above 11 with exercise no. 11 as compulsory.
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**Text Books:**

1. Communication Skills : Sanjay Kumar and Pushpa Lata , Oxford University Press
2. Developing Communication Skill : Krishna Mohan, Meera Banerji,- McMillan India Ltd.
3. English for Business Communication : Simon Sweeney , Cambridge University Press

**1. Books for references:**

1. NASSCOM-Global Business Foundation Skills: Accenture,Convergys,Dell et.al. Foundation Books : Cambridge University Press
  2. Basic Managerial Skills for all E. H. McGrath, Eastern Economy Edition, Prentice hall India.
  3. Personality Development and Group Discussions,Barun K. Mitra, Oxford University Press
  2. Group Dissussions and Interview Skills : Priyadarshi Patnaik : Foundation Books : Cambridge University Press
  3. Thinks and Grow Rich: Napoleon Hill, Ebury Publishing, ISBN 9781407029252
  4. Awaken the Giant Within: Tony Robbins HarperCollins Publishers, ISBN-139780743409384
  5. Change Your Thoughts, Change Your Life: Wayne Dyer, Hay House India, ISBN-139788189988050
  6. 8 Habits of Highly Effective People: Stephen Covey Pocket Books, ISBN-13 9781416502494
  7. 9The Power of Your Subconscious Mind: Dr Joseph Murphy Maanu Graphics , ISBN-13 9789381529560
  8. The new Leaders: Daniel Coleman Sphere Books Ltd , ISBN-139780751533811
  9. The 80/20 Principal: by Richard Koch, Nicholas Brealey Publishings , ISBN-13 9781857883992
  10. Time management from inside out: Julie Morgenstern, Owl Books (NY), ISBN-13 9780805075908
  11. Wonderland of Indian Manageress: Sharu Ranganekar, Vikas Publishing Houses,ISBN-13 9788125942603
  12. You can win: Shiv Khera, Macmillan, ISBN-139789350591932
  13. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success: Gopalaswamy Ramesh, Mahadevan Ramesh
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**First year: Semester Second**

| Course | Course Title | Teaching | Internal | External | Total |
|--------|--------------|----------|----------|----------|-------|
|--------|--------------|----------|----------|----------|-------|

|                                                                                                                                                                                                                                                                                                                                        |                                                             | time/week                          |       |        |       |        |       |        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|------------------------------------|-------|--------|-------|--------|-------|--------|
|                                                                                                                                                                                                                                                                                                                                        |                                                             |                                    | Marks | Credit | Marks | Credit | Marks | Credit |
| General Education component (Total Credits 12)                                                                                                                                                                                                                                                                                         |                                                             |                                    |       |        |       |        |       |        |
| E.I.A. 2.1                                                                                                                                                                                                                                                                                                                             | Mathematics -I                                              | 3 hours (4 period of 45 minutes)   | 10    | 1      | 40    | 2      | 50    | 3      |
| E.I.A. 2.2                                                                                                                                                                                                                                                                                                                             | Electronics                                                 | 3 hours (4 period of 45 minutes)   | 10    | 1      | 40    | 2      | 50    | 3      |
| E.I.A. 2.3                                                                                                                                                                                                                                                                                                                             | Instrumentation                                             | 3 hours (4 period of 45 minutes)   | 10    | 1      | 40    | 2      | 50    | 3      |
| E.I.A. 2.4                                                                                                                                                                                                                                                                                                                             | Computer networking                                         | 3 hours (4 period of 45 minutes)   | 10    | 1      | 40    | 2      | 50    | 3      |
| Skill Component (Total Credits 18)                                                                                                                                                                                                                                                                                                     |                                                             |                                    |       |        |       |        |       |        |
| S.I.A. 2.1                                                                                                                                                                                                                                                                                                                             | Computer hardware & networking applications in industry     | 4.5 hours (6 period of 45 minutes) | 10    | 1      | 40    | 4      | 50    | 5      |
| S.I.A. 2.2                                                                                                                                                                                                                                                                                                                             | Electronics applications in industry                        | 4.5 hours (6 period of 45 minutes) | 10    | 1      | 40    | 3      | 50    | 4      |
| S.I.A. 2.3                                                                                                                                                                                                                                                                                                                             | Instrumentation applications in industry                    | 4.5 hours (6 period of 45 minutes) | 10    | 1      | 40    | 3      | 50    | 4      |
| S.I.A. 2.4                                                                                                                                                                                                                                                                                                                             | Linguistic Proficiency (English) with Language lab training | 4.5 hours (6 period of 45 minutes) | 10    | 1      | 40    | 4      | 50    | 5      |
| An internal mark consists of test, Tutorials, Seminars, Attendance, performance, Assignment of student, while External marks are for theory Examination or practical examination (conducted by skill sector or industrial partner). Practical marks include, practical performance, oral, regular completion of record books, project. |                                                             |                                    |       |        |       |        |       |        |

**E.I.A. 2.1 Mathematics -I**

**(Credit 3) (50 marks) (45 Periods)**

**Statistical Methods, data Interpretation and Business mathematics for all specializations**

Unit 1. Probability and Statistics.

1.1 Permutation and combination. 1.2 Simple concept of probability and laws of probability. addition rule, conditional probability, multiplication rule, 1.3 Conditional probability. Probability mass function and probability density function 1.4 Frequency and cumulative frequency distribution. 1.5 Measure of central tendency. 1.6 Measure of dispersion. 1.7 Normal, Binomial and Poisson distributions and their applications.

Unit 2. Exploratory Data Analysis and Descriptive Statistics

2.1 Examples of Random Variables and Associated Data Types 2.2 Graphical Displays of Sample Data • Dotplots, Stemplots,... • Histograms: Absolute Frequency, Relative Frequency, Density 2.3 Summary Statistics • Measures of Center: Mode, Median, Mean,... (+ Shapes of Distributions) • Measures of Spread: Range, Quartiles, Variance, Standard Deviation...

Unit 3. Correlation and Regression

3.1 Introduction, Definitions, Curve Fitting, equation of Straight line, parabola and exponential Linear Correlation and Regression (+ Least Squares Approximation) 3.2 Extensions of Simple Linear Regression • Transformations (Power, Logarithmic) 3.3 Regression Models 3.4 Power Law Growth, Exponential Growth, Multilinear Regression, Logistic Regression, 3.4 Errors and Error analysis Errors, Blunders. 3.5 Types of Errors, a. Systematic Errors b. Random Errors . 3.5 Error Sources... a. Natural Errors ..., b. Instrument Errors..., c. Human Errors ....

Unit 4. Numerical Methods:

4.1 Solution of a system of linear equations by L-U decomposition, 4.2 Gauss-Jordan and Gauss-Seidel Methods, 4.3 Newton's interpolation formulae, Solution of a polynomial and a transcendental equation by Newton-Raphson method, 4.4 numerical integration by trapezoidal rule, 4.5 Simpson's rule and Gaussian quadrature, numerical solutions of first order differential equation by Euler's method

Reference books:

- 1) Numerical Methods for Scientists and Engineers (Dover Books on Mathematics) Paperback by Richard W. Hamming (Author)
- 2) Numerical Methods in Science and Engineering ,by Rajasekaran S.
- 3) Linear Regression And Correlation: A Beginner's Guide, by Scott Hartshorn
- 4) Probability: For the Enthusiastic Beginner, by David Morin
- 5) Probability and Statistics for Engineers and Scientists: PNIE, 9e, by Walpole
- 6) An Introduction to Probability and Statistics, 2ed, by Vijay K. Rohatgi and A.K. Md. Ehsanes Saleh

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**E.I.A. 2.2 Electronics**

**(Credit 3) (50 marks) (45 Periods)**

**Unit 1. Semiconductors, Amplifiers and Oscillators :** Diodes, BJT, FET, UJT, SCR, Diac, Triac (Construction ,Characteristics and working )  
Amplifiers: Transistor basing, CE, CB and CC amplifiers  
Oscillators: Barkhausen criteria, Wein bridge oscillator, RC phase shift oscillator, Hartley and Colpitts oscillator.

**Unit 2. Power Supply:** AC power Supply, Three Phase Power Supply, DC Power Supply: Regulated Power Supply ( using Transistor, ICs), Single phase AC-DC converters: working principles,

performance parameters, control of ac-dc Filters : Low, high, band pass, band rejection. Converters. DC-DC converters: control of dc-dc converter, Voltage regulators: Linear and DC voltage, regulators, basics of switching regulator: Voltage and current waveforms, basics of step-down, switching regulator.

Unit 3. **Operational amplifier(Op-amp.)** Characteristics of Operational amplifier, OPAMP parameters, inverting, non-inverting, OPAMP as differentiator, OPAMP as Schmitt trigger. Voltage summing with average, Voltage subtracter, Current booster, Integrator, and practical integrator, Differentiator and practical differentiator,

Unit 4. **Digital electronics:** Boolean Algebra, Logic Gates: Basic gates- AND, OR, NOT, Derived gates- NAND, NOR, EX-OR, EX-NOR, Number System & Codes: Decimal, Binary, Octal, Hexadecimal, Binary arithmetic, BCD, EBCDIC, ASCII, gray code, Excess-3 code.

**Text Books:**

4. Ramakant Gaikwad, "Operational Amplifiers" PHI, 3<sup>rd</sup> ed., 1992
5. William D. Stanley, "Operational Amplifiers With Linear Integrated Circuits", 4<sup>th</sup> ed., Pearson Education India, 2002.

**Reference Books:**

6. Paul Horowitz, Winfield Hill, "The Art of Electronics", 2<sup>nd</sup> Ed., Cambridge University press, 2008.
7. Digital electronics by Malvino leach
8. Basic electronics by V K mehta

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**E.I.A. 2.3 Instrumentation**

**(Credit 3) (50 marks) (45 Periods)**

**Unit I: Introduction:** Static and Dynamic characteristics of instruments, dead zone, hysteresis, threshold, resolution, input & output impedance, loading effects, fundamentals of measurements, Types of Error, Statistical Analysis, Probability of Errors, Limiting Errors, calibration of instruments, traceability, calibration report & certification.

**Unit II: Analog Indicating Instruments :** DC galvanometer, PMMC and Moving Iron instruments, voltmeters, ammeters, ohmmeters, multi-meters and extension of range of instruments, AC indicating instruments, Potential and current transformers, watt-meters, energy meters, DC Potentiometers, self-balancing potentiometers, standardization, application

**Unit III: Bridge Circuits: DC bridges:** Wheatstone bridge and Kelvin bridge design, null type and deflection type bridges, applications of DC bridges. **AC bridges:** General equations for bridge balance, Maxwell bridge, Hey bridge, Schering bridge, Wein bridge, applications of AC bridges. **Oscilloscope:** Introduction, Oscilloscope Block Diagram, Cathode Ray Tube, CRT

Circuits, Vertical Deflection System, Delay Line, Multiple Trace, Horizontal Deflection System, front panel controls, deflection sensitivity, dual trace CRO, Oscilloscope Probes, measurement of electrical parameters like voltage, current, frequency, phase, Digital Storage Oscilloscope

**Unit IV: Digital Instruments:** Block diagram, principle of operation, Accuracy of measurement Digital Multimeter, Kilo Watt Hour meter, Phase meter, Digital Tachometer, Ultrasonic Distance meter, Digital Thermometer. **Recording Instruments and Waveform Generation:** Principle and working of strip chart and X-Y recorders, single and multi-channel recorders, driving systems for pen and chart, chart speed and their applications, Waveform generation methods, Function generator, Virtual Instrumentation

**Text and reference books:**

1. Electrical and Electronics Measurements and Instruments ,Sahwaney A K
2. W. D. Cooper & A. D. Helfrick, '*Electronic Instrumentation And Measurement Techniques*', PHI,4th e/d, 1987
3. David Bell, '*Electronic Instrumentation and Measurements*', PHI, 2e/d,
4. Anand M. M. S., '*Electronic Instruments and Instrumentation Technology*',PHI, 2004
5. Kalsi H. S., '*Electronic Instrumentation*', TMH, 2nd e/d, 2004
6. R. Subburaj, '*The foundation for ISO 9000 and TQM*',
7. Bouwens A. J., '*Digital Instrumentation*'
8. Electronic Instrumentation and Measurement Techniques byH. Cooper, PHI
9. Digital Instrumentation by A. J. Bowen
10. Electronic Instrumentation Handbook by Coombs.
11. Electronic Instrumentation by Oliver Cage, McGraw Hill.
12. ElectronicInstrumentation by J. J. Carr.
13. Electrical and Electronic Measurements and Instrumentation by David A. Bell
14. Electrical and Electronics Measurement and Instrumentation by A.K. Sawhney
15. Electronic Instruments and Instrumentation Technology by Anand M. M. S.

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**E.I.A. 2.4 Computer networking**

**(Credit 3) (50 marks) (45 Periods)**

**Unit1:** Networking Fundamentals -Definition, Need, Applications - Network Topologies o BUS, STAR, MESH, Hybrid: Definition, Advantages & Disadvantages, Applications - OSI Reference Model: Diagram, Working & Significance of Each Layer. - Protocol Basics: Definition, Types of Protocols, Usage of Various Protocols & Port nos : TCP/IP, NetBeui, VPN, SNMP, FTP/SMTP/POP/HTTP,SSL/TSL -Arcnet, Ethernet, MAN, SAN, NAS, Virtual LANs, ATM's:- Definition, Need, Significance, Application - Networking Components (Hardware): Cables & Connectors (Coaxial, UTP/STP, Fiber Optics, Cat(x) Cables), Switches (Unmanaged, Smart Web Managed, Full Managed), Hardware/Software Firewall, Study of UTM, Wireless Routers

DSL/ADSL – Latest Examples and Usage Advances in Network Applications: Mobile as a Network Client, Types & Application of CCTV Network, Types and Application of Access Control Devices

Unit 2: Network Hardware and Components Concept of Server, client, node, segment, backbone, host etc. Analog and Digital transmission, Network Interface Card, Crimping tools and Color standards for Straight crimping and Cross crimping Functions of NIC, Repeaters, Hub, Switches, Routers, Bridges, Router etc.

Classification of Servers – Latest Versions with Examples and Applications - Concept of Client Server Technology- Definition, Need, Significance, Application - Application Server- Definition, Need, Significance, Application - File/Storage / Print Server- Definition, Need, Significance, Application - Mail / Web Servers- Definition, Need, Significance

Unit3: Server Operating Systems - Introduction to Network Operating Systems - Functions of Network Operating System - Concepts of Thick Servers and Thin Clients, RDP Devices - Microsoft Network Operating Systems - Linux Operating Systems, Android OS and its Flavors, IOS, Win8 for Mobile - DNS,WINS, DHCP, Concepts - User and Group Management Concepts

Unit 4: Internet of things (IoT):

1. Introduction: Internet of Things. Integration of embedded computers, WSNs and everyday Things; RFID/GRIFS, EPC, WSNs/Mobile, etc.
2. Security and Privacy: Definitions, notions, relations, needs, threats, requirements; Privacy Enhancing Technologies (PET), etc.
3. Decentralized and Interoperable Internet of Things: REST ful and Web-oriented approaches, Object-Information Distribution Architecture, Object Naming Service (ONS), Service Oriented Architecture, Network of Information, etc.
4. Composition models for the Web of Things and resources on the Web: Discovery, search, Web mashups and other.
5. Semantic technologies (e.g. ontologies, microformats, context, etc.) for describing and discovering things
6. Interaction models and paradigms between human and things (mobile interfaces, etc).
7. Concrete applications and use-cases of Web-enabled Things: Energy management & smart homes, Ambient Assisted Living, Intelligent Transport, etc.

Books for References:

1. Cisco Certified Network Associate – BPB Publication
2. Upgrading and Trouble Shooting of Networks by Zackers
3. Linux Bible (Any Publication)
4. Mastering Windows 2003 Server by Minasi
5. Computer Networks by Tanen Baum
6. Network Hand Book by Taylor
7. Computer Network Protocols, Stds, & Interfaces

8. Firewalls – A Complete Guide by Black
  9. Firewall & Internet Security by Cheswick Bellovin
  10. Network + Certification by Microsoft Press
  11. Upgrading & Repairing PC's by Scott Muller
  12. Networking Complete BPB Publication (2) Computer Networking Andrew S. Tanenbawan By PHI
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**S.I.A.2.1** Computer hardware & networking applications in industry  
(Credit 5) (50 marks) (45 Periods)

Basic computer

(Students are expected to perform minimum 5 experiments.)

- 1) Working with windows ,
- 2) Practical's related to MS Excel
- 3) Practical's related to MS word
- 4) Practical's related to Power point
- 5) File copy, pest, move

Practical Work

(Students are expected to perform minimum 10 experiments.)

- 1) Testing and Measurement of SMPS
- 2) Assembling of a Computer
- 3) Installation of different Operating Systems
- 4) Installation of different device drivers
- 5) Installation of different Application Software
- 6) To Run All Dos Command (Internal and External Dos Command)
- 7) Assembling and Disassembling Of a Computer System
- 8) Installation of Different Operating Systems : Windows XP, Windows 7
- 9) Troubleshooting and Repair Operating System : Windows XP, Windows 7
- 10) Tacking Data Backup and System Formatting and OS Installation
- 11) Installation of Different Device and Drivers PCI, PCI-E, AGP
- 12) Installation of Ms Office 2003, Ms-Office 2007 and Ms-Office 2010
- 13) Installation of On Board and PCI Device Driver
- 14) Installation of Application Software : Photoshop 7.0, Page Maker 6.5, CorelDraw 12
- 15) Installation of CD-DVD Burning Software like: Nero 7.0 & PowerISO 4.0
- 16) Installation and Troubleshooting Different types of Antivirus Software
- 17) Installation and Troubleshooting of Printer (Dot-Matrix and Laser Printer)
- 18) Installation and Troubleshooting of Scanner (Photo & Bar Code Scanner)

- 19) To Repair and Troubleshooting of SMPS, Monitor, Printer and Motherboard
- 20) To Install All Types of Connectors and Converters
- 21) To Run All Types of Network Troubleshooting Command

#### Practical II

(Students are expected to perform minimum 10 experiments.)

- 1) Installing and Configuring Windows 2003 and 2008 Server
- 2) Cable Crimping using Different Color Codes (Straight and Cross Cable )
- 3) Installation and configuring Peer to Peer and Server-Client Network
- 4) Installation and Configuring Active Directory Services
- 5) Installation and Configuring DNS & DHCP Services
- 6) Installation and Configuring FTP, HTTP Services
- 7) Backup and Restoration for ADS, DHCP and User Data
- 8) FAT and NTFS Sharing Permission
- 9) Configuring & Implementing Unmanageable Network Switch
- 10) Configuring & Implementing Manageable Network Switch
- 11) Configuring a Local Security Policies & Domain Security Policies
- 12) Installing Printer in Windows XP, Windows 7, Windows 2003 & 2008 Server
- 13) Configuring Gateway Service for Internet Connectivity
- 14) Configuring ADSL+2 Router for BSNL Internet Connectivity
- 15) Configuring Wireless Access Point
- 16) Installation and Configuring Wire Network
- 17) Installation and Configuring Wireless Network
- 18) Installation of AD-hoc Wireless Network
- 19) Installation and Configure Different Antivirus Software and Admin Console
- 20) Remote Desktop, Remote Assistance, Telnet, HyperTerminal, Team-Viewer

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#### **S.I.A. 2.2 Electronics applications in industry**

**(Credit 4) (50 marks) (45 Periods)**

(Students are expected to perform minimum 10 experiments.)

1. Study of logic gates (OR,AND, NAND, NOR, EX-OR)
2. Study of OPAMPS (Inverting, Non-Inverting, Adder, Subtractor, Integrator)
3. Design of Power supply (Using Transistor, IC)
4. Transistor amplifiers (CE, CB, CC)
5. Study of Diodes, BJT, FET, UJT, SCR, Diac, Traic
6. Study of oscillators (Wein bridge oscillator,RC, Hartely)

7. Band width measurement of Inverting and Non-inverting amplifier
8. Designing and implementation of Integrator
9. Designing and implementation of Differentiator
10. Comparator, Schmitt trigger
11. Voltage regulators: linear variable regulator LM723
12. Measurement of performance of voltage regulator

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**S.I.A. 2.3 Instrumentation applications in industry (Credit 4) (50 marks) (45 Periods)**

**List of Experiments** (Students are expected to perform minimum 10 experiments.)

- 1) Design of multirange ammeter and voltmeter, conversion of ammeter into voltmeter.
- 2) Design of series and shunt type ohmmeter.
- 3) Design of DC Bridges.
- 4) Design and Study of AC Bridges.
- 5) Measurement of unknown voltage using D.C. potentiometer.
- 6) Measurement of power using wattmeter (Single phase)
- 7) Measurement of power using Energymeter (Single phase.)
- 8) Measurement of voltage, Frequency and phase using CRO,
- 9) Study of Arbitrary Waveform Generator
- 10) Study of R, L, C, Q meter
- 11) Study of CRO (voltage, current, frequency, phase)
- 12) Study of Digital Storage Oscilloscope
  
- 13) Study of Function generator
- 14) Study of DC galvanometer, PMMC and Moving Iron instruments, voltmeters, ammeters, ohmmeters, multi-meters, watt-meters, energy meters
- 15) Study of AC indicating instruments, Potential and current transformers, DC Potentiometers, self-balancing potentiometers

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**S.I.A. 2.4 Linguistic Proficiency (English) with Language lab training (Credit 5) (50 marks) (45 Periods)**

LIST OF EXERCISES

- 1) a) CALL Lab Introduction to Phonetics- Speech Sounds- Vowels and Consonants  
b) ICS Lab Ice Breaking Activity, Prepositions, Word Formation-Prefixes & suffixes, Synonyms & Antonyms
- 2) a) CALL Lab Structure of Syllables- Past Tense Marker and Plural Marker- Weak forms and Strong forms- Consonant Clusters  
b) ICS Lab Situational Dialogues- Role Play- Expressions in various situations- Self introduction and introducing others Greetings- Apologies- Requests- Social and Professional Etiquette- Telephone Etiquette Concord (Subject in agreement with Verb) and words often misspelt- confused/misused.
- 3) a) CALL Lab Minimal Pairs- Word Accent and Stress Shifts- Listening Comprehension.  
b) ICS Lab Descriptions- Narrations- Giving directions and guidelines Sequence of Tenses, Question Tags and One Word Substitutes.
- 4) a) CALL Lab Intonation and Common Errors in Pronunciation.  
b) ICS Lab Extempore- Public Speaking Active and Passive Voice, Common Errors in English, Idioms and Phrases.
- 5) a) CALL Lab Neutralization of Mother Tongue Influence and Conversation Practice.  
b) ICS Lab Information Transfer- Oral Presentation Skills Reading Comprehension and Job Application with Resume Preparation.
- 6) Study of Functions of organs of speech, Manner and Place of Articulation and Speech Anatomy
- 7) Study of English vowel (Monophthones and Diphthongs)
- 8) Study of English consonant
- 9) Study of Supra-segmental
- 10) Practicing the following modules through self- learning software:
  - a. Grammar with special emphasis on Tenses
  - b. Pronunciation: of consonants, vowels, syllables and individual words
  - c. Word Stress: based on accentual patterns
  - d. Rhythm in speech based on content words and strong words
  - e. Intonation: rising, falling and rising- falling tone
  - f. Pause groups
  - g. Speech making / public speaking
- 11) Introducing self and others keeping in mind kinesics.
- 12) Common conversation practice (making small talk etc.).
- 13) Asking for permission.
- 14) Making requests.
- 15) Describing events / people / places
- 16) Extempore.
- 17) JAM Session (Just a Minute Session).
- 18) Role play
- 19) Holding informal discussions.
- 20) Logical presentation of one's views on a given topic.

- 21) Delivering a speech using Stress, Rhythm and Intonation.
- 22) Practicing the following modules through self- learning software:
- Pronunciation: of consonants, vowels, syllables and individual words
  - Word Stress: based on accentual patterns
  - Rhythm in speech based on content words and strong words
  - Intonation: rising, falling and rising- falling tone
  - Pause groups
  - Presentation skills
- 23) Participating in Mock Interviews
- 24) Participating in Group Discussions
- 25) Giving Presentations keeping in mind Kinesics, Para language, and Proxemics
- 26) Participating in Role Play for enhancing interpersonal and corporate communication skills

**Second Year: Semester III**

| Second Year, Semester III                      |                                               |                                    |          |        |          |        |       |        |
|------------------------------------------------|-----------------------------------------------|------------------------------------|----------|--------|----------|--------|-------|--------|
| Course                                         | Course Title                                  | Teaching time/week                 | Internal |        | External |        | Total |        |
|                                                |                                               |                                    | Marks    | Credit | Marks    | Credit | Marks | Credit |
| General Education component (Total Credits 12) |                                               |                                    |          |        |          |        |       |        |
| E.I.A. 3.1                                     | Hydraulics                                    | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 3.2                                     | Pneumatics                                    | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 3.3                                     | HMI & MMI                                     | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 3.4                                     | Environmental science                         | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| Skill Component (Total Credits 18)             |                                               |                                    |          |        |          |        |       |        |
| S.I.A. 3.1                                     | Hydraulics applications in industry           | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 4      | 50    | 5      |
| S.I.A. 3.2                                     | Pneumatics applications in industry           | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 3      | 50    | 4      |
| S.I.A. 3.3                                     | HMI & MMI applications                        | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 3      | 50    | 4      |
| S.I.A. 3.4                                     | Environmental Awareness and Industrial Safety | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 4      | 50    | 5      |

(Credit 3)    (50 marks)    (45 Periods)

**Unit 4. Design of hydraulic circuit: Manual, Automatic, Regenerative, use of check valve, basic circuits**

**Hydraulic system maintenance, repair and reconditioning: Common faults, repair, contamination, filter maintenance, Seal failure, Noise, Safety measures**

- 1) Hydraulics and Pneumatics Hardcover, by Andrew Parr (Author)
- 2) Hydraulics & Fluid Mechanics Including Hydraulics Machines, by P.N. Modi and S.M. Seth
- 3) OIL HYDRAULIC SYSTEMS: PRINCIPLES AND MAINTENANCE, by Majumdar, S
- 4) Hydraulic Data Book for Engineers, by S.K. Likhii
- 5) A Textbook of Hydraulics, Fluid Mechanics and Hydraulic Mechanics, by R.S Khurmi and N Khurmi

(Credit 3)    (50 marks)    (45 Periods)

**Unit 1. Introduction to Pneumatic systems and its basic requirement:** Applications, principle, generation of compressed air, selection of pipe line, tube size ,Air compressor and servicing compressed air: types, selection criteria, Safety valve, Air filter, regulator, manometer, FRL unit

Unit 2. Pneumatic cylinders, air motors and pneumatics valves: type, mounts, construction, piston speed, force, Air and electrical motor, directional control valve, Impulsive valve, types of valve

Unit 3. Basic pneumatic circuits and Hydro-pneumatics circuits: basic circuits, Fluidics and Fluid logic, Automation & principle of pneumatics circuit design

Unit 4. Maintenance and trouble shooting of pneumatics systems : Need of Maintenance, common problem, trouble shooting, seal failure, Maintenance of air compressor

**Reference Books:**

- 1) Introduction to Hydraulics and Pneumatics, by Ilango Sivaraman
- 2) Hydraulic and Pneumatic Controls, by Sundaram K. Shanmuga
- 3) Pneumatic and Hydraulic Systems, by K. Hiraniya Singh
- 4) PNEUMATICS CONCEPTS, DESIGN AND APPLICATIONS, by Jagadeesha
- 5) Hydraulics and Pneumatics, by Jagadeesha T.

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**E.I.A. 3.3 HMI & MMI**

**(Credit 3) (50 marks) (45 Periods)**

Unit 1 : Introduction to HMI, Architecture of HMI/MMI, Creating Slides/Screens, Images, Objects Configuration, Alarm Configuration

Unit 2. MMI/HMI Human Machine Interface: MMI- Introduction of MMI, application of MMI, types of MMI, selection of MMI, h/w of MMI, cable of MMI

Unit 3 ports of MMI, programming s/w of MMI, key field, changing the set points of timer, changing the set points of counter, use of user define function keys, display of outputs, display of faults, display of timer current value.

Unit 4 Interfacing with PLC. MMI Programming, Trouble shooting of MMI

**Reference Books:**

- 1) PLC and HMI Course, by Brian Starr
- 2) Human Machine Interface: Concepts and Projects, by Dr. Samuel Guccione and Dr. James McKirahan
- 3) PLC Logics and HMI Screens for Machine Sequencers Automation: A practical approach to twin and parallel sequencers using IEC 61131 - 3 Ladder Logic (AUTOMATION RECIPES), by Rosario Cirrito

- 4) Hmi 103: Volume 1, 2, and 3 (Hmi Training Manual), by Brian Daniel Starr
- 5) HMI Second Edition, by Gerardus Blokdyk

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**E.I.A. 3.4 Environmental science (Credit 3) (50 marks) (45 Periods)**

**Unit-I: Multidisciplinary nature of Environmental Science and Natural Resources**

Definition, Scope and Importance of Environmental Science and Need of public awareness.

**Natural resources : Renewable and non-renewable resources**

Natural resources and associated problems.

**a. Forest Resources:** Use and over Exploitation , Deforestation, Timber extraction, Mining, dams and their effects on forests and tribal people. **b. Water Resources:** Use and over utilization of surface and ground water, Floods, Drought, Conflicts over water, dams- benefits and problems. **c. Mineral Resources:** Use and exploitation, environmental effects of using and extracting minerals resources, case studies. **d. Food Resources:** World food problems, Changes caused by agriculture and over grazing, effects of modern agriculture, fertilizer pesticide problems, Water logging, Salinity, case studies. **e. Energy Resources:** Growing energy needs, renewable and nonrenewable energy sources, use of alternative energy sources, case studies. **f. Land Resources:** Land as resource, Land degradation, Man induced land slides, Soil erosion and desertification. - Role of individual in conservation of resources, - Equitable use of resources for sustainable life style

**Unit-II Ecosystem:**

Concept of an Ecosystem, Structure of Ecosystem, Function of Ecosystem, Producer Consumer and decomposers, Energy flow in the Ecosystem, Ecological Succession, Food chains, Food web, Ecological Pyramids

**Introduction, types, characteristics features structure and function of the**

**following ecosystem:** **a-** Forest Ecosystem, **b-** Grassland Ecosystem, **c-** Desert Ecosystem, **d-** Aquatic Ecosystem:(Ponds, streams, lakes, rivers, oceans, estuaries)

**Unit-III Environmental Pollution:**

Environmental Pollution. Definition, Causes, effects and control measures of

-Air Pollution, -Water Pollution, -Soil Pollution:, -Marine Pollution:, -Noise Pollution:  
-Thermal Pollution, -Nuclear Hazards

**Solid Waste Management:** -Causes, Effects and Control measures of Urban and Industrial Wastes. -Role of an Individual in prevention of pollution.

**Disaster Management:** Floods, Earthquake, Cyclones and Landslides.

**Unit-IV Social Issues and the Environment:**

From unsustainable development to sustainable development, Urban problems related to Energy, Water conservation, Rain water Harvesting, Water shed management, Resettlement and Rehabilitation of people; its problems and concerns, Environmental ethics: issues and possible solutions Wasteland reclamation , Consumerism and waste

product. Environment protection Act, Air (prevention and control of Pollution) Act, Water (prevention and control of Pollution) Act, wildlife protection Act, Forest conservation act, Issues involved in Enforcement of Environmental Legislation, Public Awareness.

## Human Population and the Environment

Population growth variation among nations, Population Explosion, Family welfare programme, Environment and Human Health, Human Rights, Value education,, Women and Child welfare, Role of Information Technology in Environment and Human Health.

## Reference Books:

- 1) Fundamental Concepts in Environmental Studies, by Mishra D.D.
- 2) Environmental Studies: Third Edition, by R. Rajagopalan
- 3) Trueman's UGC NET Environmental Science, by Anil Tyagi and Virendra Singh
- 4) Textbook of Environmental Studies for Undergraduate Courses, by Erach Bharucha
- 5) Environmental Science, by Y.K. Singh
- 6) Environmental Science, by Subhas Chandra Santra

**S.I.A. 3.1** Hydraulics applications in industry (Credit 5) (50 marks) (45 Periods)

- 1) Study of Hydraulic power pack
- 2) Study of Pressure relief valve
- 3) Study of Directional control valve
- 4) Study of single acting cylinder
- 5) Study of double acting cylinder
- 6) Study of meter in /out flow control
- 7) Study of regenerative circuits
- 8) Characteristics of hydraulic pumps
- 9) Study of pilot operated check valve
- 10) Study of pressure reducing valve
- 11) Working with diaphragm type accumulator
- 12) Study of direct operated pressure relief valve
- 13) Study of indirect operated pressure relief valve (pilot)
- 14) Study of Hydraulic motor (gear)
- 15) Study of Bleed of circuit

**S.I.A. 3.2** Pneumatics applications in industry (Credit 5) (50 marks) (45 Periods)

- 1) Study of Air filter, lubricator and regulator
- 2) Study of manifold block
- 3) Study of 2/2 way DC valve
- 4) Study of single acting cylinder
- 5) Study of double acting cylinder
- 6) Study of 5/2 way valve
- 7) Study of 4/2 way DC valve
- 8) Study of 5/3 way mid position closed valve

- 9) Study of 5/2 way double pilot valve air operated with manual over ride
  - 10) Study of one way flow control valve
  - 11) Study of quick exhaust valve
  - 12) Study of vacuum generator
  - 13) Study of 5/2 way valve (solenoid operated)
  - 14) Study of OR gate/ shuttle valve
  - 15) Study of AND gate
  - 16) Study of indirectly actuation of single valve
  - 17) OPERATION OF S. A. CYLINDER USING OR GATE.
  - 18) OPERATION OF D. A. CYLINDER USING OR GATE.
  - 19) OPERATION OF S. A. CYLINDER USING AND GATE.
  - 20) OPERATION OF D. A. CYLINDER USING AND GATE.
- 

**S.I.A. 3.3 HMI & MMI applications (Credit 5) (50 marks) (45 Periods)**

- 1) HMI Power-up Sequence, Establishing Communications , The HMI ScreenBuilder
  - 2) Installing and Configuring the HMI ScreenBuilder , HMI ScreenBuilder Main Window, HMI Setup , Function Key Setup , Configure Register
  - 3) Notes Window , The HMI Setup Window , The Function Key Setup Window , The Configure Register Window , The Notes Window
  - 4) Putting It All Together - Building Projects, Components of an HMI Project
  - 5) HMI; Creating applications, creating tags
  - 6) HMI; Downloading / uploading programs
  - 7) HMI; Creating alarm messages
  - 8) HMI; Communication with PLC
  - 9) HMI; Fault diagnostics
  - 10) Installation's iFIX SCADA/HMI Software
  - 11) HMI Development. Data Processing, Control Algorithm Programming
- 

**S.I.A. 3.4 Environmental Awareness and Industrial Safety (Credit 5) (50 marks) (45 Periods)**

- 1) Fires in electrical Circuits & Precautions
- 2) Fire Extinguishers & its Types
- 3) General Safety of Tools & Equipment
- 4) Rescue of person who is in contact with live wire
- 5) Treat a person for electric shock/ injury
- 6) Treat a person for heart attack (first aid, CPR), Artificial Respiration
- 7) First aid for injury Snake, bee etc bite
- 8) Disposal procedure of waste materials like cotton waste, metal chips/burrs etc.

- 9) Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Preventive measures for electrical accidents & steps to be taken in such accidents. Identify, handle and store / dispose off dangerous goods and substances according to site policy and procedures following safety regulations and requirements.

#### **Occupational Hazards**

Basic Hazards, Chemical Hazards, Vibro-acoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.

- 10) Recognize and report all unsafe situations according to site policy.
- 11) Identify and observe site policies and procedures in regard to illness or accident /injury procedures.
- 12) Identify safety alarms accurately
- 13) Identify Personal Protective Equipment (PPE) and use the same as per related working environment.
- 14) Comply environment regulation and housekeeping
- 15) Identify environmental pollution & contribute to the avoidance of instances of environmental pollution
- 16) Avoid waste and dispose waste as per procedure
- 17) Recognize different components of 5S and apply the same in the working environment.
- 18) Occupational health, Occupational hygiene, Occupational Diseases/ Disorders & its prevention
- 19) Care of injured & Sick at the workplaces, First-aid & Transportation of sick person
- 20) Reason for shock, method of isolating supply
- 21) Working at height ladder/scaffold
- 22) **Pollution:** how to prevention of **pollution** and pollutants including liquid, gaseous, solid and hazardous waste.
- 23) **Energy Conservation:** Conservation of Energy, re-use and recycle.
- 24) **Preventive measure for Global warming:** Global warming, climate change and Ozone layer depletion.
- 25) Practical for Conservation and Harvesting of water
- 26) Right attitude towards environment, Maintenance of in -house environment
- 27) Study of bio-gas plant
- 28) Study of Solar water heater, Solar PV panel
- 29) Study of Wind Turbine
- 30) Study of other non conventional energy sources

#### **Suggested field work**

Visit to local area to document environment assets river/ forest/ grassland/ hill/mountain, visit to local polluted site urban/ rural/ industrial/ agricultural, study of common plants,

insects, birds, study of simple ecosystems pond river, hill slopes etc. Visit to non conventional energy resources plants

#### Second Year: Semester IV

| Course                                                                                                                                                                                                                                                                                                                                 | Course Title                       | Teaching time/week                 | Internal |        | External |        | Total |        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------|----------|--------|----------|--------|-------|--------|
|                                                                                                                                                                                                                                                                                                                                        |                                    |                                    | Marks    | Credit | Marks    | Credit | Marks | Credit |
| General Education component (Total Credits 12)                                                                                                                                                                                                                                                                                         |                                    |                                    |          |        |          |        |       |        |
| E.I.A. 4.1                                                                                                                                                                                                                                                                                                                             | Study of embedded systems          | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 4.2                                                                                                                                                                                                                                                                                                                             | SCADA                              | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 4.3                                                                                                                                                                                                                                                                                                                             | Human Resource Management          | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 4.4                                                                                                                                                                                                                                                                                                                             | Study of CAD-CAM                   | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| Skill Component (Total Credits 18)                                                                                                                                                                                                                                                                                                     |                                    |                                    |          |        |          |        |       |        |
| S.I.A. 4.1                                                                                                                                                                                                                                                                                                                             | Microcontroller programming        | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 4      | 50    | 5      |
| S.I.A. 4.2                                                                                                                                                                                                                                                                                                                             | SCADA programming                  | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 3      | 50    | 4      |
| S.I.A. 4.3                                                                                                                                                                                                                                                                                                                             | Implant training (minimum 75 hrs.) | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 3      | 50    | 4      |
| S.I.A. 4.4                                                                                                                                                                                                                                                                                                                             | C programming                      | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 4      | 50    | 5      |
| An internal mark consists of test, Tutorials, Seminars, Attendance, performance, Assignment of student, while External marks are for theory Examination or practical examination (conducted by skill sector or industrial partner). Practical marks include, practical performance, oral, regular completion of record books, project. |                                    |                                    |          |        |          |        |       |        |
| During Implant training student should present at least 75 hours in the company and he/she will have to produce attendance cum performance certificate to college.                                                                                                                                                                     |                                    |                                    |          |        |          |        |       |        |

#### E.I.A. 4.1 Study of embedded systems

**(Credit 3) - (50 marks) (45 Periods)**

Unit 1: **Introduction:** Microcontrollers and embedded processors, Choosing a microcontroller, Microcontroller Basics: Internal Block Diagram, 8051 microcontroller hardware, input/output

pins, ports and circuits, external memory, counters and timers, serial data and input/output, interrupts

**Unit 2: Assembly language programming:** The assembly language programming process, PAL instruction, programming tools and techniques, programming the 8051, moving data, addressing modes, logical operations, arithmetic operations, jump and call instructions, an 8051 microcontroller design, 8051 timer programming in assembly, 8051 serial port programming in assembly, 8051 interrupts programming in assembly

**Unit 3: External Interfaces:** LCD and keyboard interfacing, ADC, DAC and sensor interfacing, interfacing to external memory, interfacing with 8255, stepper motor interfacing, DC motor interfacing, DS12887 interfacing, Relays and opto-isolators interfacing, Seven segment numeric display, pulse measurement,

**Unit 4: Embedded system:** an embedded system, classification of embedded system, processor in the system, digital signal processor (DSP), ASSP, GPP, power source and power dissipation and consumption, clock oscillator circuit and clocking unit, real time clock(RTC), reset circuits, memories, I/O ports, I/O buses and IO interfaces, interrupt handler, DAC using a PWM, ADC, LED & LCD display, keypad/keyboard, GPIB, linking and interfacing buses, exemplary cases, software embedded into system, embedded SOC and in VLSI

**Unit 5: Programming concepts for embedded system:** programming in ALP and C, C programming elements, headers and source files and processor directives, MACROS and functions, data types, structures, statements, loops, use of function calls, Queues, stacks, list and order list

Reference Books:

1. The 8051 microcontroller – Kenneth J. Ayala, Penram International, 3rd edition
2. 8051 Microcontroller and embedded systems – M. Mazidi, Pearson Higher Education
3. Programming and Customizing the 8051 microcontroller – Myke Predko, TATA McGraw Hill Edition.
4. Embedded System - Raj Kamal, TATA McGraw Hill Edition

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#### E.I.A. 4.2 SCADA

(Credit 3) (50 marks) (45 Periods)

**Unit 1.** An Introduction to SCADA, Supervisory Control & Data Acquisition (SCADA), Definition of SCADA, Functional Block Diagram, Function of SCADA: a) Creating static & dynamic objects with animation b) SCADA data base configuration c) Alarm management d) Real time & historical trends.

**Unit 2.** SCADA (Wonder ware, Win cc, Intellection or RS view, configuration of different drivers, gateway. Database of tags and its use. selection of SCADA s/w, programming cable of SCADA, creating new SCADA application, crating & editing graphic display, crating & editing elementary graphic, creating data base of tags, start stop command, drivers of SCADA s/w, configuration of

drivers file in s/w, communication of SCADA s/w, data entry, analog entry, connectivity between s/w

Unit 3. Advance Applications of PLC and SCADA, PLC programming methods as per IEC 61131, PLC applications for batch process using SFC, Analog Control using PLC, PLC interface to SCADA using communication links (RS232, RS485) and protocols (Modbus ASCII/RTU) Interfacing with PLC and simulation of PLC application in SCADA

Unit 4 Communication between PLC and SCADA, SCADA Applications Supervisory and control functions, Energy management center, SCADA & PLC, SCADA in power systems, Supervisory power management, SCADA system components and communication technologies and applications

#### Reference Books

- 1) Applied Instrumentation in the process Industries, Volume I, Andrew and Williams Gulf Publishing Company Second Edition
- 2) Programmable Logic Controllers by Garry Dunning, 3rd Ed, PHI Pub. 2004.
- 3) Control Valve Handbook by ISA
- 4) Distributed Computer Control for Industrial Automation, Poppovik Bhatkar, Dekkar Publications.
- 5) Programmable Logic Controllers: Principles and Applications, Webb and Reis, PHI.
- 6) Computer Aided Process Control, S.K.Singh, PHI
- 7) The Management of Control System: Justification and Technical Auditing, N.E.Battikha, ISA
- 8) Computer Based Process Control, Krishna Kant, PHI

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#### E.I.A. 4.3 Human Resource Management

(Credit 3) (50 marks) (45 Periods)

##### HUMAN RESOURCE MANAGEMENT

Objectives: To provide the future manager with inputs with a view to Enhancing the appreciation of the Human Resources function as a potential career option, Understanding the interface of the Human Resources function with Operations, Marketing, and Finance functions.

UNIT 1: Human Resource Philosophy - Changing environments of HRM - Strategic human resource management - Using HRM to attain competitive advantage - Trends in HRM - Organization of HR departments - Line and staff functions - Role of HR Managers. Employment planning and forecasting – Recruitment, selection process- Building employee commitment: Promotion from within – Sources- Induction.

UNIT 2: Orientation & Training : Orienting the employees, the training process, need analysis, Training -techniques, Developing Managers : Management Development - On-the-job and off-the-job Development techniques using HR to build a responsive organisation. Management Developments - Performance appraisal in practice. Managing careers : Career planning and development - Managing promotions and transfers.

UNIT 3: Establishing Pay plans : Basics of compensation - factors determining pay rate - Current trends in compensation - Job evaluation -- Incentives- Practices in Indian organisations. 868 Statutory benefits - non-statutory (voluntary) benefits - Insurance benefits - retirement benefits and other welfare measures to build employee commitment.

UNIT 4: Labour relations -Employee security - Industrial relation-Collective bargaining : future of trade unionism. Discipline administration - grievances handling - managing dismissals and separation. Labour Welfare : Importance & Implications of labour legislations - Employee health - Auditing -Future of HRM function.

#### REFERENCES

1. Gary Dessler, "Human Resource Management", Seventh edition, Prentice-Hall of India
2. Venkatapathy R.& Assissi Menacheri, Industrial Relations & Labour Welfare, Adithya Publications, CBE, 2001.
3. VSP Roa, Human Resource Management : Text and cases, First edition, Excel Books,

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#### E.I.A. 4.4 Study of CAD-CAM

(Credit 3) (50 marks) (45 Periods)

Unit 1: Computer Hardware Product Development Cycle – Introduction to CAD/CAM – Graphics I/O Devices - Bresenham's Algorithm and DDA, Graphics software, Clipping, Hidden line/surface removal, Color models Lighting and shading - Graphics Standards – Neutral File formats – IGES, STEP

Unit 2: Principles of Computer Graphics Geometric Modeling – Wireframe, Surface and Solid – Parametric representation of curves & surfaces - CSG and B-Rep- World/device coordinate representations. 2D and 3D geometric transformations. Matrix representation, translation, scaling, shearing, rotation and reflection, composite transformations, concatenation.

Unit 3: CNC Machine Tools Introduction to NC, CNC, DNC- Manual part Programming – Computer Assisted Part Programming – Examples using NC codes- Adaptive Control – Canned cycles and subroutines – CAD / CAM approach to NC part programming – APT language, machining from 3D models

Unit 4: Group Technology, CAPP and FMS Introduction to part families-parts classification and coding – group technology machine cells-benefits of group technology – Process Planning – CAPP & types of CAPP – Flexible manufacturing systems (FMS) – the FMS concept-transfer systems – head changing FMS –Introduction to Rapid prototyping, Knowledge Based Engineering.

Unit V CIM wheel – CIM Database- CIM-OSI Model– Networking Standards in CIM Environment – Network structure – Network architecture –TCP/IP, MAP – Virtual Reality, Augmented Reality- Artificial Intelligence and Expert system in CIM.

Text Books

1. CAD/CAM: Principles and Applications 3rd Edition, Tata McGraw Hill, India, 2010. 2. Ibrahim Zeid and R. Sivasubramaniam, 2nd Edition, Tata McGraw Hill, India, 2009
2. Mikell P. Grover, Automation, Production Systems and Computer Integrated Manufacturing (2016), Fourth Edition, Pearson Education.

Reference Books

1. Mikell P. Groover, "Automation, Production Systems and Computer Integrated Manufacturing", Pearson Education, 2007
  2. James A. Rehg, Henry W. Kraebber, "Computer Integrated Manufacturing", Pearson Education. 2007
  3. Donald Hearn and M. Pauline Baker "Computer Graphics" with OpenGL Prentice Hall, International, 2010
  3. P. Radhakrishnan, S. Subramanyan, V. Raju, CAD/CAM/CIM (2011), New age International.
  4. Mikell P. Grover, Enory W. Jr Zimmers, CAD/CAM (2006), Pearson Education.
  5. P. N. Rao, CAD/CAM: Principles and Applications (2010), Tata Mc Graw Hill.
  6. Tien-Chein Chang, Richard A. Wysk, Hsu-Pin (Ben) Wang, Computer Aided Manufacturing (2009), Pearson Education.
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**S.I.A. 4.1 Microcontroller programming**

**(Credit 5) (50 marks) (45 Periods)**

1. Addition, subtraction of two numbers
2. Double addition
3. Generate square wave on LED
4. Write routine to display "Hello World" on LCD
5. Using keys toggle LED's state
6. To display the key pressed on PC AT Key board
7. Sound synthesis
8. Vary the pot & display hex conversion on LCD
9. Interfacing EEPROM with microcontroller (using I<sup>2</sup>C interface)
10. Interfacing EEPROM with microcontroller (using SPI interface)
11. Generate square wave on LED (using timer interrupt)
12. Interfacing with stepper motor
13. Interfacing with seven segment display

Practical using PIC-16F877 embedded system

or

Practical using 89C51RD2 embedded system (using cross assembler)

or

Practical using 89C51RD2 embedded system (using cross compiler (Keil))

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**S.I.A. 4.2 SCADA programming**

**(Credit 5) (50 marks) (45 Periods)**

- 1) SCADA; Programming
- 2) SCADA; Real time trends, Historical trends
- 3) SCADA; Alarm generation
- 4) SCADA; Security, Recipe management, Security
- 5) Creating static & dynamic objects with animation
- 6) SCADA data base configuration
- 7) crating & editing graphic display
- 8) crating & editing elementary graphic
- 9) creating data base of tags
- 10) start stop command
- 11) drivers of SCADA s/w, configuration of drivers file in s/w
- 12) communication of SCADA s/w, data entry, analog entry, connectivity
- 13) SCADA; Communication with Excel, Communication with PLC

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**S.I.A. 4.3 Implant training (minimum 75 hrs.)**

**(Credit 5) (50 marks) (45 Periods)**

Training in automation based company for at least 75 hours in this semester

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**S.I.A. 4.4 C programming**

**(Credit 5) (50 marks) (45 Periods)**

**Unit 1: INTRODUCTION TO 'C' LANGUAGE:**

CHARACTER SET, VARIABLES AND IDENTIFIERS, BUILT-IN DATA TYPES, VARIABLE DEFINITION, ARITHMETIC OPERATORS AND EXPRESSIONS, CONSTANTS AND LITERALS, SIMPLE ASSIGNMENT STATEMENT, BASIC INPUT/OUTPUT STATEMENT, SIMPLE 'C' PROGRAMS

**CONDITIONAL STATEMENTS AND LOOPS:**

DECISION MAKING WITHIN A PROGRAM, CONDITIONS, RELATIONAL OPERATORS, LOGICAL CONNECTIVES, IF STATEMENT, IF-ELSE STATEMENT, LOOPS: WHILE LOOP, DO WHILE, FOR LOOP, NESTED LOOPS, INFINITE LOOPS, SWITCH STATEMENT, STRUCTURED PROGRAMMING

**Unit 2: ARRAYS ONE DIMENSIONAL ARRAYS:**

ARRAY MANIPULATION; SEARCHING, INSERTION, DELETION OF AN ELEMENT FROM AN ARRAY; FINDING THE LARGEST/SMALLEST ELEMENT IN AN ARRAY; TWO DIMENSIONAL ARRAYS, ADDITION/MULTIPLICATION OF TWO MATRICES, TRANSPOSE OF A SQUARE MATRIX; NULL TERMINATED STRINGS AS ARRAY OF CHARACTERS, REPRESENTATION SPARSE MATRICES

**FUNCTIONS:**

TOP-DOWN APPROACH OF PROBLEM SOLVING, MODULAR PROGRAMMING AND FUNCTIONS, STANDARD LIBRARY OF C FUNCTIONS, PROTOTYPE OF A FUNCTION: FUNCTIONAL PARAMETER LIST, RETURN TYPE, FUNCTION CALL, BLOCK STRUCTURE, PASSING ARGUMENTS TO A FUNCTION: CALL BY REFERENCE, CALL BY VALUE, RECURSIVE FUNCTIONS, ARRAYS AS FUNCTION ARGUMENTS

**Unit 3: STRUCTURES AND UNIONS:**

STRUCTURE VARIABLES, INITIALIZATION, STRUCTURE ASSIGNMENT, NESTED STRUCTURE, STRUCTURES AND FUNCTIONS, STRUCTURES AND ARRAYS: ARRAYS OF STRUCTURES, STRUCTURES CONTAINING ARRAYS, UNIONS

**Unit 4: POINTERS:**

ADDRESS OPERATORS, POINTER TYPE DECLARATION, POINTER ASSIGNMENT, POINTER INITIALIZATION, POINTER ARITHMETIC, FUNCTIONS AND POINTERS, ARRAYS AND POINTERS, POINTER ARRAYS

**FILE PROCESSING:**

CONCEPT OF FILES, FILE OPENING IN VARIOUS MODES AND CLOSING OF A FILE, READING FROM A FILE, WRITING ONTO A FILE

**Reference Books:**

- 1) Programming in ANSI C, by Balagurusamy
- 2) Let Us C 16TH EDITION, by Yashavant Kanetkar
- 3) C in Depth, by Deepali Srivastava and S. K. Srivastava
- 4) Programming in C, by Reema Thareja
- 5) Learning C for Arduino, by Syed Omar Faruk Towaha

**Third Year: Semester V**

| Course                                                                                                                                                                                                                                                                                                                                 | Course Title                       | Teaching time/week                 | Internal |        | External |        | Total |        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------|----------|--------|----------|--------|-------|--------|
|                                                                                                                                                                                                                                                                                                                                        |                                    |                                    | Marks    | Credit | Marks    | Credit | Marks | Credit |
| General Education component (Total Credits 12)                                                                                                                                                                                                                                                                                         |                                    |                                    |          |        |          |        |       |        |
| E.I.A. 5.1                                                                                                                                                                                                                                                                                                                             | Mechatronics                       | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 5.2                                                                                                                                                                                                                                                                                                                             | Mathematics-II                     | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 5.3                                                                                                                                                                                                                                                                                                                             | Advance PLC programming            | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 5.4                                                                                                                                                                                                                                                                                                                             | Process Control                    | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| Skill Component (Total Credits 18)                                                                                                                                                                                                                                                                                                     |                                    |                                    |          |        |          |        |       |        |
| S.I.A. 5.1                                                                                                                                                                                                                                                                                                                             | Mechatronics application           | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 4      | 50    | 5      |
| S.I.A. 5.2                                                                                                                                                                                                                                                                                                                             | Industrial Mathematics and drawing | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 3      | 50    | 4      |
| S.I.A. 5.3                                                                                                                                                                                                                                                                                                                             | Advance Ladder programming in      | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 3      | 50    | 4      |
| S.I.A. 5.4                                                                                                                                                                                                                                                                                                                             | Applications of Process control    | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 4      | 50    | 5      |
| An internal mark consists of test, Tutorials, Seminars. Attendance, performance, Assignment of student, while External marks are for theory Examination or practical examination (conducted by skill sector or industrial partner). Practical marks include. practical performance. oral. regular completion of record books. project. |                                    |                                    |          |        |          |        |       |        |

**E.I.A. 5.1 Mechatronics**

**(Credit 3) (50 marks) (45 Periods)**

- 1) Introduction to mechatronics :** Definition , need, design, Advantages, disadvantages, Scope, applications,
- 2) Elements of CNC machine:** NC machine (element, classification, application), CNC machine (functions, advantages, disadvantages, application), **Mechatronics driving systems;** Place of the driving system in the frame of the Mechatronics system; Principles of choice of the driving system, **MEMS;** Introduction to microelectromechanical systems (MEMS)
- 3) Signal conditioning elements:** concept, need, signal processing, Functions of signal conditioning equipment, types, OPAMP amplifiers, noise problem, **Data acquisition**

**systems:** Introduction, DAQ systems, ADC, DAC, single channel and multichannel DAS, Data signal transmission

- 4) **Belts:** types, material used, belt drives, parameter, **Chains:** classification, advantages and disadvantages, **Cams:** classification, types, applications and **Gears:** classification, material, advantages, applications

**Reference Books:**

- 1) Mechatronics, by M D Singh, J. G. Joshi, PHI learning Pvt. LTd
- 2) A text Book of Mechatronics, R. K. Rajput, S. Chand publication
- 3) Mechatronics, Ganesh Hegde, University science press
- 4) Intr. to Mechatronics, Appuu kuttan kk, OXFORD university press
- 5) Distributed Computer Control for Industrial Automation, Poppovik Bhatkar, Dekkar Publications.
- 6) Computer Aided Process Control, S.K.Singh, PHI
- 7) The Management of Control System: Justification and Technical Auditing, N.E.Battikha, ISA
- 8) Computer Based Process Control, Krishna Kant, PHI
- 9) Distributed Computer Control for industrial Automation by Bhatkar (dekkar)

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**E.I.A. 5.2 Mathematics-II**

**(Credit 3) (50 marks) (45 Periods)**

**Unit 1:** Linear Algebra: Algebra of matrices, inverse, rank, system of linear equations, symmetric, skewsymmetric and orthogonal matrices. Hermitian, skew-Hermitian and unitary matrices. eigenvalues and eigenvectors, diagonalisation of matrices

**Unit 2:** Calculus: Functions of single variable, limit, continuity and differentiability, Mean value theorems, Indeterminate forms and L'Hospital rule, Maxima and minima, Taylor's series, Fundamental and mean value theorems of integral calculus. Evaluation of definite and improper integrals, Functions of two variables, partial derivatives, Euler's theorem for homogeneous functions, total derivatives

Vector Calculus: Gradient, divergence and curl, vector identities, directional derivatives, line, surface and volume integrals, Stokes, Gauss and Green's theorems (without proofs) applications.

**Unit 3:** Linear Differential Equations Linear Differential Equations with constant coefficients, Homogenous Linear differential equations, method of variation of parameters, Ordinary Differential Equations: First order equation (linear and nonlinear) Applications of LDE with constant coefficients to Electrical systems. Partial Differential Equation, Four standard forms of partial differential equation of first order.

**Unit 4:** Transform Calculus:- Concept of Transforms, Laplace Transform(LT) and its existence, Properties of Laplace Transform, Evaluation of LT and inverse LT, Evaluation of integral equations with kernels of convolution type and its Properties, Complex form of Fourier

Integral, Introduction to Fourier Transform, Properties of general (complex) Fourier Transform, Concept and properties of Fourier Sine Transform and Fourier Cosine Transform, Evaluation of Fourier Transform,

TEXT BOOK:

1. "Advanced Engineering Mathematics", Erwin Kreyszig, 9th edition, John Wiley & Sons.

REFERENCE BOOKS:

1. "Advanced Engineering Mathematics", Peter V. O'Neil, Thomsons Brooks/Cole.
2. J. N. Wartikar & P. N. Wartikar, "A text book of Applied Mathematics: Vol. I, II and III" Vidyarthi Griha Prakashan, Pune.
2. Dr. B. S. Grewal. "Higher Engineering Mathematics" 3. Erwin Kreyszig.
3. "Advanced Engineering Mathematics" 4. N. P. Bali, Ashok Saxena and N. Ch. S. N. Iyengar "A textbook of Engineering Mathematics" Laxmi Publication, Delhi.

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**E.I.A. 5.3 Advance PLC programming (Credit 3) (50 marks) (45 Periods)**

- 1) PLC Networks, PLC Applications and Case Studies, Programming and interfacing with different types of PLC, Integration with PLC & HMI
- 2) Simple Position Logic (PLC programming), Integration with PLC and Cognex Vision System  
Hi level functions implementation in by using RS500, RS 5000, GX Developer, Shift Register, Absolutely Drum Function
- 3) PLC drives: AC Drives, Fundamentals of AC Drive, Block diagram of AC drive, Configuration of different drives, Control of drive with and without PLC, Various applications of AC Drive, Interfacing with PLC, Variable Frequency Drives, Integration VFD with PLC logic
- 4) Industrial applications
  - a) Continuous Bottle-filling system
  - b) Batch mixing system
  - c) Speed control of dc motor
  - d) Automatic frequency control of Induction heating
  - e) Door simulation
  - f) Silo simulation
  - g) Traffic light simulation
  - h) 4 stage elevator

Reference Books:

1. Introduction to programmable Logic Controller, Gary Dunning
2. Programmable Logic Controllers (principles and applications), John W. Webb and Ronald A. Reis.

3. Programmable Logic Control NIFT; Prentice Hall India
  4. Instant PLC Programming with RSLogix 5000, by Austin Scott
  5. Advanced Programming Concepts!: Volume 2 (Plc Programming Using Rslogix 500), by Gary D. Anderson
  6. Programmable Logic Controllers: Programming Methods and Applications, by HACKWORTH
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#### E.IA. 5.4 Process Control

(Credit 3) (50 marks) (45 Periods)

- 1) **Introduction to process control:** concept, definition, types of process, implementation, , open loop vs close loop systems, feedback vs feed forward systems, feasibility, principles of control system, Control objectives and benefits, importance,
- 2) **Process dynamics and mathematical models:** Aspects, types , common system, mathematical modeling, types and uses of mathematical modeling,
- 3) **Theory of controller:** classification, terms, continuous and discontinuous controller  
**Close loop response:** Transfer function, proportional counter in close loop, integral controller in close loop, PI, PD and PID control in close loop
- 4) **Stability analysis:** Concept of Stability, Stability analysis of linear systems, Stability analysis of control systems (Bode method), **Cascade, feed forward & ratio control:** Selective and adoptive control systems.

#### Reference Books

- 1) Process control ( principles and applications) , Surekha Bhanot
  - 2) Process control , Thomas E. Marlin, TATA MCgraw-hill
  - 3) Control System Design -- G. Goodwin, S. Graebe, Mario Salgado, Pearson Education.
  - 4) Control System Engineering- Norman Nise, Wiley International
  - 5) Control System Engineering- Nagrath and Gopal , Tata-McGrawHill Publication.
  - 6) Feedback Control of Dynamic Systems- G. Franklin, J.Powell, A. Naeini, Pearson Education.
  - 7) Automatic Control Engineering Francis Raven, McGraw-Hill International. fifth edition.
  - 8) Control System Design, G. C. Goodwin, S. F. Graebe, M. E. Salgado, Pearson education.
  - 9) Process control and instrument technology, C. D. Johnson, TMH
  - 10) Instrumentation for process measurement and control, N. A. Anderson
  - 11) Process Control, Instrument Engineering Hand book, B. G. Liptak
  - 12) Tuning of industrial control systems, ISA
  - 13) Control valve handbook, ISA
-



1. Engineering Drawing, N.D. Bhat / Charotar.
2. Engineering Drawing and Graphics, Venugopal K, New Age International.

#### References

1. Engineering drawing- P.J. Shah. / S. Chand.
2. Engineering Drawing- Narayana and Kannaiah / Scitech Publishers.
3. Engineering Drawing- Johle / Tata Mc Graw Hill

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### S.I.A. 5.3 Advance Ladder programming in industry (Credit 5) (50 marks) (45 Periods)

- 1) Traffic light control
- 2) Silo control
- 3) Batch processor
- 4) Dual compressor
- 5) Continuous Bottle-filling system
- 6) Batch mixing system
- 7) Speed control of dc motor
- 8) Automatic frequency control of Induction heating
- 9) Door simulation
- 10) 4 stage elevator
- 11) Programming and interfacing with different types of PLC
- 12) Integration with PLC & HMI
- 13) Integration with PLC & SCADA
- 14) Integration with PLC and Cognex Vision System
- 15) Hi level functions implementation in by using RS500, RS 5000, GX Developer, Shift Register , Absolutely Drum Function
- 16) Configuration of different drives
- 17) Control of drive with and without PLC
- 18) Various applications of AC Drive
- 19) Variable Frequency Drives , Integration VFD with PLC logic

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### S.I.A. 5.4 Applications of Process control (Credit 5) (50 marks) (45 Periods)

- 1) Study & analysis of flow, pressure, and level control loop (Analysis includes process parameters such as type of process, dead time, capacity etc.)
- 2) Implementation of cascade controller.

- 3) Design & implementation of feed-forward controller.
- 4) Design of orifice plates as per BS1042 / ISO 5167
- 5) Control loop design for Power.
- 5) Control loop design for Automobile and Building Automation.
- 6) Designing of control valve for liquid/gas/vapor applications.
- 12) Practical's on temperature control
- 13) Characteristics of I/P and P/I converters
- 14) Characteristics of various type of control valves
- 15) Characteristics of control valve with and without positioner
- 16) Design of ON/OFF, PI and PID controller for the pressure process
- 17) Design of ON/OFF, PI and PID controller for the level process
- 18) Design of ON/OFF, PI and PID controller for the flow process
- 19) Design of ON/OFF, PI and PID controller for the temperature process
- 20) Tuning of controllers
- 21) Study of complex control system
- 22) Responses of different order processes with and without transportation lag

**Third Year: Semester VI**

| Course                                         | Course Title                                     | Teaching time/week                 | Internal |        | External |        | Total |        |
|------------------------------------------------|--------------------------------------------------|------------------------------------|----------|--------|----------|--------|-------|--------|
|                                                |                                                  |                                    | Marks    | Credit | Marks    | Credit | Marks | Credit |
| General Education component (Total Credits 12) |                                                  |                                    |          |        |          |        |       |        |
| E.I.A. 6.1                                     | Project Management                               | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 6.2                                     | PID                                              | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 6.3                                     | DCS                                              | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| E.I.A. 6.4                                     | Robotics                                         | 3 hours (4 period of 45 minutes)   | 10       | 1      | 40       | 2      | 50    | 3      |
| Skill Component (Total Credits 18)             |                                                  |                                    |          |        |          |        |       |        |
| S.I.A. 6.1                                     | Designing of Industrial Projects (Major project) | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 4      | 50    | 5      |
| S.I.A. 6.2                                     | PID & DCS applications in industry               | 4.5 hours (6 period of 45 minutes) | 10       | 1      | 40       | 3      | 50    | 4      |

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|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------|----|---|----|---|----|---|
| S.I.A.<br>6.3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Implant training (minimum 75 hrs.) | 4.5 hours (6 period of 45 minutes) | 10 | 1 | 40 | 3 | 50 | 4 |
| S.I.A.<br>6.4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Robotics applications in industry  | 4.5 hours (6 period of 45 minutes) | 10 | 1 | 40 | 4 | 50 | 5 |
| <p>An internal mark consists of test, Tutorials, Seminars, Attendance, performance, Assignment of student, while External marks are for theory Examination or practical examination (conducted by skill sector or industrial partner). Practical marks include, practical performance, oral, regular completion of record books, project.</p> <p>During Implant training student should present at least 75 hours in the company and he/she will have to produce attendance cum performance certificate to college.</p> |                                    |                                    |    |   |    |   |    |   |

#### E.I.A. 6.1 Project Management

(Credit 3) (50 marks) (45 Periods)

Unit 1: Concept of Entrepreneurship Entrepreneurship- Entrepreneurship - Enterprises:- Conceptual issue Entrepreneurship vs. Management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.

Unit 2: Project Preparation & Marketing analysis Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of Product Life Cycle (PLC), Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.

Unit 3: Institutions Support Preparation of Project Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.

Unit 4: Investment Procurement Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.

#### Text Books

1. R.Danreid & Sanders., (2009), Operations Management, John Wiley & Sons
2. Buffa E.S., (2009), Modern Production / Operational Management, John Wiley & Sons
2. Nigel Slack, Stuart Chambers, Robert Johnston., (2010) Operation Management, Pearson Education

3. Panneerselvam. R. (2006), Production/Operations Management, Prentice Hall of India Pvt Ltd
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**E.I.A. 6.2 PID (Credit 3) (50 marks) (45 Periods)**

**Unit 1: Basics of PID control:** feed back control, on/off control, Actions of PID control(proportional ,integral, derivative), structure, choice of controller, Some PID control fundamentals, Phase lock loop method and PID control

**Unit 2: Derivative filter design:** Significance of filter, Ideal vs series form, , **Anti-windup strategies:** Integrator windup, anti windup techniques, conditional integration, , **Set pint weightings:** constant set point weighting, variable set-point weighting

**Unit 3: Use of feed forward actions:** linear casual feed forward action, no casual feed forward action , **Plug and control:** self tuning temperature control, time-optimal plug and control

**Unit 4: Design of multi loop and multi variable PID control:** multivariable systems and control, multi-loop PID control, Multivariable PID control , **Performance assessment:** Stochastic, deterministic, **Control structures:** Cascade control, ratio control

**Reference Books**

- 2) PID control, Michael A. Johnson, Mohammad H. Moradi, Springer
  - 3) Practical PID control, Antonio Visioli, Springer
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**E.I.A. 6.3 DCS (Credit 3) (50 marks) (45 Periods)**

**Unit 1: Overview of Distributed Control Systems:**

Introduction, Basic concepts of Distributed Computing, volution of Distributed Computing System, Present market trends in DCS, Basic DCS specification. General description of a commercial DCS Advantage of DCS systems, DCS selection criteria. DCS architecture, **Basic DCS controller configuration:** Historical Control modes, Tracking and initialization in control slots used for cascade control, Control functions, Control algorithms, Sequential programs for batch processing, Defining equipment procedures. Phase logic programming, Phase logic interface, Logic block functions in advanced controller, DCS controller configuration

**Unit 2: Alarm system management:**

An alarm system, Functions of the plant or process operator, Functions of an alarm system, An effective alarm system, Design overview, Human and ergonomic factors, Structure of a good alarm system, Safety integrity level (SIL) , Definition of strategy, Strategy for alarm system design. **distributed control system reporting:** Introduction , Operation of advanced DCS using multi-screen display, cross screen invocation and linking, Alarm reporting, generation and

acceptance, Alarm reporting, Generation of alarms, Different types of logs and reports configurable on a DCS

**Unit 3: Distributed control system (DCS) configuration:**

Introduction, An engineering station, System/project tree structure, DCS system database, Configuration of control functions, Configuration of operator/monitoring functions, Configuration of system hardware structure, Configuration of system software, Documentation, Commissioning. **Maintenance consideration:** Introduction, Maintenance requirements of system and system elements

**Unit 4: Programming of DCS systems:**

Functions and function blocks, Local and global variables, Elementary data types, Variables, Functions, Resource, Tasks, Structured text, Expressions, Statements, Basics, Methodology, Signal flow, Feedback path, Network layout, Function execution control, Jumps and labels, Integrating functions & function blocks, Feedback paths, Jumps and labels, Calling functions and function blocks, Portability and other issues, Actions, Action qualifiers, Action control function block,

**Reference Books**

- 1) Practical distributed control systems for engineers and technicians,, IDC technologies
- 2) Guide to Industrial Control Systems (ICS) Security - Supervisory Control and Data Acquisition (SCADA) systems, Distributed Control Systems (DCS), and ... such as Programmable Logic Controllers (PLC), by nist
- 3) Designing distributed Control Systems: A Pattern Language Approach (MISL-WILEY) by Veli-Pekka Eloranta, Johannes Koskinen, Marko Leppänen, Ville Reijonen
- 4) Distributed Computer Control Systems in Industrial Automation: 66 (Electrical and Computer Engineering), by Dobrivojic Popovic and Vijay P. Bhatkar
- 5) Distributed Control and Filtering for Industrial Systems (Control, Robotics and Sensors) by Magdi S. Mahmoud

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**E.I.A. 6.4 Robotics**

**(Credit 3) (50 marks) (45 Periods)**

- 1) **Introduction to Robotics** : Types, laws of robotics, generation, basic principle, notations, Robot end-efforts, degree of freedom, arm, wrist, links, sensors,
- 2) **Direct and Inverse kinematics of robotic positions:** mechanism, matrix representation, forward and inverse kinematic equations, transformations equations, **Dynamic modeling and trajectory planning:** Lagrangian mechanics, Euler-Lagrangian formulation
- 3) **Robotic programming** : method, motion interpolation, wait, signal, delay command, Robot languages, motion command, language structure, online and offline programming ,VAL programming,
- 4) **Robotic applications:** Industrial applications; Manufacturing applications: material handling , material transfer, machine loading/unloading, Processing application, Assembly applications, Inspection application,

- 1) Robotics and control, R K Mittal, I J Nagrath
  - 2) Robotics (Fundamental concept and analysis), Ashitava Ghosal
  - 3) Robotics, K.S. Fu, R C Gonzalez, C G S Lee
  - 4) Automation and robotics, Khushdeep Goyal, Deepak Bhandari
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**S.I.A. 6.1 Designing of Industrial Projects (Major project) (Credit 5) (50 marks) (45 Periods)**

Design one project per 3 students

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**S.I.A. 6.2 PID & DCS applications in industry (Credit 5) (50 marks) (45 Periods)**

- 1) PID experiments from pid simulator (anshuman)
  - 2) flow control application using PID
    - a) Study of close loop flow control systems.
    - b) Study of flow transmitter .construction & working..
    - c) Study of PID Controller
    - d) Programming & tuning of PID Controller.
    - e) Tuning of PID Controller for flow control application.
    - f) Study of process component in flow process plant.
    - g) study of rotameter.
    - h) study of flow measurement by rotameter
    - i) Study of I TO P Converter
    - j) Study of control valve characteristics
  - 3) level control application using PID
    - k) Study of close loop level control systems.
    - l) Study of level transmitter .construction & working
    - m) Tuning of PID Controller for level control application.
    - n) Study of process component in level process plant.
    - o) Calibrating capacitance type level transmitter.
  - 4) Understanding Controller Output Response
  - 5) Understanding Controller Actions
  - 6) Understanding Controller Proportional (P) Action
  - 7) Understanding Controller Proportional-Integral (PI) Action
  - 8) Understanding Controller Proportional-Derivative (PD) Action
  - 9) Understanding Controller Proportional-Integral-Derivative (PID).
  - 10) DCS practical (anshuman)
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**S.I.A. 6.3** Implant training ( minimum 75 hrs.) (Credit 5) (50 marks) (45 Periods)

Student should complete implant training in automation based company

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**S.I.A. 6.4** Robotics applications in industry (Credit 5) (50 marks) (45 Periods)

- 1) Study of different parts of Robot
  - 2) Robotic hand using PLC (Pick and place)
  - 3) Robotic hand using PLC (continuous)
  - 4) Study of Robotic hand using microcontroller
  - 5) Study of Robotic hand using Arduino-uno
  - 6) Robotic programming using Bioloid-g
  - 7) Basic motion: feedback control in various task spaces,
  - 8) Grasping & Manipulation,
  - 9) ROS (Robot Operating System): basics, the navigation/SLAM packages,
  - 10) Data collection and (Reinforcement) learning for basic control.
  - 11) Experiential Learning through Designing Robots and Motion Behaviors:
  - 12) Practical Robotics with 3D printing (4 ECTS)
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