2017

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (MS)

Deen Dayal Upadhyay KAUSHAL Kendra

Course Structure and Curriculum

Bachelor of Vocation
(B.Voc)

In

Industrial Automation

Choice Based Credit System

(Effective from June 2017 onwards)

Curriculum for Bachelor in Vocation
(B.Voc)

(Choice Based Credit System)

This Bachelor in Vocation programme is divided into six semester shaving 192 credits. Each semester will have courses based on General Education Components and Skill Development Components. In each Semester, there will be four theory components of skill development with their corresponding laboratory coursework, apart from general education components. Moreover, each semester will contain dedicated Project and/or Industrial Training/Internship. The program offers following **General Education Components** viz. Linguistic Proficiency, Computer Science, Environment Management, Business & Accounting, Industrial Ethics and Safety Management, Statistical Tools, Commerce & Management Fundamentals and **Skill Development Components** in Industrial Automation.

Preamble:

Dr. Babasaheb Ambedkar Marathwada University proposes to offer a three year Bachelor programme invocation (B. Voc.).The curriculum design of this program is undertaken in the following framework (assumptions).

a) Although there has been remarkable progress in all sectors of education in last couple of decades, the less regulated area of the education sector-vocational training—seems to have lost its significance/importance. This has led to the widening gap between the supply and demand for skilled manpower across various industries and R&D organizations. This shortage of skills has translated directly into unemployment among an increasing number of graduates who pass-out every year and are forced to bare-trained in order to become market table.

   This programme is designed to produce skilled manpower so that wide variety of options in automobiles, industrial automation and travel &tourism would be available and it will improve the opportunities for the unemployed youths in the country in both the private and public sectors.

b) According to a study conducted by the Associated Chambers of C ommerce and Industry of India (ASSOCHAM), there will be a deficit of 40 million working professionals by the year 2020 and the employers would face the difficulty of filling positions because of the dearth of suitable talent and skilled person all in their industry. **This programme aims to provide some solution for this problem and this would facilitate to improve:**

    (i) Quality of training
    (ii) High drop-out rates
    (iii)Linkages with Universities and industry
    (iv)Inadequacy of resources.

c) This programme is intended to offer practical training and skills needed to pursue an occupation straight away. It will provide options to the students to select the courses of their choice which are directly aligned to land a job in a chosen profession or a skilled trade. The end result of this programme is to enable an individual to at train self-employment.

Program Educational Objectives:

The objectives of B.Voc (Industrial automation) program are to produce graduates who -

1. Are equipped with time relevant knowledge of mechatronics and electronics to address multi disciplinary demand of automated manufacturing, and process in modern industries in capacity of productive System Developers and System Integrators.
2. Have a broad-based background to practice industrial automation in the areas of robotics, manufacturing, and process control in industry and Government settings meeting the growth expectations of stakeholders.
3. Have an ability to pursue higher studies and succed in academic and professional careers.
4. Have the ability to address professional demands individually and as a team member communicating effectively in technical environment using modern tools.
5. Recognize the need for and possess the ability to engage in lifelong learning.
6. Will be sensitive to consequences of their work both ethically and professionally for productive professional career.

Program Outcomes (PO):

Vocational Education is education that prepares the students for specific trades, crafts and career sat various levels and scopes. It trains the students from a trade/ craft, technician or professional position in R & D organizations.

The Program Outcomes are the skills and knowledge which the students have at each exit level/at the time of graduation. These Outcomes are generic and are common to all exit levels mentioned in the programme structure. Graduates of the B.Voc program are expected to -

PO1. **Domain knowledge:** Apply broad based fundamental knowledge of the specific skill based trade for the solution of target skill sector.

PO2. **Problem Analysis:** Identify industry domain related problems at varied complexity and analyze the same to formulate/ develop substantiated conclusion using first principles of domain sectors and technical literature.

PO3. **Design Development of solutions :** Design / develop solutions for broad based problems in the target skill based trade to address changing challenges put forward by market demand/ stakeholder

PO4. **Conduct Investigation of complex problems:** Design and conduct technology enabled experiments, analyze the resulting data and interpret the same to provide valid conclusions

PO5. **Modern tools:** Use the techniques, skills and modern tools necessary skill based trade to practice with clear understanding of limitations.

PO6. **The citizenship and society:** Apply broad understanding of ethical and professional skill based trade practice in the context of global, economic, environmental and societal realities while encompassing relevant contemporary issues.

PO7. **Environment and sustainability:** Apply broad understanding of impact of skill based trade in a global, economic, environmental and societal context.

PO8. **Ethics:** Apply ability to develop practical solutions for skill trade problems within positive professional and ethical boundaries.

PO9. **Individual and team work:** Function effectively as a leader and as well as team member in diverse/ multidisciplinary environments.

PO10. **Communication:** Communicate effectively in oral and written format addressing specific professional/ social demands.

PO11. **Project management and finance**: Demonstrate knowledge and understanding of the first principles of skill trade and apply these to one's own work as a member and leader in a team, to complete project in any environment.

PO12. **Life-long learning:** Recognize the need for and have the ability to address to the changing technological demands of the target skill trade.

Program Specific Outcomes (PSO):

Graduates of the B.Voc (Industrial Automation) program are expected to -

1. Apply broad based fundamental knowledge of electronics, electrical, mechatronics fundamentals and Industrial automation specialization for the solution of automated manufacturing and process related problems.

2. Identify complex industrial automation related problems at varied complexity and analyze the same to formulate/ develop substantiated conclusion using first principles of electronics, electrical and mechatronics and technical literature.

3. Design and conduct technology enabled experiments, analyze the resulting data and interpret the same to provide valid conclusions.

4. Use the techniques, skills and modern tools necessary for industrial automation practice clear understanding of limitations.

Exit Options:

The course allows exit of a student from the course on successful employment. Scopes will be there for further continuation of study. The other wise exit options will be as follows-

Exit Point	Duration	Diploma / Degree to be Offered
First exit	After 6 months	Certificate in Vocation
Second exit	After 1 yr.	Diploma in Vocation(D. Voc.)
Third exit	After 2 yrs.	Advanced Diploma in Vocation(Adv. D. Voc.)
Fourth exit	After 3 yrs.	Bachelor in Vocation (B. Voc.)

Eligibility:

Automobile, Industrial Automation:
Those who have completed XII Science OR equivalent/ MCVC / ITI (Two Years) with relevant / equivalent trade from any recognized Board/Institution are eligible for registration / admission to first year (Semester I) of B. Voc degree program.

Admission / Promotion Process:

In response to the advertisement for registration, interested students will have to register themselves for a Common Entrance Test (CET). Admission will be done on the basis of performance of students at Common Entrance Test (CET). The CET will be conducted in the month of June every year.

A candidate who has sought admission to Semester – I shall be admitted to Semester – II automatically (provided, he submits an application to that effect). A candidate who has passed 75% of the papers at First Year (First and Second Semesters together) examinations shall be allowed to take admissions in third semester. Similarly, a candidate who has passed 75% of the papers at the Second Year (Third and Fourth Semesters together) examinations shall be allowed

to take admission in the Fifth semester. However, if a candidate has not passed the First and Second Semester examinations, he shall not be allowed to take admission in the Fifth Semester. Appearance in the First, Third and Fifth semester is compulsory to get promoted to next semester.

Dropout students will be allowed to register for second or third year as and when the concerned courses are offered by the Centre, however he/she should not exceed more than twice the duration of the course from the date of first registration at the Centre. Therefore, for obtaining B. Voc. degree a student will have to complete all semesters successfully within 6 years/12 semesters.

Choice Based Credit System (CBCS):

The choice based credit system is going to be adopted by this Centre. This provides flexibility to make the system more responsive to the changing needs of our students, the professionals and society. It gives greater freedom to students to determine their own pace of study. The credit based system also facilitates the transfer of credits.

- ☐ Students will have to earn 30 credits for the award of Six Month Certificate in Vocation
- ☐ Students will have to earn 60 credits for the award of one year Diploma in Vocation(D. Voc.)
- ☐ Students will have to earn 120 credits for the award of two year Advance Diploma in Vocation (Adv. D. Voc.)
- ☐ Students will have to earn 180 credits for the award of three year Bachelor Degree in Vocation (B. Voc.)

Credit-to-contact hour Mapping:

(a) One Credit would mean equivalent of 15 periods of 60 minutes each for theory lecture.

(b) For lab course/ workshops/internship/field work/project, the credit weightage for equivalent hours shall be 50% that for lectures /workshop

(c) For self- learning, based on e-content or otherwise, the credit weightage for equivalent hours of study should be 50% or less of that for lectures/workshops.

Attendance:

Students must have 75 % of attendance in each course for appearing examination otherwise he / she will not be strictly allowed for appearing the examination of each course.

Departmental Committee:

The Departmental Committee (DC) of DDU-KK will monitor the smooth functioning of the programme.

Results Grievances / Redressal Committee

Grievances / redressal committee will be constituted in the department to resolve all grievances relating to the evaluation. The committee shall consist of Director of DDU-KK, the concerned teacher of a particular course and senior faculty member of Department of Committee. The decision of Grievances / redressal committee will have to be approved by Department committee.

Evaluation Methods:

☐ The assessment will be based on 20: 80 ratio of continuous internal assessment (CIA) and semester end examination (SEE). Performance will be decided after combining performance in CIA and SEE. In case of failure in SEE in particular course(s), exam will be conducted in immediate subsequent semester. However, if a student fails in CIA (considering independent CIA score), he/she may appear for the same CIA, at his/her own responsibility in the next academic year, when the same course is offered during regular academic session.

☐ In case a student fails in certain course(s) in a particular semester and the same course(s) are modified/ revised/ removed from the curriculum in due course, the student will have to appear as per the newly framed curriculum and/or pattern in subsequent semester, at his/her own responsibility.

Continuous Internal Assessment (CIA):

(A) For 4 credit courses-

☐ There will be 20 marks for Continuous Internal Assessment. Two internal tests (of 20 marks each) will be conducted, after completion of 40% and 80% of the curriculum respectively. Average performance of the two sets will be considered for final marks-memo preparation. The setting of question papers and the assessment will be done by concerned teacher.

(B) For 2 credit courses-

☐ There will be 10 marks for Continuous Internal Assessment. Two internal tests (of 10 marks each) will be conducted, after completion of 40% and 80% of the curriculum respectively. Average performance of the two sets will be considered for final marks-memo preparation. The setting of question papers and the assessment will be done by concerned teacher.

Semester End Examination (SEE):

☐ The semester end theory examination for each theory course of 4 credits will be of 80 marks, whereas, for 2 credit theory course, the same will be of 40 marks. Therefore, the total marks

shall be 100 for 4 credit theory course (80 marks semester end exam + 20 marks CIA) and 50 for 2 credit theory course (40 marks semester end exam + 10 marks CIA).

☐ Semester end examination (SEE) time table will be declared by the departmental committee (as per the university annual calendar). The paper setting and assessment of theory courses, laboratory courses and project will done by external (50 %) and internal (50%) examiners. However, in case of non-availability of external examiner for either paper setting or assessment or both, department committee will be empowered to take appropriate decision.

☐ Pattern of semester end question paper will be as below:

(A) For 4 credit courses-

o The semester end examination of theory course will have two parts (20+60 = 80 Marks)

o Part A will be consisting of 10 questions having 2 marks each (multiple choice questions / fill in the blanks/ answer in one sentence) as compulsory questions and it should cover entire course curriculum (20 Marks)

o Part B will contain 07 questions of 12 marks each (with more or less equal weightage on every module). Students will have to attempt 05 questions out of 07 (60 Marks).

o 20 to 30% weightage can be given to problems/ numerical (wherever applicable) wherein use of non-programmable scientific calculator may be allowed.

o Number of sub questions (with allotment of marks) in a question may be decided by the examiner.

(A) For 2 credit courses-

o The semester end examination of theory course will have two parts (10+30 = 40 Marks)

o Part A will be consisting of 10 questions having 1 marks each (multiple choice questions / fill in the blanks/ answer in one sentence) as compulsory questions and it should cover entire course curriculum (10 Marks)

o Part B will contain 05 questions of 10 marks each (with more or less equal weightage on every module). Students will have to attempt 03 questions out of 05 (30 Marks).

o 20 to 30% weightage can be given to problems/ numerical (wherever applicable) wherein use of non-programmable scientific calculator may be allowed.

o Number of sub questions (with allotment of marks) in a question may be decided by the examiner.

☐ Assessment of laboratory courses and project will be carried out at the end of semester. Student must perform at least eight experiments from each laboratory course. The

semester end practical examination will be conducted at the end of each semester along with the theory examination.

☐ At the end of each semester, the Departmental Committee will assign grades to the students.
☐ The Director of the Centre shall send all results to the Controller of Examination for further processing.

☐ Every student will have privilege for revaluation of answer sheets or recounting of marks for each semester end examination. However, students will have to submit an application within 15 days from the date of declaration of results.

☐ Applications received for revaluation / recounting will be discussed in the Departmental committee and examiners will be appointed accordingly.

☐ The results of revaluation / recounting will be approved by Departmental committee and forwarded to Controller of Examination for further processing.

Earning Credits:

At the end of every semester, a letter grade will be awarded in each course for which a student had registered. A student's performance will be measured by the number of credits that he/she earned by the weighted Grade Point Average (GPA). The SGPA (Semester Grade Point Average) will be awarded after completion of respective semester and the CGPA (Cumulative Grade Point Average) will be awarded at the respective exit point.

Grading System:

☐ The grading reflects a student-own proficiency in the course. A ten point rating scale shall be used for the evaluation of the performance of the students to provide letter grade for each course and overall grade for the Master Programme. Grade points are based on the total number of marks obtained by him / her in all heads of the examination of the course. The grade points and their equivalent range of marks are shown in Table-I

Table – I : Ten point grade and grade description

Marks Obtained (%)	Grade Point	Letter Grade	Description
90-100	9.00- 10	O	Outstanding
80-89	8.00-8.90	A^{++}	Exceptional
70-79	7.00-7.90	A^{+}	Excellent

60-69	6.00-6.90	A	Very Good
55-59	5.50-5.90	B$^+$	Good
50-54	5.00-5.40	B	Fair
45-49	4.50-4.90	C^{++}	Average (Above)
41-44	4.1-4.49	C	Average
40	4.0	P	Pass
< 40	0.0	F	Fail (Unsatisfactory
	0.0	AB	Absent

☐ Non-appearance in any examination / assessment shall be treated as the students have secured zero marks in that subject examination / assessment.

☐ Minimum P grade (4.00 grade points) shall be the limit to clear / pass the course / subject. A student with F grade will be considered as ―failed in the concerned course and he / she has to clear the course by appearing in the next successive semester examinations. There will be no revaluation or recounting under this system.

☐ Every student shall be awarded grade points out of maximum 10 points in each subject (based on 10 point scale). Based on the grade points obtained in each subject, Semester

Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) shall be computed. Results will be announced at the end of each semester and CGPA will be given at respective exit point.

Computation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average)

Grade in each subject / course will be calculated based on the summation of marks obtained in all five modules.

The computation of SGPA and CGPA will be as below

☐ Semester Grade Point Average (SGPA) is the weighted average points obtained by the students in a semester and will be computed as follows

$$SGPA = \frac{Sum\ (Course\ Credits)\ X\ Number\ of\ Grade\ Points\ in\ concerned\ Course\ Gained\ by\ the\ Student}{Sum\ (Course\ Credits)}$$

The SGPA will be mentioned on the grade card at the end of every semester.

☐ The Cumulative Grade Point Average (CGPA) will be used to describe the overall performance of a student in all semester of the course and will be computed as under.

$$CGPA = \frac{\text{Sum (All six Semester SGPA)}}{\text{Total Number of Semester}}$$

The SGPA and CGPA shall be rounded off to the second place of decimal.

Grade Card

Results will be declared by the Centre and the grade card (containing the grades obtained by the student along with SGPA) will be issued by the university after completion of every semester. The grade card will be consisting of following details.

☐ Title of the courses along with code opted by the student.
☐ Credits associated with the course.
☐ Grades and grade points secured by the student.
☐ Total credits earned by the student in a particular semester.
☐ Total credits earned by the students till that semester.
☐ SGPA of the student.
☐ CGPA of the student (at respective exit point).

Cumulative Grade Card

The grade card showing details grades secured by the student in each subject in all semesters along with overall CGPA will be issued by the University at respective exit point.

Course Structure

Paper No	Paper Title	Credits
Semester - I		
General Education Components		
VOC 101	Functional English and Marathi	4
VOC 102	Basic Computing	2
VOC 103	UPS Repairing (Theory)	2
VOC 104	UPS Repairing (Practical)	2
VOC 105	Occupational Practice Essentials	2
Skill Development Components - Industrial Automation (A)		
VOC 111	Analog and Digital Electronics	2
VOC 112	Electrical Systems	2
VOC 113	Industrial Electronics	2
VOC 114	Industrial Instrumentation	2
VOC 115	Laboratory Coursework – I (IA)(Analog and Digital Electronics)	2
VOC 116	Laboratory Coursework – II (IA) (Electrical Systems)	2
VOC 117	Laboratory Coursework – III (IA) (Industrial Electronics)	2
VOC 118	Laboratory Coursework – IV (IA) (Industrial Instrumentation)	2
Total Credits = General Education Components + Skill Development Components		12+16= 28
Semester - II		
General Education Components		
VOC 201	Communicative English and Hindi	4
VOC 202	Basic Computer Hardware System : Theory	2
VOC 203	Basic Computer Hardware System : Lab- Course	2
VOC 204	Environment Management	4
Skill Development Components - Industrial Automation (A)		
VOC 211	Interfacing and Signal Conditioning	2
VOC 212	Control Systems Fundamentals	2
VOC 213	Fundamentals of Drives	2
VOC 214	PLC Fundamentals	2
VOC 215	Laboratory Coursework–V (IA)(Interfacing and Signal Conditioning)	2
VOC 216	Laboratory Coursework – VI(IA) (Control Systems Fundamentals)	2
VOC 217	Laboratory Coursework – VII (IA) (Fundamentals of Drives)	2
VOC 218	Laboratory Coursework – VIII (IA) (PLC Fundamentals)	2
VOC 219	In-plant Training – I (IA)	4
Total Credits = General Education Components + Skill Development Components		12+20= 32

Semester – III		
General Education Components		
VOC 301	Linguistic Proficiency-III	4
VOC 302	Business Software Tools –I	4
VOC 303	Statistical Tools (Probability and Statistics)	4
Skill Development Components - Industrial Automation (A)		
VOC 311	Analog and Digital Circuit Design	2
VOC 312	Mechanical Power Transmission	2
VOC 313	Fundamentals of Hydraulics	2
VOC 314	Embedded System Concepts	2
VOC 315	Laboratory Coursework–IX (IA)(Analog and Digital Circuit Design)	2
VOC 316	Laboratory Coursework–X(IA) (Mechanical Power Transmission)	2
VOC 317	Laboratory Coursework – XI (IA) (Fundamentals of Hydraulics)	2
VOC 318	Laboratory Coursework – XII (IA)(Embedded Systems Concepts)	2
Total Credits = General Education Components + Skill Development Components		12+16= 28
Semester – IV		
General Education Components		
VOC 401	Industrial Ethics and Safety Management(for Industrial Automation and Automobile) / Ethical, Legal and Regulatory Aspects of Tourism(for Travel & Tourism)	4
VOC 402	Business Software Tools-II	4
VOC 403	Fundamentals of Business and Accounting	4
Skill Development Components - Industrial Automation (A)		
VOC 411	PLC based Automation	2
VOC 412	Process Control	2
VOC 413	Fundamentals of Pneumatics	2
VOC 414	Embedded System Applications	2
VOC 415	Laboratory Coursework–XIII (IA)(PLC based Automation)	2
VOC 416	Laboratory Coursework–XIV(IA) (Process Control)	2
VOC 417	Laboratory Coursework – XV (IA) (Fundamentals of Pneumatics)	2
VOC 418	Laboratory Coursework – XVI(IA)(Embedded System App.)	2
VOC 419	In-plant Training/Field work/Mini Project – II (IA)	4
Total Credits = General Education Components + Skill Development Components		12+20= 32
Semester – V		
General Education Components		
VOC 501	Personality Development and Stress Management	4
VOC 502	Operations Management	4
VOC 503	Business Communication	2
VOC 504	Production Engineering	2

Skill Development Components - Industrial Automation (A)		
VOC 511	Workshop Technology	2
VOC 512	Introduction to Robotics	2
VOC 513	Networking Essentials	2
VOC 514	Advance Microcontrollers	2
VOC 511A	Fundamentals of Microprocessor 8086	2
VOC 512A	Interfacing with Microprocessor 8086	2
VOC 515	Laboratory Coursework – XVII (IA)(Pertaining to VOC 511 and VOC 512)	3
VOC 516	Laboratory Coursework – XVIII(IA)(Pertaining to VOC 513 and VOC 514)	3
VOC 515A	Lab. Coursework – XVIV(IA)(Pertaining to VOC 511A and VOC 512A)	3
VOC 517	Major Project – Phase I	2
VOC 518	In-plant Training/Field work/Mini Project – III (IA)	2
Total Credits = General Education Components + Skill Development Components		12+ 18= 30

Semester – VI		
General Education Components		
VOC 601	Foreign Language(German/Chinese/Japanese/Russian)	4
VOC 602	Entrepreneurship Development	4
VOC 603	Production Management	4
Skill Development Components - Industrial Automation (A)		
VOC 611	Flexible Manufacturing System	2
VOC 612	Industrial Robotics	2
VOC 613	Introduction to SCADA	2
VOC 614	Introduction to IOT	2
VOC 611A	Numerical Controls	2
VOC 612A	Single manufacturing Cells	2
VOC 615	Laboratory Coursework – XVII (IA)(Pertaining to VOC 611 and VOC 612)	3
VOC 616	Lab. Coursework – XVIII (IA)(Pertaining to VOC 613 and VOC 614)	3
VOC 615A	Lab. Coursework – XVIV(IA)(Pertaining to VOC 611A and VOC 612A)	3
VOC 617	Major Project – Phase II	2
VOC 618	In-plant Training/Field work/Mini Project – IV (IA)	2
Total Credits = General Education Components + Skill Development Components		12+ 18= 30
Total Credits (Semester I to VI)		180

In Semester V, students have to opt for either course group I- (VOC 511, VOC 512, VOC 515) or course group II- (VOC 511A, VOC 512A , VOC 515A)
In Semester VI, students have to opt for either course group I- (VOC 611, VOC 612, VOC 615) or course group II- (VOC 611A, VOC 612A , VOC 615A)

Paper Code Description:

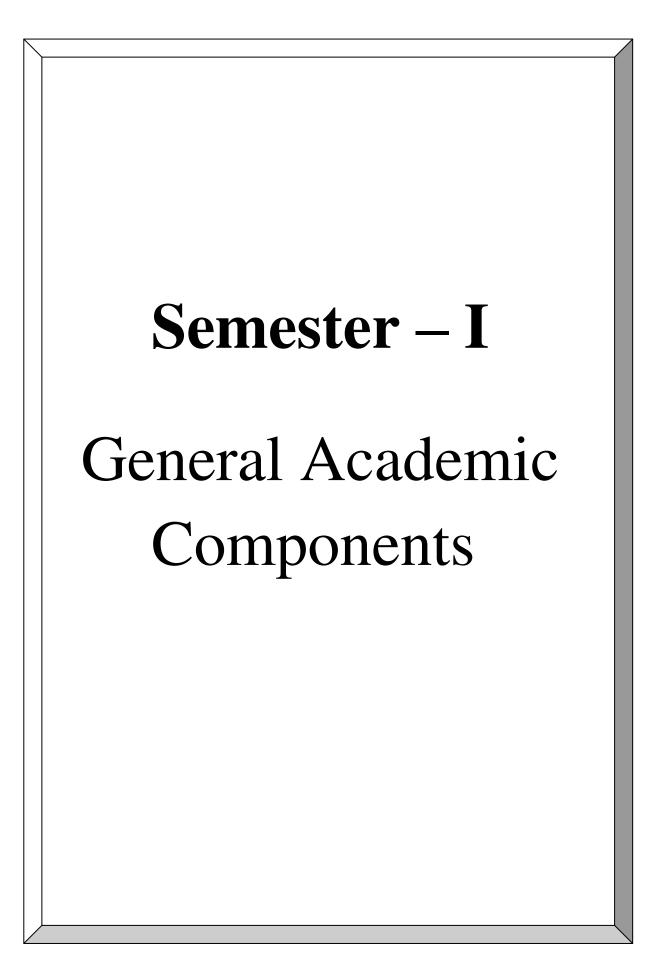Each course will be identified by a unique three digit code.

The first digit refers to Semester.

The second digit refers to General academic component or Skill Development Component

(according to specialization / trade) as per following scheme of nomenclature

> **0** - Refers to General paper / course
>
> **1** - Refers to Industrial Automation

Third digit refers to incremental number for paper / course of respective semester.

Semester – I

General Academic Components

Semester – I

General Education Components

VOC-101: Linguistic Proficiency-I (English and Marathi) with language lab training
(4 Credits: 100 Marks)

Course Outcomes

On completion of the course, students should be able to –

1	Compare between different tenses in English. Explain different types of linguistic expressions in Marathi
2	Apply concept of tenses to formulate correct sentences in English Apply proper linguistic expression in Marathi to address situational demand
3	Describe basic rules of Pronounciations and phonetic subscriptions in English
4	Formulate different types of dialogues, expression of ideas/informations in English and Marathi to address situational demand
5	Compose applications, reports, requests, responses, summary and comprehensions in English and Marathi

Course Contents:

Part A: BASIC STRUCTURE OF THE ENGLISH LANGUAGE

Module – I: Tenses   **(10 hrs)**

Present tense, Past tense, Future tense

Module- II: Spoken English-I   **(14 hrs)**

Basic of pronunciation - Vowels, diphthongs; Certain basic sounds including th, dh, gh sounds, fricatives etc.; Differences in the sounds of the letters, especially, w/v, f/ph etc.; Phonetic transcriptions

Module- III: Spoken English-II   **(14 hrs)**

Introducing yourself (The communicator), Introducing people to others, Giving personal information, Getting people's attention and interrupting, Giving instructions and seeking clarifications, Making requests and responding to requests

References:

1. Business Communicator – V.K. Jain, O. P. Biyani, S. Chand, New Delhi.
2. The Communicator – Board of Editors , Orient Blackswan Pvt. Ltd
3. The Art of Powerful Communication – Dinesh K. Vohra, Are Maria Publications, Pune

Part B : BASIC STRUCTURE OF THE MARATHI LANGUAGE
(ON NEXT PAGE….)

उद्दिष्टे -

१) संज्ञापनाचे स्वरूप आणि प्रकार, संज्ञापन व्यवहारातील भाषेचे महत्त्व आणि कार्य यांचे महत्त्व समजावून देणे.

२) भाषा व्यवहाराची अपारंपरिक आणि अनौपचारिक क्षेत्रे, औपचारिक भाषा व्यवहाराची क्षेत्रे आणि त्याचे क्षेत्रनिहाय स्वरूप समजावून देणे.

३) विविध स्तरावरील भाषिक कौशल्ये आणि क्षमता विकसित करणे.

४) प्रसार माध्यमांचे स्वरूप आणि त्यासाठी आवश्यक असलेल्या भाषा व्यवहाराचे स्वरूप समजावून देणे.

५) कार्यालयीन / लेखन व्यवहारातील भाषेचे स्वरूप समजावून घेणे.

६) परिभाषानिष्ठ भाषाव्यवहार म्हणजेच निरनिराळ्या शास्त्रीय विषयांवरील लेखना करिता

७) भाषाव्यवहारातील आधुनिक तंत्रोपकरणांची (व तंत्रांची) माहिती करून देणे, मराठीतून व्यवहार करणाऱ्या संस्थांना भेटी देणे इत्यादी.

घटक४

संज्ञापन व भाषिक कौशल्ये

अ) संज्ञापन म्हणजे काय ? संज्ञापनाचे प्रकार – संज्ञापनातील भाषेचे, महत्त्व आणि कार्य भाषेचे औपचारिक व अनौपचारिक उपयोग.

आ) भाषेची प्राथमिक कौशल्ये (श्रवण, भाषण, वाचन, लेखन)

इ) भाषेची प्रगत कौशल्ये -

१) वर्णन, कथन, निवेदन, संभाषण, सूत्रसंचालनइ.
२) आकलन, संक्षेप, विस्तार, भाषांतर, गद्य रूपांतर, संवादलेखन इ.

औपचारिक भाषाव्यवहाराचे विविध प्रकार

अ) इतिवृत्त, टिप्पणी, अर्जलेखन, कार्यालयीन पत्रलेखन, निवेदन प्रसिध्दीपत्रक, निविदा इ.
ब) मुलाखत लेखन

स्मरणिका / गौरविका / संस्थापत्रिका / वार्षिक अहवाल इत्यादींचे संपादन

Module V : Tutorials, assignments and presentation based on Module I to IV

संदर्भ पुस्तके:

१) मराठी शुध्दलेखन प्रदीप   - मो. रा. वाळंबे, गो. य. राणे प्रकाशन

२) मुद्रित शोधन   - य. ए. धायगुडे - वि. पूना प्रेस ऑनर्स असो.

३) मराठी शुध्दलेखनविवेक   - द. न. गोखले - सोऽहं प्रकाशन

४) शुध्दशब्दसूची   - स्नेहल तावरे - स्नेहवर्धन

५) राजभाषापरिचय   -

६) व्यावहारिक मराठी   - पुणेविद्यापीठ

७) व्यावहारिक मराठी   - ल. रा. नसिराबादकर -फडके बुकसेलर्स,कोल्हापूर

८) व्यावहारिक मराठी   - प्रकाश परब

९) वार्तासंकलन   - चंद्रकांत ताम्हणे

१०) व्यावहारिक मराठी   - (संपादकडॉ. स्नेहल सावरे) स्नेहवर्धन प्रकाशन, पुणे

VOC-102: Basic Computing

(2 Credits: 50 Marks)

Course Outcomes

On completion of the course, students should be able to –

1	Extend the knowledge of basic and advanced tools of Word Processing, Spreadsheet, Presentation Graphics, DBMS, and Internet in MS-Office for specific tasks
2	Apply Word Processing tools to create Notice, Application
3	Use Spreadsheet tools to create and manage attendance sheets
4	Demonstrate Presentation Graphic tools to create, modify and refine presentation
5	Implement DBMS tools to create/modify tables/forms, reports
6	Apply search engines and write e-mails

Course Contents:

Software for Hands-on:
- Windows Vista
- MS Office 2007
- Internet Explorer
- Online collaboration tools

Course Contents:

Module - I: Word Processing   (6 hrs)

- Overview of Word Processing
- Creating and Editing a Document (Exercise 1 - Creating Notice)
- Revising and Refining a Document (Exercise 2 - Revise your notice)
- Using Additional Word Features (Exercise 3 – Creating notice for different classes)
- Changing the Display of the Document (Exercise 4 - Changing the display of your notice)
- Using Mail Merge (Exercise 5 – Sending notice using Mail Merge)
- Using Standard Templates (Exercise 6–Create notice using standard templates)
- Word Processing in Other Languages (Exercise 7 - Creating a notice in Marathi)

Module - II: Spreadsheet and Presentation Graphics   (8 hrs)

- Overview of Excel
- Creating and Editing (Exercise 1 – Creating attendance sheet)
- Using Charts (Exercise 2 – Creating a chart)
- Managing a Workbook (Exercise 3 – Managing Attendance Sheet)
- Overview of Presentation Graphics
- Creating a Presentation (Exercise 1 – Creating a Annual Day Presentation)

- Modifying and Refining a Presentation (Exercise 2 – Modifying and Refining Presentation)
- Using Advanced Presentation Features (Exercise 3 – Advanced Features for Presentation)

Module - III: Database Management Systems   **(8 hrs)**

- Overview
- Creating a Database (Exercise 1 – Creating a Student Database)
- Modifying a Table (Exercise 2 – Modifying a Student Database)
- Creating Forms (Exercise 3 – Creating Form for Student Database)
- Queries and Reports (Exercise 4 – Creating Report)
- Protecting the Database (Exercise 5 – Protecting a Student Database)

Module - IV: Internet   **(8 hrs)**

- Internet Basics
- Navigating the Web (Exercise 1 – Navigating the web site)
- Finding Information on the Web (Exercise 2 – Searching result on the web)
- Communication Using E-Mail (Exercise 3 – Communicate result to your friends)

Module - V:

Tutorials, assignments and presentation based on Module I to IV

References:

1. Microsoft Office Word 2007 a Beginners Guide: A Training Book of Microsoft Word 2007, By W.R. Mills, United States of America, Bloomington, Indiana.
2. Microsoft Office Word 2007: Illustrated Co: Illustrated Complete, By Jennifer A. Duffy, Carol M. Cram
3. Sams Teach Yourself Microsoft Office 2007 All in One, By Greg Perry
4. Microsoft Office Excel 2007: Comprehensive Concepts and Techniques, By Greg B. Shelly, Thomas J. Cashman, Jeffrey J. Quasney.
5. Microsoft Office Power Point 2007: Illustrated Introductory: Introductory, By David Beskeen
6. Microsoft Office Power Point 2007: Top 100 Simplified Tips & Tricks, By Paul McFedries.
7. Microsoft Office Access 2007: Comprehensive Concepts and Techniques, By Thomas J. Cashman, Philip J. Pratt
8. New Perspectives on Microsoft Office Access 2007, Comprehensive, Joseph J. Adamski, Kathleen T. Finnegan
9. Basic Internet, By O.H.U. Heathcote
10. Microsoft Office 2007 Power Point: A Training Book for Microsoft Power Point 2007, By W. R. Mills

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Industrial Automation

VOC-103: UPS Repairing

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(2 Credits: 50 Marks)

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Course Outcomes

On completion of the course, students should be able to -

1	Classify Electrical circuit. Voltage, current, resistance, series and parallel circuit with help of ohm's law
2	Identify Active & passive Electronic components & Explain Characteristics of PN junction diode
3	Explain basic term logy of single phase HWR, Full Wave, Bridge Rectification Circuits
4	Select Inverter for particular application and compare VSI & CSI inverter operation

Course Contents:

Module -I: Introduction & Engaging With Customers   **(8 hrs)**

Qualifications Pack -Occupational Standards For Electronics Industry by Electronic Sector Skill Council (Field Technician: UPS and Inverter Corresponding NOPS ELE/N0061)

Module -II: Install The UPS/Inverter   **(6 hrs)**

Qualifications Pack -Occupational Standards For Electronics Industry by Electronic Sector Skill Council (Field Technician: UPS and Inverter Corresponding NOPS ELE/N7201)

Module - III: Repair dysfunctional UPS/Inverter   **(8 hrs)**

Qualifications Pack -Occupational Standards For Electronics Industry by Electronic Sector Skill Council (Field Technician: UPS and Inverter Corresponding NOPS ELE/N7202)

Module - IV: Interaction with Co-workers and Colleagues   **(8 hrs)**

Qualifications Pack -Occupational Standards For Electronics Industry by Electronic Sector Skill Council (Field Technician: UPS and Inverter Corresponding NOPS ELE/N9962)

Module - V:

Tutorials, assignments and presentation based on Module I to IV

References:

1. Basic Electronics - Repair & Maintenance of Power supply, Invertor & UPS –NIMI Published by National Instructional Media Institute, Chennai
2. Switching Power Supply Design, 3rd Ed. by Abraham Pressman (Author),
3. Uninterruptible Power Supplies Alexander King, William Knight McGraw Hill Professional

Industrial Automation

VOC 104 : UPS Repairing(Practical)

(2 Credits: 50 Marks)

Course Outcomes

On completion of the course, students should be able to -

1	Identify broad based components and circuit cards inside an UPS
3	Fault find and solve problems UPS & Inverter circuit
4	Design Battery charging circuit With help of Bridge controlled rectification circuit

As Per Field Technician: UPS and Inverter Corresponding NOPS ELE/N0061, ELE/N7201, ELE/N7202, NOPS ELE/N9962

VOC-105: Occupational Practice Essentials

(2 Credits: 50 Marks)

Course Outcomes:

On completion of the course, students should be able to –

1	State the Inventory Management, quality management, recognize Manufacturing practices, Define of Project, Jobs, Events - Arrow Diagrams - Time Analysis and Derivation of the Critical Path.
2	Explain the effect of demand uncertainty, Risk pooling, A single warehouse inventory example
3	Apply Kaizen, T.P.M., S.M.E.D., 5-S Principles, Housekeeping, Kanban, Poka -Yoke, JIT as tools for better productivity
4	Compare centralized versus decentralized systems, plan JIT manufacturing and Lean manufacturing through waste elimination.
5	Test Problem solving tools such as- seven Tools for quality control such as Pareto charts, Check sheets, Cause and effect diagram, Scatter diagrams, Histogram, Graphs or flow charts, Control charts
6	Prepare Shortest Route Problem, develop Project Planning & Control by use of CPM/PERT Concepts

Course Contents:

Module- I: Inventory Management   **(8 hrs)**

Introduction, A single warehouse inventory example, The economic lot size model, The effect of demand uncertainty, Risk pooling, Centralized versus decentralized systems, Managing inventory in the supply chain.

Module -II : Manufacturing Tools   **(6 hrs)**

Total productivity through such practices- Kaizen, T.P.M., S.M.E.D., 5-S Principles, Housekeeping, Kanban, Poka -Yoke, JIT, JIT manufacturing and Lean manufacturing through waste elimination.

Module -III : Quality Management   **(6 hrs)**

Introduction and evolution of quality movement, Problem solving tools such as- TQC Tools – problem solving, TQC Tools – Management, Quality Improvement and Total Employee Involvement

Module –IV: Network Analysis   **(8 hrs)**

Minimal Spanning Tree Problem - Shortest Route Problem, Maximal Flow in Capacitated Network - Concepts and Solution Algorithm as Applied to Problem, Project Planning & Control by use of CPM/PERT Concepts. Definitions of Project, Jobs, Events - Arrow Diagrams - Time Analysis and Derivation of the Critical Path.

Module - V:

Tutorials, assignments and presentation based on Module I to IV

References :

1   Toyota Production Systems - Taichi Ohno, Kaizen , Masaki Imai
2   Chronicles of a Quality Detective - Dr Shrinivas Gondhalekar, Payal Sheth
3   Beyond T.Q.M - By Robert L. Flood
4   T.Q.M Process - By Gopal Kanji, Mike Asher
5   Operation Research - Taha
6   Quantitative Techniques in Management – N.D.Vohra
7   Quantitative Techniques in Management – J.K.Sharma

Semester – I

Industrial Automation

(Skill Development Components)

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<u>Skill Development Components</u>

<u>Industrial Automation</u>

VOC-111: Analog and Digital Electronics

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(2 Credits: 50 Marks)

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<u>Course Outcomes</u>

On completion of the course, students should be able to -

1	Identify Analog and Digital Electronics Components like diodes, transistors, Various digital ICs, etc.
2	Explain basic operation of Analog and Digital Electronics Components like diodes, transistors ,Various digital ICs, etc.
3	Explain role of various components in different types of DC voltage regulated power supplies
4	Demonstrate inter-conversions between number systems , operation of simple and combinational logic gates
5	Apply laws of Boolean algebra for simplification of digital circuits, conversion of logic expression to circuit diagram and vice versa
6	Design basic circuits using analog and/or digital electronic components for simple applications that include (but not limited to) power supply, water level control etc.

Course Contents:

Module -I: Basic Electronic Components **(8 Hrs)**

Basic Electronic Components - Resistor – Study of Resistor, Types of resistor, construction, and Color Coding of resistor; Capacitor - Study of capacitor, Types of capacitor and their construction; Inductor - Study of inductor & their types
Semiconductor Devices – P-N Junction Diode, Zener Diode, Light Emitting Diode, Photodiode, Transistor (CE,CB, CC modes), Phototransistor, Field Effect Transistor

Module -II: Power Supply Fundamentals **(8 Hrs)**

Power supply building blocks**,** Rectifier, Need of rectifier, Types of Rectifier, Filter and their types, Zener Diode as voltage regulator, Transistorized voltage regulator, Three terminal voltage regulator such as IC 78XX and IC 79 XX, Adjustable voltage regulator using LM-317

Module -III: Number system and Logic gates   **(6 hrs)**

Number System – Decimal, Binary, Octal, Hexadecimal and their conversion. Binary addition, subtractions
Logic Gates – Basic logic gates – AND, OR, NOT; Basic Circuit, Symbol, Truth table, universal gates & their truth table
Boolean Algebra – Basic Laws, De Morgan's Theorem, Conversion of Boolean expression to logic diagram, Simplification Techniques

Module – IV: Combinational Logic   **(8 hrs)**

Combination of Logic Gates: Converting a Boolean Expression to a Logic Diagram, Converting a Truth Table to a Boolean Expression, Converting a logic diagram to a truth table, AND-OR logic, Minterm, OR-AND logic, Maxterm, EX-OR gate, EX-NOR Gate, NAND and NOR gate, Universal Property of NAND and NOR gate

Module - V:

Tutorials, assignments and presentation based on Module I to IV

References:

1. Electronic Devices- Thomas l. Floyd; Pearson Education, Ninth Edition, 2012, New Jersey

2. Principles of Electronics- V. K. Mehta, Rohit Mehta; S. Chand Publishers, Twelfth Edition, 2008, New Delhi

3. Semiconductor Electronics – A. K. Sharma; New Age International publishers, 2001 Reprint, New Delhi

4. Electronic Principles- A. P. Malvino, D. J Bates; Mc. Graw Hill (India Pvt. Ltd), Seventh Indian Edition, 2007, New Delhi

5. Digital Fundamental- Thomas L. Floyd; Third Edition, 1987, Universal Book Stall, New Delhi/ Tenth Edition, 2008, Pearson

6. Digital Design: Principles and Practices- John F. Walkerly; Fourth Edition, Second Impression, 2009,Prentice Hall of India, New Delhi

7. Modern Digital Electronics- R. P. Jain; Fourth Edition,2010, Tata Mc. Graw Hill, New Delhi

VOC-112: Electrical Systems

(2 Credits: 50 Marks)

Course Outcomes

On completion of the course, students should be able to-

1	Analyze simple DC circuits by applying DC network theorems
2	Explain various parameters of Single phase AC signal and interconnection of phases for Three phase AC signal
3	Describe basic construction and working principle of Single Phase and three phase transformers
4	Describe basic construction and operation of AC and DC motors and select requisite motor for application specific demand
5	Compare between renewable and non-renewable sources, describe basic working of solar and wind power plant and apply modular solar/ wind power generators for basic applications

Course Contents:

Module -I: Basic Circuit Elements and D.C. Network Analysis   (8 hrs)

Basic Circuit Elements -Idea of Electric Potential and Current, Resistance -Unit, Law, Conductance and Conductivity, Effect Of Temperature on Resistance, Temperature Coefficient of Resistance, Ohms Law, Resistance and Parallel, Voltage Divider Rule, Short and Open Circuits, Equivalent Resistance. Inductance- Self inductance, mutually induced EMF, Capacitance – Charging & Discharging, Time Constant

D.C. Network Analysis- Introduction (Circuit, Parameters, Types of Circuits, Types of

Networks, Node, Branch, loops, Mesh), Kirchoff's Volatage and Current Law, Thevenin Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Delta /Star and Star /Delta Transformation.

Module -II: Electrical Fundamentals and Transformer   (8 hrs)

Single Phase AC - Generation of Alternating Voltage and Current, Equation of Alternating Voltage & Current, Simple Waveform, Complex waveform, Cycle, Time Period, Frequency, Amplitude Different form of EMF Equations, Phase, Phase Difference, Root mean Square Value(RMS) , Representation of Alternating Quantities.
Three Phase AC - Generation of Three phase voltage, Phase Sequence, Phase sequence at load, Numbering of phases, Interconnection of phases (Star and delta Connection), Concept of

balance and unbalanced Load

Single Phase Transformers- Construction, Working Principle, EMF Equations, Transformation Ratio, Working of Transformer On no load and with load, losses, efficiency

Three Phase Transformers- Construction, Working Principle, Three phase transformer connections; Instrument transformers (Current and Potential transformer)

Module -III: Electric Motors   (8 hrs)

AC motors – Principle, Stator construction and operation (two and three phase), Single Phase Induction motors, Motor characteristics, Resistance-start-induction-run motor,
capacitor start- induction run motor, Three phase motors, Induction motor, Synchronous motor, parameters on motor nameplate

DC motors - Principle, Basic motor Construction, Motor classifications, Significance of back e.m.f., Rotary Motion, control of field flux, Counterelectromotive force, Armature reaction, Armature torque and shaft torque, Torque and speed of a DC motor, DC motor characteristics Speed control of DC motor

Module -IV: Energy Sources   (7 hrs)

Energy Sources – Renewable and non-renewable, Thermal & Nuclear Power Plant - Working principle, application, advantages & limitations, Solar & Wind Power plant – Working principle, application, advantages & limitations

Module – V:

Tutorials, assignments and presentation based on Module I to IV

References:

1. Electrical Technology (Vol 1 and 2)- B.L.Thereja, A. K. Thereja; S. Chand Publishers; First multicolour edition, 2005; New Delhi
2. Network Analysis and Synthesis- Ravish R. Singh; Mc. Graw Hill Education (India) Pvt. Ltd. First Edition, 2013, New Delhi
3. Grob's Basic Electronics- M.E. Schultz; Mc.Graw Hill Pvt. Ltd., Special Indian Edition (Tenth) 2007, New Delhi
4. Industrial Electronics – Terry Bartlet; Cengage Learning India Edition, Second Indian Reprint, 2006, New Delhi
5. Non Conventional Energy Resources- B.H. Khan; Mc. Graw Hill Education, Second Edition, 2009, New Delhi.

VOC 113: Industrial Electronics

(2 Credits: 50 Marks)

Course Outcomes:

On completion of the course, students should be able to-

1	Describe Silicon Controlled Rectifier (SCR) characteristics, protection circuits for thyristors and basic principles of various members of thyristor family, and triggering devices
2	Explain turn on and turn off mechanism for SCRs and compare between various triggering techniques for SCR
3	Design basic gate trigger circuits for SCR and implement them in projects/experiments
4	Explain concept of phase control and contrast between different phase control rectifier circuits
5	Explain the concept of Chopper and develop basic chopper circuits
6	Explain the concept of inverters, classify inveters and compare among various categories of inverters

Course Contents:

Module- I: Power Electronic Devices   (8 hrs)

Introduction – Concept, Applications, Power electronic devices

Silicon Controlled Rectifiers (SCRs) – Static I-V characteristics, Switching on and off of SCR, SCR protection (Snubber circuits, overvoltage protection, overcurrent protection, gate protection), Heating, cooling and mounting

Members of Thyristor Family- LASCR, DIAC, TRIAC, ASCR, RCT; Triggering Devices- UJT, PUT

Module- II: Turn ON and Turn OFF methods of SCR   (7 hrs)

Turn ON mechanism of SCR- High Voltage triggering, thermal triggering, Illumination triggering, dv/dt triggering Gate triggering.

Gate trigger circuits - R triggering circuit, RC triggering circuit, UJT triggering circuit (Operation, applications and limitations). Use of Pulse transformer in triggering circuit,

Turn OFF Circuits - Concept of Turn OFF / commutation mechanism of SCR through various methods

Module -III: Phase Controlled Rectifiers   **(8 hrs)**

Phase control – Basic concept (Firing Angle α and conduction angle θ)

Phase Control Rectifiers - Single phase half wave controlled rectifier with R, RL load, Effect of freewheeling diode; Single phase centre tapped full wave controlled rectifier with R, RL load; Effect of freewheeling diode; Single phase Bridge type full wave controlled rectifier with R, RL load; Effect of freewheeling diode (operation and waveforms). (Basic three phase half wave uncontrolled and controlled rectifier; Need and Uses of Poly phase rectifier.
Understand need and use of Isolation transformer and Power scope.

Module - IV: Choppers & Inverters   **(8 hrs)**

Choppers- Fundamental Concept, basic circuit and its operation using SCR and MOSFET
Step Up and Step down Chopper
Inverters- Fundamental Concept, Need of an inverter, Classification of inverters, Important applications of inverter, Working principle of Series, Parallel, bridge inverter, Performance parameters of inverter.
Block diagram and working principle of SMPS and UPS.

Module – V:

Tutorials, assignments and presentation based on Module I to IV

References:

1. Power Electronics - Dr. P.S. Bhimbra, Khanna Publishers, Fifth Edition, 2014 Reprint, New Delhi

2. Power Electronics - M.D. Singh, K. Khanchandani, Tata Mc. Graw Hill Publishers, Second Edition, 2008 Third Reprint, New Delhi

3. Industrial and Power Electronics - Deodatta Shingare, Electrotech Publication, Second Edition, 2004, Pune

4. Industrial Electronics – Terry Bartlet; Cengage Learning India Edition, Second Indian Reprint, 2006, New Delhi

5. Power Electronics Circuits Devices and Applications - Muhammad H. Rashid; Prentice Hall of India; Third Edition, Seventh Impression, 2009, New Delhi

6. Power Electronics and Its Applications - Alok Jain; Penram International Publishing (India) Pvt. Ltd., Second Edition, 2004, Mumbai .

VOC-114: Industrial Measurements and Instrumentation

(2 Credits: 50 Marks)

Course Outcomes

On completion of the course, students should be able to-

1	Discuss primary blocks of an Instrumentation System and describe basic selection criteria for transducers as per application demand
2	Describe and classify displacement and position detection sensors, and apply them for real time measurements
3	Describe and classify temperature and pressure sensors, and apply them for real time measurements
3	Explain and compare flow and level measurement sensors accordance to application demands
4	Discuss humidity measurement devices, speed measurement methods, weight measurement principle and principle of vibration and thickness sensing

Course Contents:

Module - I: Displacement and Detection Sensors (8Hrs)

Instrumentation System- Block diagram, Function of each block
Sensors and Transducers- Definition, Needs, Classification, Selection criteria
Measurement of Linear and Angular Displacement - Linear and Angular Potentiometers, Capacitive Transducers, LVDT
Detection Sensors – Limit Switches, Proximity Detectors, Hall Effect Sensor, Photoelectric sensors, Ultrasonic Sensors

Module – II: Temperature and Pressure Sensors (8 Hrs)

Temperature measurement - Temperature: Definition and units, Different temperature scales & their conversions; Classification of temperature measuring transducers: Gas Filled thermometer, Bimetallic thermometer, Thermistors, RTD – (PT-100) , 2 wire systems (circuit diagram only), Thermocouple – Seeback & Peltier effect, Types J, K, R , S, T(Based on material, temperature ranges)

Pressure measurement - Pressure: Definition, Types - Absolute, Gauge, Atmospheric, Vacuum

(Definition, Units), Classification of Pressure measuring devices; Non elastic pressure transducer: U tube, Inclined Tube, Well type manometer; Elastic pressure transducer: Bourdon Tube, Bellows, Diaphragm, Capsule, Electronic pressure transducers- Bourdon tube with LVDT Diaphragm with Strain gauge

Module – III : Flow and Level Sensors (6 Hrs)

Flow measurement - Flow: Definition, Types of Flow – Laminar, turbulent , Reynolds number Classification of flow measuring transducers : Variable head flow meter- Venturimeter, orifice plate meter, Variable area flow meter – Rota meter, Electromagnetic Flow meter, Ultrasonic flow meter-Doppler Type, Solid flow measurement, Flow measurement

Level Measurement - Classification of level measurement methods: Float type – linear & rotary potentiometer (Contact type), Capacitive type (Contact type), Ultrasonic type (Non-contact type) Radiation type (Non-contact type), RADAR type (Non-contact type)

Module – IV : Special Purpose Sensors (8 Hrs)

Humidity: Definition, unit, Types - Absolute, relative
Humidity measurement devices: Psychrometer - Dry & wet Bulb thermometer type, Hygrometer-hair type ,Speed : Definition, unit, Classification of speed measurement methods. Photoelectric pick-up & Proximity sensor (Non contact type)
Weight: Definition, unit, Classification of weight measurement methods.
Load cells. Vibration Sensor, Thickness Sensor

Module – V:

Tutorials, assignments and presentation based on Module I to IV

References:

1. Electrical and Electronic Measurements and Instrumentation - A.K.Sawhney; Dhanpat Rai & Sons.
2. Industrial Instrumentation & Control - S.K.Singh; Tata McGraw Hill Publishing Co. Ltd; 2006, Second Edition, New Delhi
3. Principles of Industrial Instrumentation - D. Patranabis; Tata McGraw Hill Publishing Co. Ltd; Third Edition, 1995, New
4. Electronics Instrumentation – H. S. Kalsi; Second Edition, 2004, Tata McGraw Hill Publishing Co. Ltd; N. Delhi
5. Industrial Electronics – Terry Bartlet; Cengage Learning India Edition, Second Indian Reprint, 2006, New Delhi
6. Mechatronics- M.D.Singh, B.Joshi; First Edition, 2006,Prentice Hall of India, New Delhi

VOC 115: Laboratory Coursework – I
(Analog and Digital Electronics)

(2 Credits: 50Marks)

Course Outcomes

On completion of the course, students should be able to -

1	Demonstrate operation of diodes, transistors ,various digital ICs, etc.
2	Construct circuits deploying operation of simple and combinational logic gates
3	Apply laws of Boolean algebra for simplification of digital circuits, conversion of logic expression to circuit diagram and vice versa
4	Design basic circuits using analog and/or digital electronic components for simple applications that include (but not limited to) power supply, water level control etc

List of Experiments:

1. Study of P-N junction diode characteristics.
2. Study of characteristics of CE configuration of transistor.
3. Study of transistor as small signal amplifier (CE configuration) and Switching Device.
4. Study of SCR characteristics.
5. Study of Zener diode characteristics.
6. Study of rectifiers (half wave, full wave, bridge rectifier)
7. Study of Series and shunt Voltage regulator using transistor
8. Study of Zener diode as voltage regulator
9. Study of Voltage regulator IC-78XX & IC-79Xx
10. Study of adjustable voltage regulator using IC-317
11. Study of digital logic gates and De'morgans theorem using logic gates
12. Study of discreet components (diodes and transistors) as logic gates
13. Study of universal logic gates NAND & NOR gates

VOC 116: Laboratory Coursework – II
(Electrical Systems)

(2 Credits: 50 Marks)

Course Outcomes

On completion of the course, students should be able to-

1	Analyze DC circuits by employing network theorems
2	Verify working of single phase transformer
3	Explain working of AC induction motor and DC shunt/series motor
4	Explain working of a solar and wind power generator

List of Experiments:

1. Study of Series and parallel resistive circuit, KCL and KVL
2. Study of Charging and discharging of Capacitor
3. Study of Superposition Theorem and Maximum Power Transfer Theorem
4. Study of Norton's Theorem & Thevenins theorem
5. Study of Single Phase Transformer
6. Study of voltages and currents in passive loads in Three phase star Configuration
7. Study of voltages and currents in passive loads in Three phase star Configuration
8. Study of three phase circuits with balanced load
9. Study of three phase circuit with unbalanced load
10. Study and verify Load Characteristics of DC Shunt Motor
11. Study and verify Load Characteristics of DC Series Motor
12. Study of single Phase Induction motor
13. Study of three phase squirrel cage motor
14. Study of V-I characteristics of solar cell and dusk to dawn switch
15. Study of various modes of constant voltage charging technique.
16. Study of Wind Power generation

VOC 117: Laboratory Coursework – III

(Industrial Electronics)

(2 Credits: 50 Marks)

Course Outcomes:

On completion of the course, students should be able to-

1	Demonstrate operation of Silicon Controlled Rectifier
2	Demonstrate Resistance and Resistance Capacitor triggering for SCR
3	Demonstrate phase control using Silicon Controlled Rectifier
4	Demonstrate operation of Choppers

List of Experiments:

1. Study of DC characteristics of SCR
2. Study of switching characteristics of SCR
3. Study of firing circuits for SCR
4. Study of SCR Commutation Techniques (Any two)
5. Study of DIAC
6. Study of TRIAC
7. Study of the effects of variation of R, C in R and RC triggering circuits on firing angle and output voltage of SCR.
8. Study of the output waveforms of single phase full wave controlled rectifier with R, RL load, freewheeling diode and measure load voltage.
9. Study of the output voltage waveform of three phase half - wave controlled rectifier with resistive load and measure load voltage.
10. Study of the effect of firing angle on output voltage in DIAC - TRIAC phase control circuit.
11. Study of Step UP chopper (with SCR/MOSFET/Transistor)
12. Study of Step Down chopper (with SCR/MOSFET/Transistor)

VOC 118: Laboratory Coursework – IV
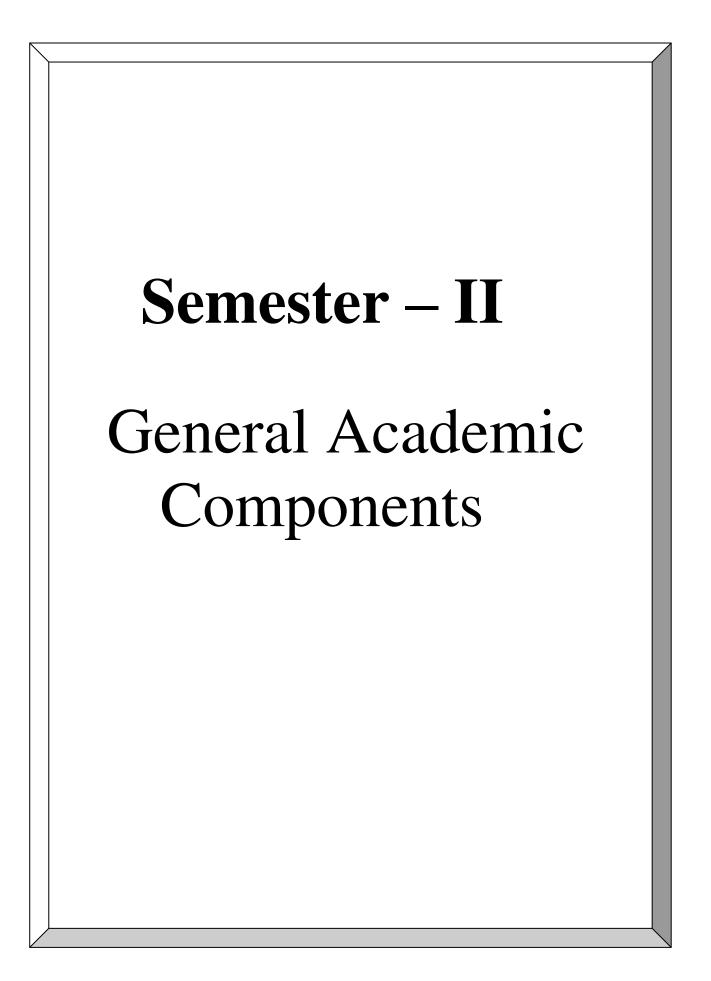## (Industrial Instrumentation)

(2 Credits: 50 Marks)

Course Outcomes

On completion of the course, students should be able to-

1	Demonstrate characteristics of different sensors/detectors (pertinent to theory course VOC 114)
2	Apply different sensors/detectors (pertinent to theory course VOC 114) for real time applications

List of Experiments:

1. Study of proximity sensors
2. Study of Hall effect switch
3. Study of photoelectric sensors
4. Study of temperature of liquid using Resistance Temperature Detector (PT 100)
5. Study of temperature of liquid using thermocouple
6. Displacement measurement using LVDT
7. Weight Measurement using strain gauge transducer with cantilever setup
8. Pressure Measurement using Bourdon tube pressure gauge
9. Determine the rate of flow of liquid in pipe using orifice, ventury, Rotameter
10. Level measurement using by capacitive/float/conductive probe method
11. Observe and interpret humidity of air using wet and dry bulb Hygrometer
12. Measure speed of motor using non contact type photo electric / Inductive pick up/Tachogenerator

Semester – II

General Academic Components

General Education Components

VOC - 201: Linguistic Proficiency-II

(4 Credits: 100 Marks)

Part - A: English

Course Outcomes

On completion of the course, students should be able to-

1	Write notices, agendas, minutes of meetings in English and Hindi
2	Write applications for jobs, and business related letters in English and Hindi
3	Develop effective listening skills and prepare speeches, proposals and reports in English and Hindi
4	Prepare Surveys, Proposals and Projects reports in English and Hindi

Course Contents:

Module –I: Introducing written communication (10 hrs)

1. Writing Notices
2. Drafting Agendas   (Synergy)
3. Writing minutes
4. Note taking
5. Basic of spoken English

Module-II: Writing applications, letters and business correspondence (12 hrs)

(Introducing Business Correspondence):

1. Writing applications for various jobs, referring to the ads.

2. Writing letters:

       a. Letters of inquiry
       b. Letters of order
       c. Letters of complaint
       d. Letters of indent
       e. Letters of credit
       f. Bills of lading
          (Exercises from Synergy) Orient Longman

Module- III: Introducing listening skills   **(12hrs)**

1. Approaches to listening skills
2. Barriers to effective listening
3. Tips for effective listening
4. Preparing for interview, Interview facing techniques
5. Preparing -
   a. Speeches
   b. Presentations
   c. Meetings
   d. Surveys
   e. Report writing
   f. Making Project reports
   g. Preparing Proposals
   h. Seeking financial assistance / loan for your proposal

References:

1) Synergy: Communication in English and study skills (Orient Blackswan) – (2008)
2) Macmillan foundation English – R. K. Dwivedi, A. Kumar: Macmillan India Ltd. 2001
3) Mastring Communication – Nicky Stanlon: Palgrave Macmillan (2009)
4) Scientists must write – Robert Barrass: Routledge Publication, London
5) Functional Grammar and Spoken and Communication in English – Bikram K. Das: Orient Longman Publication (2006)

PART-B: BASIC STRUCTURE OF THE HINDI LANGUAGE

(ON NEXT PAGE…………..)

संप्रेषणमूलक व्यावसायिक हिंदीः

Module- IV:

वाणिज्य व्यवसाय और हिंदीः

- वाणिज्य व्यापार से तात्पर्य एंव व्यावसायिक व्यापार के साधन

- वाणिज्य व्यापार और भाषिक प्रकार्य

- वाणिज्य-व्यावसायिक संरचनात्मक विशेषताएँ

- भाषा कौशल्यः

   श्रवण, भाषण, वाचन, लेखन

व्यावसायिक - संप्रेषणः

- संप्रेषण के तात्पर्य एवं स्वरूप
- संप्रेषण के प्रमुख प्रकारः भाषिक तथा भाषेतर
- व्यावसयिक पत्राचार

क) व्यापारिक- व्यावहारिक सामाण्यपत्रा, आवेदनपत्र, यासाखपत्रा, संदर्भ तथा साखपत्रा के जॉंचपत्रा, मुल्य ज्ञापनपत्र, आदेशोके निरसन सम्बंधीपत्रा, शिकायतपत्र, समायोजनपत्र, तगादायावसूलीपत्र, विक्रय प्रतिनिधत्व संबंधीपत्र,

ख) विशेष व्यावहारिकपत्रः

   -बीमातथाबीमा - पत्र

   -रेल तथा जहाज द्वारा माल परिवहन से संबंधितपत्र

ग) प्रकल्प / सर्वेक्षण / प्रात्यक्षिकः

- भाषिक कौशल्य अभ्यास

- वाणिज्य - व्यावसायके भाषिक प्रकार्या कासर्वेक्षण

- व्यापारिक संप्रेषण - पत्रलेखन का अभ्यास

सहायक ग्रंथः-

१. व्यावसयिक संप्रेषणः डॉ. अनूपचंद्र मायानी, राजपाल एण्ड संस, नईदिल्ली

२. भाषाशिक्षणःसिध्दांतऔरप्रक्रिया - मनोरमागुप्त, केंद्रियहिंदीसंस्थान, आगरा

३.मीडियालेखनः सिध्दांतऔरव्यवहार - डॉ. चंद्रप्रकाश

४. व्यावसायिकहिंदी - डॉ. दिलीपसिंह, वाणीप्रकाशन, काशन, नईदिल्ली.

५. संप्रेषणमूलक व्यावसायिक हिंदी - डॉ. माधवसोनटक्केः ओरियण्ट ब्लैक स्वाईन, दिल्ली.

VOC – 202: Computer Hardware System: Theory

(2 Credits: 50 Marks)

Course Outcomes

On completion of the course, students should be able to-

1	Illustrate Basic architecture, hardware aspects, peripherals (memory, input/ output devices) of Computers
2	Explain step by step hardware assembly of Computers
3	Compare printer categories, describe printing principles and types of scanners
4	Describe hardware features, maintenance basics and develop wi-fi network related troubleshooting skill with laptops
5	Assemble a desktop computer and install operating system/ softwares , while identifying components in Bios set-up and address problems related to installation

Course Contents:

Module-I: **(9 hrs)**

Computer Architecture, Mother Board and its all components, Computer Components (Input/ Output Devices, Primary and Secondary Memory, Power Supply, Monitor).

Observation of all parts of Floppy drives, HDD, CD, and SMPS. Identification of cables and computers. Mounting Motherboard in cabinet, Installation of cards, devices and then connecting cables. Fitting of cabinet. CMOS – Setup, Troubleshooting.

Module-II: **(10 Hrs)**

Computer Assembling, Make your own Computer, Operating System Installation, Windows Vista, Software Installation, Trouble Shooting, Bios Setups, Identifications of Components. Advanced Trouble Shooting and Maintenance.

Module-III: **(9Hrs)**

Types of printers and printing mechanism, How printer works, Inject printer, working of laser printer, Fonts/Type faces, Trouble shooting printers. Types of Scanners and its used.

Module-IV **(8 Hrs)**

Introduction to Laptops, Portable System background, System Features, Processors, Mother Boards, Memory, Power, Expansion Bus, Hard Disk & Removable Storage Devices, Laptop Components, Laptop Maintenance & Assembling, Linux, Multimedia, Internet, Computer VIRUS, Wi-Fi Network Trouble Shooting.

Module - V

Tutorials, assignments and presentation based on Module I to IV

References:

1. Hardware bible By : Winn L Rosch, Techmedia publications
2. Trouble shooting, maintaining and repairing PCs By : Stephon J Bigelow Tata McGraw Hill Publication
3. Modern All about printers By :Manohar Lotia, Pradeep Nair, BijalLotia BPB publications.
4. The complete PC upgrade and maintenance guide By : Mark Minasi, BPB Publications.

VOC – 203: Computer Hardware System : Lab- Course

(2 Credits: 50 Marks)

Laboratory Coursework

Course Outcomes

On completion of the course, students should be able to-

1	Handle computer peripherals
2	Assemble desktop systems
3	Install operating system and software in PCs
4	Troubleshoot broad based problems in Desktop and laptop systems

1. Handling of all Computer Peripherals
2. PC Troubleshooting
3. Windows Installation
4. PC Assembling
5. Fault finding in PC and recovering
6. Installation and use of Printers and Scanners
7. Fault Finding and Troubleshooting on Laptop

Rather than performing a certain prescribed number of experiments, this laboratory coursework is meant for providing sufficient hands on practice of the students with computer. However, for purpose of evaluation, at least six experiments, more or less equally divided from above listed sectors, are to be performed.

VOC-204: Environment Management
(4 Credits: 100 Marks)

Course Outcomes

On completion of the course, students should be able to –

1	Discuss Ecosystem and Natural Resources
2	Explain impact of Pollution on human beings and nature
3	Infer role of human being in pollution and waste management
4	Discuss Biodiversity and Relate necessities for conservation of nature
5	Describe issues related to urban environment, sustainability and sustainable development

Course Contents:

Module - I: Ecosystems and Natural Resources (10 hrs)

Introduction: Introduction and scope of environmental science; Need of public awareness.

Ecosystem: Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems: a) Forest ecosystem b) Grassland ecosystem c) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Natural Resources: Land resources and landuse change; Land degradation, soil erosion and desertification; Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity; Water: Use and over-exploitation of surface and ground water, floods, droughts; Energy resources: Renewable and non-renewable energy sources, growing energy needs.

Module - II: Environment Pollution,Waste Management & Role of Human being (12hrs)

Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution, Nuclear hazards and human health risks;Case Studies: Bhopal Tragedy, Cherbonyl disaster etc.

Waste management: Control and treatment measures of urban and industrial waste; Trade in Wastes; Industrial Ecology and Recycling Industry Waste trade;

Human population growth: Impacts on environment, human health and welfare. Growth Limits. Resettlement and rehabilitation of project affected persons; case studies.

Disaster management: floods, earthquake, cyclones and landslides. Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan. Environmental ethics

Module -III: Biodiversity and Conservation (10 hrs)

Levels of biological diversity: Genetic, species and ecosystem diversity; Biogeographic zones of

India; India as a mega-biodiversity nation; Endangered and endemic species of India

Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Module- IV: Environment Policies & Practices   **(08 hrs)**

Fundamentals: Sustainability and sustainable development;

Urban problems: global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture; Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act;

Environment Management System: EMS Standards, ISO 19011 & ISO 14000 Series, Bharat-II and EURO- II, Eco-Audit Scheme, Clearance/ Permission for establishing Industry

Module - V :

Tutorials, assignments and presentation based on Module I to IV

References:

1. Subramanian.V., ―The Factories Act 1948 with Tamilnadu factories rules 1950, Madras Book Agency, 21st ed., Chennai, 2000.
2. C.RayAsfahl― Industrial Safety and Health managementPearson Prentice Hall,2003.
3. National Safety Council, ―Accident Prevention Manual for Industrial Operations, N. S. C. Chicago, 1988.
4. Heinrich H.W. ―Industrial Accident Prevention, McGraw-Hill Company, New York, 1980.
5. Krishnan N.V. ―Safety Management in Industry, Jaico Publishing House, Bombay, 1997.
6. John Ridley, ―Safety at Work, Butterworth & Co., London, 1983.
7. Blake R.B., ―Industrial Safety, Prentice Hall, Inc., New Jersey, 1973
8. Bharucha, E. 2003, Textbook for Environmental Studies, University Grants Commission, New Delhi and BharatiVidyapeeth Institute of Environmental Education and Research, Pune. 361.
9. Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
10. Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
11. Gadgil, M. &Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
12. Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
13. Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
14. Heywood V.H. & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge University Press.
15. McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
16. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
17. Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
18. Pepper, I.L., Gerba, C.P. &Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic press, 2011.
19. Rao MN and Datta AK,1987.Waste Water Treatment. Oxford and IBH Publishing. Pvt. Ltd.

Semester – II

Industrial Automation

(Skill Development Components)

Industrial Automation

VOC-211: INTERFACING AND SIGNAL CONDITIONING

(2 Credits: 50 Marks)

Course Outcomes

On completion of the course, students should be able to –

1	Identify basic blocks of a Data Acquisition System (DAS) and explain necessity of signal conditioning
2	Explain fundamental characteristics of Operational Amplifiers (OP-AMPs) and illustrate OP-AMPs as building blocks of Signal conditioners
3	Design and apply various signal conditioning circuits using OPAMPs
4	Define and describe IC555 as timing element for domestic and industrial applications
5	Distinguish different operational modes of IC555 timers

Course Contents:

Module -I: Introduction to Interfacing and Signal Conditioning   (6 hrs)

Concept of Interfacing, Basic Block Diagram of DAS, Concept of Analog to Digital and Digital to Analog conversion, Necessity of Signal Conditioning, Types of Signal Conditioning (Analog and Digital), Introduction To OP-AMP (Fundamental Block Diagram, Parameters, Characteristics) and its role as a signal conditioner

Module -II: Operational Amplifier as Signal Conditioner I   (8 hrs)

Open Loop Operation, Closed Loop Operation, Inverting Configuration, Non-Inverting Configuration, Operation of OP-AMP as – Unity Gain amplifier (buffer), Adder, Subtractor, Integrator, Differentiator, Scaling and Averaging Amplifier

Module -III: Operational Amplifier as Signal Conditioner II   (7 hrs)

Sample and Hold Circuit, Logarithmic amplifier, Transducer Bridge (Instrumentation Amplifier), Converters- Current to Voltage, Voltage to Current, Frequency to Voltage, Voltage to Frequency; Comparator, Window Comparator, Schmitt Trigger

Module – IV: Integrated Timing Circuits   **(8 hrs)**

Introduction to Timers, Fundamentals of IC555 timer, Monostable Operation of IC555 , Astable Operation of IC555, Programmable Timer (XR-2240), Overview of Industrial Timers

Module – V:

Tutorials, assignments and presentation based on Module I to IV

References:

1. Ramakant A Gaikwad; 2000; OP-AMP and Liner Integrated Circuits (Fourth Edition); PHI Learning PVT LTD; Delhi (India)
2. Robert F. Coughlin, Frederick F. Driscoll, 2001, Operational Amplifiers and Linear Integrated Circuits (Sixth Edition); Prentice Hall (New Jersey)
3. http://www.mccdaq.com/pdfs/andpdf/Data-Acquisition -Handbook.pdf
4. http://www.ni.com/white-paper/3536/en/pdf

VOC-212 : Control Systems Fundamentals

(2 Credits: 50 Marks)

Course Outcomes

On completion of this course, students should be able to-

1	Define and explain basic elements and parameters of a control system
2	Contrast open loop and feedback control
3	Explain and contrast various control modes and individual and composite operation
4	Define, explain and classify industrial process technique and relate commensurate instrumentation
5	Analyze different control mode operations through NI/Lab view or equivalent software simulation

Course Contents:

Module -1: Introduction to Industrial Control Systems   **(6 hrs)**

Classification of Control System, Industrial Control System, Elements of Open and Close Loop Control System, Feedback Control, Dynamic Response of a Closed Loop System, Control System Parameters

Module -II: **The Controller Operation**   **(8 hrs)**

Block Diagram, Algebra Of Control System, Concept Of Process Control, Automatic Controllers – Analog And Digital, Control Modes- On-Off, Proportional Control, Integral Control, Derivative Control, PID Control, Time Proportioning Control, Time Proportioning Circuit

Module -III: Industrial Process Techniques   **(7 hrs)**

Batch Process, Continuous Process, Instrumentation, Measurement Devices, Feedback Loop Interface Instruments, Controllers

Module – IV: Industrial Process Instrumentation   **(7 hrs)**

Monitoring Instruments - Indicators, Alarms and Recorders. Manipulation Devices- The Control Valve, the Valve Body, Instrumentation Symbology- General Instrument Symbol, Tag Numbers, Line Symbols, Valve and Actuators Symbols

Module – V:

Tutorials, assignments and presentation based on Module I to IV

References:

1. Terry Bartelt; 2006; Industrial Electronics: Circuits, Instrument and Control Technique (INDIA EDITION) ; Cengage Learning India PVT LTD; Delhi (India)
2. Curtis D. Johnson; 2012 ; Process Control Instrumentation Technology (EIGHTH EDITION); PHI Learning PVT LTD; New Delhi (India).
3. http://www.electrical4u.com/control-system-closed-loop-open-loop-control-system/
4. https://www.facstaff.bucknell.edu/mastascu/eControlHTML/Intro/Intro1.html
5. http://www.electronics-tutorials.ws/systems/closed-loop-system.html
6. I.J.Nagrath, M.Gopal; 2009; Control Systems Engineering (Fifth Edition); New Age International Publishers; India
7. N. Barapate; 2006; Control System; Tech Max publications; Pune (India)
8. A. Nagoorkani; 2006; Control System; RBA publications; Chennai (India)
9. K. Ogata; 2002; Modern Control Engineering; Prentice Hall; New Delhi(India)
10. Richard Dorf , Robert Bishop; 2005; Modern Control System; Pearson Education ; New Jersey

VOC-213: FUNDAMENTALS OF DRIVES

(2 Credits: 50 Marks)

Course Outcomes

On completion of the course, students should be able to –

1	State and describe various class electrical drives, need of electric drives and applications of it, DC and AC drives, Types of load
2	Explain Quadrantal Diagram Of Speed-Torque Characteristics
3	Describe and classify various modes of Starting and Braking Of Motors
4	Define and explain various elements of DC drives
5	Define and explain various elements of AC drives
6	Apply industry grade AC drives to control Single phase and Three phase motors by PWM method

Course Contents:

Module -I: Electrical Drives- An Introduction   (6 hrs)

Electrical Drives, Advantages Of Electrical Drives, Parts Of Electrical Drives, Choice Of Electrical Drives, Status Of DC And AC Drives, Types Of Loads, Quadrantal Diagram Of Speed-Torque Characteristics

Module -II: Starting and Braking Of Motors   (7 hrs)

DC Motor Drives- Starting, Braking, Induction Motor Drive- Starting, Braking, Synchronous Motor Drive- Starting, Braking

Module -III: Electrical Drives I   (8 hrs)

DC Drive Fundamentals, Speed Regulators, Variable Voltage DC Drive, DC Drive System – Motor System Control, Speed Regulation, IR Compensation, Current Limiting , Speed Adjustment, Acceleration/Deceleration Adjustment

Module – IV: Electrical Drives II   (6 hrs)

AC Drive Fundamentals, AC Drive System, Drive Controller Internal Circuitry, Circuit Operation Of The AC Drive (The Converter, The Intermediate Circuit, The Inverter Operation) , Flux Vector Control, PWM Control Methods

Module – V:

Tutorials, assignments and presentation based on Module I to IV

References:

1. Terry Bartelt; 2006; Industrial Electronics: Circuits, Instrument and Control Technique (INDIA EDITION) ; Cengage Learning India PVT LTD; Delhi (India)

2. S. K. Pillai; 2001; A First Course On Electrical Drives (SECOND EDITION); New Age International PVT LTD ; New Delhi (India)

3. Gopal K Dubey; 2001; Fundamentals of Electrical Drives (SECOND EDITION); Narosa Publishing House; New Delhi (India)

4. www.electrical4u.com/electrical-drives/

5. www.electrical4u.com/control-of-electrical-drives/

6. P. K. SEN; Electrical Drives; Prentice Hall of India Private Limited; New Delhi (India)

7. Veltman André, Pulle Duco W.J., de Doncker R.W.; Fundamentals of Electrical Drives; Springer Netherlands

8. www.mpoweruk.com/motorcontrols.htm

9. www.completepowerelectronics.com/electrical-drives-introduction-classif...

VOC-214: PLC FUNDAMENTALS

(2 Credits: 50 Marks)

Course Outcomes

On completion of the course, students should be able to-

1	Define and explain basic terminologies related to PLCS and identify PLCs as a core element of automation
2	Describe PLC architecture, input output devices and necessity of networking
3	Explain and apply concepts related to ladder logic based PLCs programming
4	Compare different programming methods for PLCs and apply Ladder diagrams for basic I/O programming for PLCs
5	Identify simple automation related issues and develop ladder diagrams according to physical situations

Course Contents:

Module -1: Introduction to PLCs   (6 hrs)

Controllers, Hardware, Internal Architecture, PLC System, Input Devices, Output Devices, Examples of Applications

Module -II: Number System and I/O Processing   (6 hrs)

Review Of Number System (Binary Number System, Octal and Hexadecimal Number System, Binary Arithmetic), PLC Data, Input/output Units, Signal Conditioning, Remote Connections, Networks, Processing Inputs, I/O Addresses

Module -III: Ladder and Functional Block Programming   (7 Hrs)

Ladder Diagrams, Logic Functions, Latching, Multiple Outputs, Entering Programs, Function Blocks, Program Examples

Module – IV: Programming Methods and Internal Relays   (6 Hrs)

Instruction Lists, Sequential Function Charts, Structural Charts, Internal Relays, Ladder Programs, Battery-Backed Relays, One-Shot Operations, Set and Reset, Master Control Relay

Module – v:

Tutorials, assignments and presentation based on Module I to IV

References:

1. W. Bolton; 2006; Programmable Logic Controllers; Elsevier Publication; UK
2. John R. Hackworth, Frederick D. Hackworth Jr; 2004; Pearson Edition; New Delhi (India)
3. http://www.mikroe.com/old/books/plcbook/plcbook.htm
4. John W. Webb, Ronald A. Reis;2013; Programmable Logic Controllers, Principles And Applications; Fifth Edition; Prentice Hall India; New Delhi, India
5. Frank Petruzella; 2014; Programmable Logic Controllers; Fifth Edition; Mc Graw Hill Publishing Company; UK
6. Gary D. Anderson; 2013; PLC Programming Using RSLogix 500: Ladder Logic Diagnostics & Troubleshooting Vol 1-3.
7. www.plcs.net
8. www.plcwashington.org
9. https://www.udemy.com/nfi-plc-online-leaning/
10. www.plctutor.com
11. electrical-engineering-portal.com › Resources

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VOC - 215: Lab course V

(Interfacing and Signal Conditioning)

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(2 Credits: 50 Marks)

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Course Outcomes

On completion of the course, students should be able to –

1	Design various signal conditioning circuits using OP-AMPs
2	Design multivibrators (astable and monostable) with IC 555
3	Interface standard, elementary DAQ to PC for real time data recording
4	Program industrial timers and interface to real time systems

List of Experiments:

1. Study of inverting, non-inverting and buffer configuration of OP-AMP.
2. Study of OP-AMP as adder and subtractor.
    3. Study of OP-AMP as integrator and differentiator.
4. Study of Schmitt trigger.
5. Study of I/V converter and V/I convertor using OP-AMP.
6. Study of instrumentation amplifier using OP-AMP.
7. Study of IC555 astable mode of operation.
8. Study of IC555 monostable mode of operation.
9. Study of IC based D/A converter.
10. Study of IC based A/D converter.
11. Study of sample / hold circuit.
12. Study of data acquisition system.
13. Study of industrial timer.

(2 Credits: 50 Marks)

Course Outcomes

On completion of this course, students will be able to

1	Explain basic elements and parameters of a control system
2	Apply PID controller for simple control process

List of Experiments:

1. Study of ON/OFF controller.
2. Study of open loop system.
3. Study of close loop system.
4. Study of close loop system with disturbance.
5. Study of steady state error.
6. Study of proportional controller.
7. Study of integrator controller.
8. Study of Derivative controller.
9. Study of PI controller.
10. Study of PD controller.
11. Study of PID controller.
12. Study of PID controller in closed loop.
13. Study of open loop speed control for PWM controller with and without load.
14. Study of ON/ OFF temperature controller.
15. Study of light intensity control system.

VOC - 217: Lab course VII
(Fundamentals of Drives)

(2 Credits: 50 Marks)

Course Outcomes

On completion of the course, students will be able to –

1	Demonstrate Starting and Braking Of Motors
2	Demonstrate elements of DC drives
3	Demonstrate elements of AC drives
4	Apply industry grade AC drives to control Single phase and Three phase motors by PWM method

List of Experiments:

1. Study of speed control of DC motor with armature feedback.
2. Study of forward reverse operation with dynamic breaking.
3. Study of speed control of separately excited DC motor.
4. Study of speed control of series DC motor.
5. Study of speed control of shunt DC motor.
6. Study of speed control of single phase AC motor using cyclo converter firing circuit

7. Study of speed control of three phase AC motor using cyclo converter firing circuit
8. Study of speed control of single phase AC motor using PWM firing circuit
9. Study of speed control of three phase AC motor using PWM firing circuit
10. Study of RAMP comparator firing circuit.
11. Study of single phase half wave control converter.
12. Study of firing circuit using cosine wave scheme.

VOC-218: Lab course VIII
(PLC Fundamentals)

(2 Credits: 50 Marks)

Course Outcomes

On completion of the course, students will be able to –
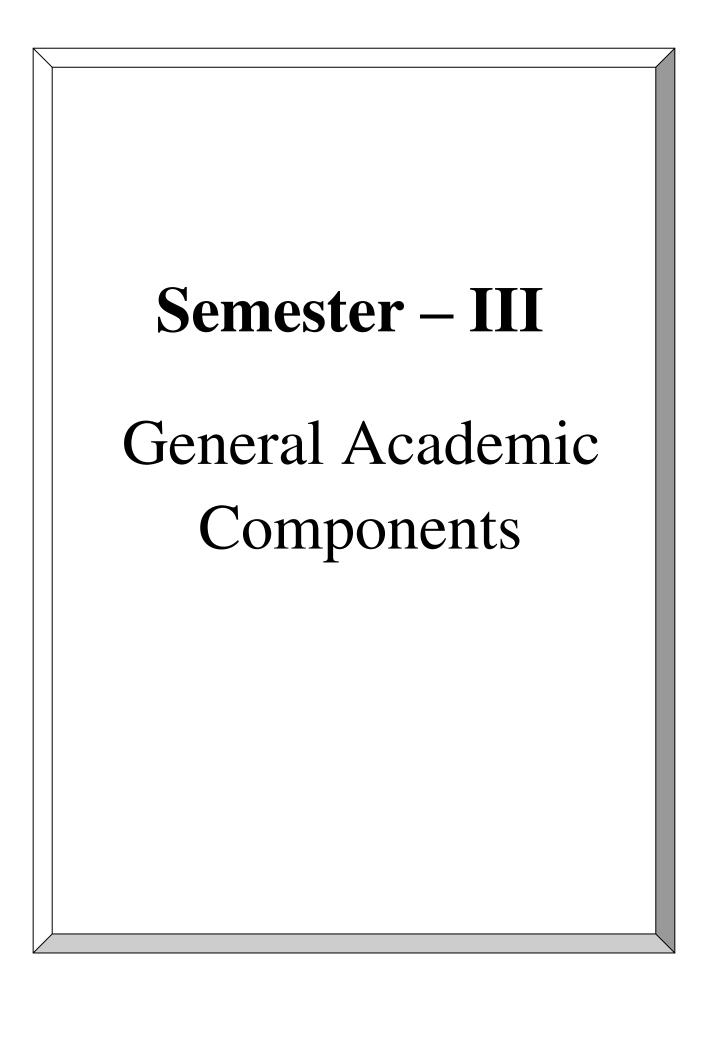
1	Interface basic input / output devices to PLCs
2	Develop ladder program for basic input –output operations with PLCs
3	Troubleshoot in ladder programs

List of Experiments:

1. Study of PLC interfacing to PC and I/P & O/P devices.
2. Study of ladder programming of PLC to interface push to ON/OFF switch.
3. Study of PLC ladder programming to demonstrate NOT, AND & OR gate operation.
4. Study of PLC ladder programming to demonstrate sealing/latching contacts.
5. Study of two – handed anti-tie down circuit using PLC ladder programming.
6. Study of two – handed anti-repeat circuit using PLC ladder programming.
7. Interface PLC to time delay relay.
8. PLC programming for interfacing conveyor belt for start and stop operation.

VOC 219: In-plant Training – II (IA)
(4 Credits: 100 Marks)

In-plant coursework on Control Panel Design and Wiring

Semester – III

General Academic Components

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Semester III

General Education Components

VOC 301: Linguistic Proficiency – III

(4 Credits: 100 Marks)

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Course Outcomes:

On completion of the course, students should be able to –

1	Explain various types of presentation skills
2	Apply advanced concepts of grammar to formulate correct sentences and paragraphs
3	Classify various forms of written communication
4	Develop ideas and logics for effective correspondence techniques
5	Prepare scripts for comparing / conducting programme

Course Contents:

Module- I: Presentation skills: (6 hrs)

(a) Oral Presentation
(b) Group Discussion/Panel Discussion
(c) Speech/Lecture
(d) Visual Presentation
(e) Use of Internet
(f) Seminar Presentation
(g) Commentary/ Reporting
(h) Language of Present functions
(i) Ability to answer& questions
(j) Exercise

Module- II: Grammar in Use: (8 hrs)

(a) Sentence Structure
(b) Verbs-Classifications
(c) Infinitive and gerunds
(d) Passivity
(e) Conditionals
(f) Concord
(g) Recapitulation of grammatical items
(h) Exercises

Module- III : Written Communication Skill: **(8 hrs)**

(a) Forms of written communication
(b) Developing ideas and logic
(c) Correspondence Techniques
(d) Writing paragraph and complete item.
(e) Exercises
(f) Writing in different forms proposals surveys, appraisals and Reports
(g) Language and grammar required
(h) Writing article/paper/news paper/media report
(i) Exercises

Module- IV: Comparing/Conducting Programmes: **(7 hrs)**

(a) Positive Attitude
(b) Language /Body Language
(c) Humour
(d) Mastering the terminology
(e) Exercises

Module- V :

Tutorials, assignments and presentation based on Module I to IV

VOC 302: Business Software Tools- I: Web Page Design

(4 Credits: 100 Marks)

Course Outcomes:

On completion of the course, students should be able to -

1	Explain tools of HTML
2	Define tags used in table definition
3	Compare hypertext and link in HTML documents
4	Explain various audio and video file formats
5	Apply tools of HTML to develop a simple form/webpage

Course Contents:

Module- I: **(10 hrs)**

A.   Introduction-The World Wide Web (WWW), HTML History, Hypertext and Hypertext Markup Language, Microsoft Front Page

B.   HTML Documents- Dividing the document into 2 parts, Headers, Body; Tags-Format, Representing 2 types of tag (odd and even); Elements of an HTML Document -Text Elements, Tag Elements, Special Character elements

C.   Structural elements of HTML documents- Header tags; Body tags- Paragraphs, Titles, Lists (Numbered lists, Non-Numbered lists, Definition lists)

D.   Formatting HTML Documents- Logical styles (source code, text enhancements, variables), Physical Styles (Bold, Italic, underlined, crossed)

Module- II: **(`12 hrs)**

A.   Managing images in html- Image format (quality, size, type, …), Importing images (scanners), Tags used to insert images, Frames

B.   Tables in HTML documents- Tags used in table definition, Tags used for border thickness Tags used for cell spacing, Tags used for table size, Dividing table with lines, Dividing lines with cells; Cell types- Titles cells, Data cells

Module- III: **(10 hrs)**

A.   .Hypertext and Link in HTML Documents- URL/FTP/HTTP; Types of links-Internal Links, External Links, Link Tags, Links with images and buttons, Links that send email messages

B.   Special effects in HTML documents- Text fonts, Sensitive Images, Tip tables; Page

background- Variable, Fixed; Rotating messages (Marquee); Counters

Module- IV: **(8 hrs)**

A.   Multimedia- Audio files and acceptable formats (*AIFF, AU, MIDI, WAVE*), Inserting audio files; Video files and acceptable formats (*MPEG, Quick Time, Video for Windows*)- Inserting video files, Screen control attributes (*WIDTH, HEIGHT, ALIGN*), Start control sttributes (*START, FILEOPEN, LOOP, LOOPDELAY, MOUSEOVER*).

B.   Managing forms- Interactive forms; Creating data entry forms; Calling JavaScripts for modifying entered data; JavaScript Primer; Handling Form Output with JavaScript; Filling out HTML forms

Module- V:

Tutorials, assignments and presentation based on Module I to IV

References:

1. Special Edition Using Intranet HTML / *Mark Surfas, Mark Brown and John Juge*
2. Dynamic HTML Web Magic / *JefDouyer – Hayden development group*
3. HTML 4 for the World Wide Web / *Elizabeth Castro*
4. Writing HTML Tutorial by Maricopa Center for Learning and Instruction (MCLI)
5. http://www.w3schools.com/html/

VOC 303: Statistical Tools: Probability and Statistics

(4 Credits: 100 Marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Explain concepts regarding random variables
2	Classify types of data, Represent data in diagrammatic/graphical mode
3	Explain gives and normal distribution
4	Discuss basic concepts, advantages, disadvantages , limitations of Operational Research,
5	Explain Linear Programming problems, Transportation problems, Assignment Problems and sequencing problems

Course Contents:

Module- I: Probability and Random Variable   (8 hrs)

Probability – Random variables – Moments – Moment generating function – Standard distributions – Functions of random variables – Two-dimensional R.Vs – Correlation and Regression.

Module- II: Statistics   (10 hrs)

Collection of data, types of data, Classification and tabulation of data, Diagrammatic/ graphical representation of data, Measures of central Tendency for ungrouped data, Mean, median ,mode of ungrouped data, Brief revision of Tabulation of data, inclusive and exclusive type of tables, Histograms, frequency polygon, frequency curve, pie diagram, Ogives(Cumulative frequency graphs) Applications of ogives in determination of median, Relation between measures of central tendency, Introduction tonormal distribution, Properties of normal distribution.

Module- III: (12 hrs)

Introduction of Operation Research (OR), Origin and Development of OR, Scientific Method in OR, advantages and limitation of OR, Application of OR

Module- IV :   (10 hrs)

Linear programming problems (LLP), Graphical methods, Simplex method, Transportation problem (TP), Assignment problem (AP). Sequencing Problem (SP), Game theory, Networking Scheduling by PERT/ CPM, Replacement Problem

Module- V :

Tutorials, assignments and presentation based on Module I to IV

References:

1. Richard Scheaffer, Madhuri Mulekar, James McClave, ―Probability and Statistics for Engineers‖, Cengage Learning, USA, 2010.
2. Gupta, S.C. and Kapur, V.K." Fundamentals of Mathematical Statistics ", Sultan Chand and Sons, New Delhi, 2011.
3. Fruend John, E. and Miller, Irwin, "Probability and Statistics for Engineering ―, Prentice Hall, 5th Edition, 1994.
4. Jay, L. Devore, "Probability and Statistics for Engineering and Sciences", Brooks/Cole Publishing Company Monterey, California, 1982.
5. Montgomery D.C and Johnson, L.A.," Forecasting and Time Series ", McGraw-Hill. 2005.
6. Anderson, O.D., " Time Series Analysis: Theory and practice ", I. North - Holland, Amsterdam, 1982.
7. Operation Research- K. Swarup, P. L. Gupta, M. Mohan; Sultan Chand & Son
8. Operation Research- Gupta & Kapur; Sultan Chand & Son
9. Operation Research- K. Swarup, P. L. Gupta ; Sultan Chand & Son

Semester – III

Industrial Automation

(Skill Development Components)

Industrial Automation

VOC – 311: Analog and Digital Circuit Design

(02 credits – 50 marks)

Course Outcome

On completion of the course, students should be able to-

1	Compare various Bipolar Junction Transistor (BJT) biasing techniques
2	Describe basic operation, and characteristics, and biasing of Junction Field Effect Transistors
3	Describe basic operation, characteristics, and biasing of Metal Oxide Semiconductor Field Effect Transistors
4	Compare various Latches, Flip Flops , Counters and apply them for specific applications
5	Define and explain basic terminologies and operation of Registers and Memory

Course Contents:

Module – I: Transistor Biasing and application (8 Hrs)

Voltage Divider bias, Voltage Divider Bias Load Line and Q Point, Base Bias, Emitter Feedback Bias, Collector Feedback Bias, CC & CB Amplifier's –Basic Idea, Voltage Gain, Input Impedance of the base , Output Impedance, CE Emitter follower, Darlington Connection, CB Amplifier.

Module- II: Field Effect Transistors (7 Hrs)

JFET – Basic Operation, JFET symbols, JFET characteristic and parameters, JFET transfer Characteristics, JFET Biasing.
MOSFET Basic Operation, E-MOSFET, The Ohmic region MOSFET characteristic and parameters And Biasing.

Module- III: Flip Flop and Counters (4 Hrs)

S-R Latch, Gated S-R Latch, S-R Flip flop, D-Flip Flop, Edge Triggered, Edge Triggered D flip flop JK Flip Flop, Master – slave flip flop.
Synchronous Counter – 2 bit,3 bit 4bit, Asynchronous Counter- 2 bit, 3 bit, 4bit, UP/DOWN Counter (up to decade operation)

Module- IV: Registers and Memory   **(5 Hrs)**

Basic Shift Register Operation ,Serial IN and Serial OUT , Parallel IN and Parallel OUT, Bidirectional Shift register operation, Modules of binary data, The Basic Memory Array, Memory address and capacity, Basic Memory operation , RAM, ROM.

Module- V:

 Tutorials, assignments and presentation based on Module I to IV

References:

1. Albert Malvino, David J Bates- Electronic Principles, Tata McGraw Hill Education Pvt. Ltd. , ISBN -13: 978-0-07-0643424-4
2. T. L. Floyd- Electronic Devices conventional current version , Dorling Kindersley (INDIA) Pvt Ltd, ISBN -978-81-775-8643-5
3. T.L. Floyd- Digital Fundamentals, 10th Edition, Pearson, ISBN -978-81-317-3448-3
4. M.M. Mano- Digital Design, Pearson Education, ISBN- 0-13-062121-8
5. P. Horowitz, W. Hill - The Art of Electronics, CAMBRIDGE University Press, ISBN 0-521-49846-5

VOC – 312: Mechanical Power Transmission

(02 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to:

1	Illustrate fundamental concepts of kinetics and kinematics of motion
2	Explain kinematic links, kinematic pairs, related classification and constrained motion
3	Explain friction as a power transfer entity, classify types of friction, and evaluate role of friction in operation of clutches
4	Discuss terminologies and operational concepts of belt, rope and chain drives and evaluate related advantages and disadvantages
5	Describe terminologies and operational concepts of gear, gear trains and cam drives and evaluate related advantages and disadvantages

Course Contents:

Module – I: Kinetics and Kinematics of Motion and Simple Mechanisms (**7 Hrs**)

Revision of concepts (vector and scalar, vector addition and subtraction, resultant vector), Rectilinear Motion, Equations of Rectilinear Motion, Angular Motion, Equations of angular motion, Newton's laws, Force, Couple, Centripetal and centrifugal force, Moment of Inertia, Moment of Momentum

Introduction to Kinematic links, types, structure, Kinematic pairs, classification, types of constrained motion, Kinematic chain, Types of joints in a chain, Mechanism

Module – II: Friction (**6 Hrs**)

Introduction to friction as a power transfer entity, Types of friction, limiting friction, laws of static and dynamic friction, friction co-efficient, Limiting angle, angle of repose, sliding body on rough plane; Screw friction, screw jack, friction in journal bearing friction cycle; friction of pivot and collar bearing, single disc/p[late clutch, Multiple disc clutch, centrifugal clutch

Module – III: Belt, Rope and Chain Drives (**7 Hrs**)

Introduction to belt drive, Selection of a belt drive, Types of belt drives and belts, belt materials, types of flat belt drives, velocity ratio in belt drive, Slip of belt, creep of belt, Power transmission by a belt drive, Centrifugal tension in abelt drive, ; V-belt drive, Advantages and disadvantages of V-belt over flat belt;

Rope drive, Types, Advantages and disadvantages of a rope drive;Chain drives, advantages and disadvantages of a chain drive, terminologies in a typical chain drive, Classification, Relation between pitch and pitch circle diameter in a chain drive, Chain speed and angular velocity of a sprocket

Module – IV: Gear, Gear Trains and Cam (**6 Hrs**)

Introduction to toothed wheels, Advantages and disadvantages of gear drive, Classification, Terminologies in gears, Helical gears, Spiral Gears; Introduction to gear trains, types of gear trains (simple Compound, Reverted, Epicyclic) Introduction to cams, classification of cams and followers, terms used in radial cam

Module -V:

Tutorials, assignments and presentation based on Module I to IV

References:

1. R. S. Khurmi, J. K. Gupta – Theory of Machines, S. Chand Publishing, ISBN -81-219-2524-X
2. Rattan – Theory of Machines, Tata McGraw Hill Education Pvt. Ltd., ISBN- 00-701-4477-X
3. T. Bevan - Theory of Machines, B S Publishers and Distributors Pvt. Ltd., ISBN – 81-239-0874-1

VOC – 313: Fundamentals of Hydraulics

(02 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to:

1	Describe fluid in motion as a power source and basic principles related to hydraulics
2	List essential properties of hydraulic fluids and categorize hydraulic pumps , explain basic construction and operational features of hydraulic pumps
3	Describe basic constructional and operational features of linear hydraulic actuators and pressure control valves with circuit based operation
4	Describe basic constructional and operational features of flow and direction control valves with circuit based operation
5	Discuss operational features of various auxiliary hydraulic components Formulate basic hydraulic circuits pertinent to industrial automation

Course Contents:

Module – I: Fluid Power Fundamentals and Hydraulic Pumps   (7 hrs)

Fundamental Principles of Hydraulics, Concepts of fluid in motion, Laminar and turbulent flow Essential properties of hydraulic fluids, Overview of characteristics of various hydraulic oils Introduction to a basic hydraulic systems and realization of pump as the power source, classification of pumps – PD and NPD pumps, Centrifugal pump, Common Constructional features and principle of PD pumps, Gear Pump, Multigear pump, Internal gear pump, Gerotor Pump, Balanced and Unbalanced Vane pump, ANSI Symbols

Module –II: Linear Actuators and Pressure Control Valves   (6 hrs)

Hydraulic cylinders, Types (According to function and construction); Construction, Seals in cylinders; Cylinder force, acceleration and losses, Calculation of cylinder forces, Mounting of cylinders (introduction to types only), Cushioning in cylinders, ANSI symbols

Pressure Relief Valves- Direct acting relief valve, Pilot operated relief valve, Poppet relief valve; Pressure sequence valve, Pressure reducing valve, Unbalanced valve, Counterbalance valve, ANSI Symbols

Module –III: Flow and Direction Control Valves   (6 hrs)

Non-Return valve, Fundamental concept of flow control, Flow regulation valve (Pressure drop compensated and non-compensated), Positioning of a flow control valve (Meter-in, Meter-Out, Bleed-Off), ANSI Symbols

Basic concept of Direction Control Valve, Basic construction and Operation Principle, Operating Methods, Construction and operation of 2, 3 and 4-way Direction Control Valves, Centre conditions of spool type DCVs, ANSI symbols

Module –IV: Auxiliary Hydraulic Components and basic circuits   **(7 Hrs)**

Fluid Conditioners – Filters, Heat Exchangers, Reservoirs;

Accumulators, Pressure Switches, Pressure gauges, Flow meters, Manifolds, Pressure Intensifier, Fluid Conductors

Basic cylinder acting circuits, Pump unloading circuit, counterbalance valve application, pressure sequence valve application, Two handed safety circuit, Auxiliary power backed circuit using accumulator

Module -V:

Presentations, Numerical problems, Assignments, Tutorials based on Module I to IV.

References:

1. S. R. Majumdar – Oil Hydraulic Systems: Principles and Maintenance, Tata McGraw Hill Education Pvt. Ltd., ISBN – 0-07-463-748-7
2. K. S. Sundaram - Hydraulic and Pneumatic Controls: Understanding Made Easy, S. Chand and Company Ltd., ISBN – 81-219-2635-1
3. W. Bolton – Pneumatic and Hydraulic Systems, Butterworth Heinemann, ISBN – 0-07-506-383-62
4. A. Parr – Hydraulics and Pneumatics: A Technician's and Engineer's Guide, Butterworth Heinemann, ISBN – 0-08-096-674-8

VOC- 314: Embedded System Concepts

(02 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to:

1	Recall basic concepts of Digital electronics and identify Microcontrollers as a core element of automation
2	Explain architecture, pin diagram/operation of each pin of 8051 microcontroller
3	Illustrate steps of assembly language program for 8051 microcontroller and explain role of important registers (PC, PSW, Flag Bits etc.) in microcontroller operation
4	Contrast various addressing modes with 8051 microcontroller
5	Apply instruction sets, timer registers in 8051 for data movement, arithmetic and logical operations

Course Contents:

Module – I: Introduction to Computing and Microcontrollers (**4 Hrs**)
Numbering and coding systems, Digital Primer (review of logic gates), inside the computer, Introduction to microcontrollers and embedded processors: History of microcontrollers, Microcontroller versus general-purpose microprocessor, criteria for choosing a microcontroller, Embedded system applications
.

Module – II: 8051 Microcontroller (**8 Hrs**)
Overview of the 8051 family: 8051, Members of 8051 family, Microcontroller block diagram, Inside 8051, 8051 architecture, 8051 pin diagram ; Assembly Language Program : Introduction, Assembling and running a program, Program counter, Flag bits and PSW register, ROM space,

Module – III: Addressing modes and Instructions (**7 Hrs**)
8051 Register banks and stack, 8051 data types and directives, Addressing modes with 8051, Data movement instructions ; Arithmetic and Logic instructions ; Loop and jump instructions

Module – IV: 8051 Programming (**5 Hrs**)
8051 Timer Registers, Programming on Keil and Keypad: Procedure for running a program; Arithmetic operations: addition, subtraction, shifting; Logical operations: AND, OR, NOT, XOR, NAND, NOR

Module - V:

Tutorials, assignments and presentation based on Module I to IV

References:

1.   The 8051 Microcontroller and Embedded Systems- M.A. Mazidi, J.G. Mazidi, R.D. McKinlay; Pearson; ISBN-0-13-119-402-X
2.   8051 architecture, programming and interfacing – K.J. Ayala; Cengage Learning; ISBN-1-

40-186-158-X

3. Embedded Systems Architecture Programming & Design by Raj Kamal, Tata Mcgraw Hill Education Private Limited- ISBN- 0-07-066-764-0

4. Advanced Microprocessors And Peripherals by Ray Ajoy, Bhurchandi K -Tata Mcgraw Hill Education Private Limited, ISBN- 0-07-014-062-6

VOC- 315:Laboratory Coursework–IX
(Analog and Digital Circuit Design)

(02 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to:

1	Illustrate working of Flip Flops
2	Design basic counter circuits
3	Illustrate basic input/output characteristics of transistor, MOSFET, JFET

List of Experiments:

1. Study of Truth Table and Verification of S-R, D, T Type Flip Flop
2. Study of Truth Table and Verification of JK and Master Slave Flip Flop
3. Study of UP/DOWN Counter
4. Study of 4 bit Synchronous Counter
5. Study of 4 bit Asynchronous Counter
6. Study the characteristics of PNP transistor on common base configuration and to evaluate –Input resistance, output resistance and current gain
7. Study the characteristics of NPN transistor on common base configuration and to evaluate –Input resistance, output resistance and current gain.
8. Study of MOSFET characteristics
9. Study of JFET characteristics

VOC- 316:Laboratory Coursework–X
(Mechanical Power Transmission)

(02 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to:

1	Illustrate concepts of resultant force
2	Illustrate different mechanical power transmission elements

List of Experiments:

1. Verification of triangle and parallelogram laws of vector addition
2. Study to determine resultant force
3. Study to resolve forces
4. Verification of Lami's Theorem
5. Study of sliding friction
6. Study of forces on an object placed on an inclined plane
7. Study of various kinematic pairs
8. Study of friction wheels, single plate clutch and multiple plate clutch.
9. Study of belt and chain drives
10. Study of different gears, simple and compound gear train
11. Study of different cam and follower arrangements

(Fundamentals of Hydraulics)

(02 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to:

1	Identify basic components of hydraulic circuits
2	Compare applicability of various hydraulic components for dedicated applications
3	Construct basic hydraulic circuits

List of Experiments:

1. Study of Double Acting Cylinder working using 4/3 way and 4/2 way valve. (Hand Lever Operated Spring Return Type)
2. Study of Single Acting Cylinder working using 4/3 way Hand Lever Operated Spring Return Type valve.
3. Study of hydraulic motor working using 4/3 way and 4/2 way valve. ((Hand Lever Operated Spring Return Type)
4. Study of Bleed –off circuit
5. Study of Meter-IN circuit
6. Study of Meter-OUT circuit
7. Study working of Sequence Valve
8. Study working of Solenoid operated Direction Control Valves.
9. Study any one application of accumulator

VOC- 318:Laboratory Coursework–XII
(Embedded Systems Concepts)

(02 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to:

1	Develop basic algorithms to perform mathematical and logical operations using Atmel 89C51 microcontroller
2	Illustrate concepts of writing, assembling, debugging of programs
3	Write small programs to perform mathematical and logical operations using Atmel 89C51 microcontroller

List of Experiments:

1. Write a program for studying data movement(array/sorting) operations using Atmel 89C51 trainer kit
2. Write a program for hexadecimal addition/ subtraction of two numbers using Atmel 89C51 trainer kit.
3. Write program for studying hexadecimal division/ multiplication using Atmel 89C51 trainer kit.
4. Write a program to find biggest number in the set of numbers using Atmel 89C51 trainer kit.
5. Write a program to convert hexadecimal number to decimal using Atmel 89C51 trainer kit.
6. Write a program to square a byte using Atmel 89C51 trainer kit.
7. Write a program for Fibbonacci series using Atmel 89C51 trainer kit.
8. Write a program for Logical operation (AND, OR & NOT) using Atmel 89C51 trainer kit.
9. Write a program for Logical operation (NAND, NOR & XOR) using Atmel 89C51 trainer kit.
10. Write a program for finding even odd numbers using Atmel 89C51 trainer kit.

VOC-319: In-Plant Training/ Field Work/Mini Project

(02 credits – 50 marks)

Semester – IV

General Academic Components

General Academic Component

VOC 401: Industrial Ethics and Safety Management

(04 credits – 100marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Define Ethics and Industrial Ethics, Moral Values, OHSAS-18001 Standard and OSHA
2	Differentiate between ethics, morality and etiquette, explain ethics at workplace, profession, leadership, Unethical Behavior, discuss Significance of Industrial Safety, Select Safety Instruments, Safety standards, discuss objectives of material Handling, Principles of material handling, Classification of hazards (Safety Hazard and Health Hazard),
3	Explain Experiment measures to ensure Industrial Safety, safety measures, demonstrate storage and Handling of Material and Equipment
4	State Safety Responsibility, prioritize Hazardous Industrial zones, analyze Industrial Safety and risk management
5	Interpret Measure safety inspection procedures (Safety audit, Safety survey, Safety survey, evaluate Possible consequences of security incidents,
6	Express Fire Extinguishers and its types

Course Contents:

Module – I: Introduction to Industrial Ethics (10 hrs)

Industrial ethics, ethical issues in engineering practices(Legal, organizational, Individual), Importance of ethics and moral standards, religion and ethics, social and ethical responsibilities, moral dilemmas, profession, ethics at workplace, values, business ethics, ethical theories, spirituality, and leadership; Unethical behavior.

Module- II: Introduction to Industrial Safety (12 hrs)

Overview of Industrial Safety Management , Need for Safety, Safety standards, Safety, Health and Environment Management Systems, Occupational Health and Safety Management Systems as per OHSAS-18001 Standard and OSHA ,Security Management of Industrial Plants ,Organization, Administration and Management Responsibility in the Field of Safety, Legal Aspects of Safety, Safe Working Practices ,Personal Protective Equipment and Protective Costumes, Storage and Handling of Material and Equipment, Safety in Transportation and Automotive Equipments, Electrical Safety, Electrical Shocks and Their Prevention

Module – III: Industrial Hazards (10 hrs)

Mechanical Hazards, Chemical Hazards, Environmental Hazards, Radiation Hazards, Industrial noise, occupational damage, sound measuring instruments, noise networks, noise surveys, risk factors, non-ionizing radiations, effects, radar hazards, microwaves and radio waves, lasers, Air sampling instruments, common causes of industrial fires, dust sample collection devices. Industrial Psychology, Ergonomics and Accidents

Module- IV: Control Measures for Industrial Hazards (12 hrs)

Safety in Hazardous Area, Industrial Safety Analysis, Risk Analysis and Risk Management, Industrial Noise and Noise Control Work Permit System ,Safety in Power Plants, Fire Prevention and Fire fighting in Plants ,Portable Fire Extinguishers ,Fire Detection, Fire Alarm and Fire Fighting Systems, Building Design and Fire Protection ,Plant Layout and Design Material, Safety during Project Construction, Safety Management of Plants During Commissioning and Maintenance ,Safety Training for Employees and Human Resource Development, Social Security in Industries, Insurance Policies for Project Construction, Operation and Maintenance, Important Ingredients of Health, Occupational Health, First Aid ,Exercises for Healthy Living. Occupational Health and Industrial Hygiene, Controlling Environmental Pollution, Environmental Guidelines for Power Plants and Infrastructure Development Energy, Conservation, Efficiency and Audit, Disaster Management.

Module – V:

Tutorials, assignments and presentation based on Module I to IV

References:

1. Slote L. handbook of Occupational safety and Health, John Willey and sons, Newyork.
2. Frank P Lees, Loss of Prevention in process industry , Vol 1 and 2, Butterworth-Heinemann Ltd , London.
3. R.K.Jain and Sunil S. Rao : Industrial Safety , Health and environment management systems, Khanna publishers, New Delhi 2006
4. Grimaldi and Simonds, Safety management: ATTBS publishers, new Delhi 2001
5. Industrial safety and pollution control handbook; national safety council and associate publishers pvt. ltd; Hyderabad
6. Code of practice on Safety management :- PDF
7.   http://www.saylor.org/books
8. The Business Ethics Workshop

VOC- 402: Business Software Tools

(04 credits – 100marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Describe basic functionalities of CSS and Photoshop
2	Describe basic functionalities of Dreamviewer and Flash
3	Apply key concepts of CMS (Computer Management System)
4	Create different projects using CMS
5	Apply key concepts of hypertext processor

Course Contents:

Module I: CSS and Photoshop (**10 Hrs**)

Introduction to CSS: Concept of CSS, Creating Style Sheet, CSS Properties, divs and spans, ids and classes, CSS Styling, Working with block elements and objects, working with Lists and Tables, internal CSS declarations, CSS formatting and alignment.

CSS Advanced: CSS color, Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Image Sprites, Attribute sector, Creating page Layout and Site Designs, Embedded audio files

Module II: Dreamweaver and Flash (**10 Hrs**)

Introduction to Photoshop: Creating new files, Resizing images, Image transformations, Levels & Color Balance, Cropping, The Ruler Tool, Zooming, History Panel, Saving & file formats.

Photoshop Advance: Selections, Extracting regions of an image, Combining images (basic), Introduction to layers, Layer styles, History panel, Setting up your workspace, Frames & Objects, Working with text, Text formatting, Paragraph formatting, Linked text frames.

Module III: Management System (**12 Hrs**)

Introduction of CMS is Web Development, Configuring a domain name and web hosting, Exploring CMS terminology, including open source, server-side, client side, Static HTML website, how CMS web pages are generated, Website strategy and planning, site mapping, content planning, Introduction of Joomla, Adding and displaying menus in Joomla, Linking menus to articles and other features Joomla

Dreamweaver: Dreamweaver basics, Setting up your workspace, Site management, Text formatting, Images & Media, Links, styles, Inserting Tables, Adding Frames, Rollovers, Putting it all together

Flash basics: Introduction to the Flash IDE, Creating a new project, Drawing simple vector shapes, Lines & Fills, Colors, Shape Tweens, Layers

Flash advance: Review symbols and instances, Review internal timelines, 3D rotation tool, Mask layers, Deco Brush, Custom mouse pointers

Module IV: PHP (Hypertext Preprocessor)   (12 Hrs)

Introduction, installation , syntax , variables, echo/print, data types, constant, string operators, if-else else if, switch, while, for, array, super globals, Form validation, form required Array Multi, Date and Time, Include, File open read, create / write, upload, Cookies, Sessions, My Sql-Connect, Create DB, Create Table, Insert Data, Prepare , select, delete and updates

Module – V:

Tutorials, assignments and presentation based on Module I to IV

References:

1. Thomas POW; 2010; HTML & CSS: The Complete Reference (Fifth Edition); Mc Graw Hill Education; USA.

2. Thomas Powell and Fritz Schneider; 2013; JavaScript: The Complete Reference Paperback (Third Edition); Mc Graw Hill Education; USA

3. Steven Holzner; 2008; PHP: The Complete Reference (Second Reprint); Tata Mc Graw Hill Publishing Company Limited; New Delhi

4. Graig Grannell; 2007; The Essential Guide to CSS and HTML Web Design;Apress

5. Nicholas C. Zakas (2012); Professional Javascript for Web Developers; John Willey and Sons (Third Edition)

6. Kogent Learning Solutions Inc; 2009; Dreamweaver Cs5 in Simple Steps by Dreamtech Press, New Delhi.

VOC 403: Fundamentals of Business and Accounting

(04 credits – 100marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Describe overall concept of a business system, process of identification of entrepreneurial opportunities in business and process of setting up a business enterprise
2	Explain concepts, terminologies and Functioning of Financial Accounting
3	Elaborate Accounting terms, Equation and Journal
4	Apply Voucher approach in accounting
5	Explain the terminologies and prepare trading and profit./loss account and balance sheets

Course Contents:

Module- I : Introduction to Business   (12 hrs)

Concept, Nature and Scope of Business Enterprise; Concept of Business as a System; Business and Environment Interface; Entrepreneurial opportunities in contemporary business environment or emerging trends in business: Networking marketing, Franchising, Business Process Outsourcing, knowledge Process Outsourcing, Ecommerce and M-Commerce. Opportunity and Idea Generation - role of Creativity and Innovation. Feasibility study and preparation of Business Plan Basic considerations in setting up a Business Enterprise. Process of setting up a Business Enterprise.

Module- II : Introduction to Financial Accounting   (10 hrs)

Accounting-An Introduction: Business transactions, Book-keeping, Accounting and its branches. Nature, functions and objectives of Financial Accounting. Accounting Assumptions-Accounting Concepts: Meaning, concepts: Matching, Accrual, Realisation and Dual Aspect Concept.

Module- III: Accounting Terms, Accounting Equation and Journal   (12 hrs)

Accounting Terms-Accounting Equation Need of Accounting equation, Meaning and preparation of Accounting equation. Rules of Accounting -Journal Meaning, classification of journal into General journal and special journals (with examples). Incorporation of journal entries involving different accounts. Cash Book Meaning, types-Simple Cash Book, Two column Cash Book and Three column Cash Book.\

Module- IV : Voucher Approach in Accounting and Financial Statements   (12 hrs)

Vouchers and their preparation - Day Book and Subsidiary Day Books -Recording the vouchers into Day Books -Recording the Vouchers into Subsidiary Day Books -Ledger Posting of Day Book -Posting of Subsidiary Day -Trial Balance -Errors and their Rectification

Capital and Revenue - Preparation of Trading and Profit and Loss Account and Balance Sheet - Preparation of Trading and Profit and Loss A/c and Balance Sheet (with adjustments).

Module- V : Tutorials, assignments and presentation based on Module I to IV

References:

1. Anthony, R.N., and J.S. Reece, *"Accounting Principles",* Richard D. Irwin, Inc.
2. Monga, j.R., *"Financial Accounting: Concepts and Applications",* Mayoor Paper Backs, New Delhi.
3. Shukla, M.C., T.S. Grewal and S.C.Gupta, *"Advanced Accounts",* Vol-I, S.Chand& Co., New Delhi.
4. Gupta, R.L. and M. Radhaswamy, *"Advanced Accountancy*", Vo!-I, Sultan Chand & Sons, New Delhi.
5. Maheshwari, S.N. and. S. K. Maheshwari, *"Financial Accounting",* Vikas Publishing House, N ew Delhi.
6. Tulsian, P.C., *" Advanced Accounting",* Tata Me Graw Hill, New Delhi.
7. *"Compendium of Statements and Standards of Accounting",* The Institute of C hartered Accountants of India, New Delhi.

Semester – IV

Industrial Automation

(Skill Development Components)

Skill Development Components
Industrial Automation

VOC-411: PLC Based Automation

(02 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Explain various inbuilt timers in PLCs
2	Explain various inbuilt counters in PLCs
3	Discuss timer, counter, and other intermediate programming functions
4	Formulate application based ladder logic for data manipulation and arithmetic operations

Course Contents:

Module -I: Timer in PLCs (6 hrs)

Timer, Types of timer-ON-delay timer, Off-delay timer, Pulse timer,- Programming Timer, Programming Examples- flashing light, Traffic light sequence.

Module –II: Counter in PLCs (6 Hrs)

Counter, Up Counter, Down Counter, Counter Reset, Timer with counter, Programming Forms of Counter Sequencer.

Module -III: Data Manipulations and Arithmetic Instructions (6 Hrs)

Data Comparisons Instruction – Equal to, Less Than, Greater Than, Not Equal to, Less than equal to, Greater than Equal to, Limit Function. Concept of Integer and Floating Address, Arithmetic Instruction – ADD, SUB, MUL, DIV, SQR

Module -IV: Application Oriented PLC Programming (6 Hrs)

Conveyor Belt using DC motor, Linear Bottle Filling Station, Rotary Bottle Filling Station, Elevator Simulator, Density Based Traffic Light Control

Module –V: Tutorials, assignments and presentation based on Module I to IV

References:

1. J. W. Webb, R. A. Reis – Programmable Logic Controllers: Principles and Applications- PHI, New Delhi, 2013 ISBN: 9788120323087, 8120323084
2. W. Bolton – Programmable Logic Controllers – Elsevier, UK, 2006 **ISBN:** 9780128029299
3. http://www.mikroe.com/old/books/plcbook/plcbook.htm
4. J. R. Hackworth, F. D. Hackworth Jr- Programmable Logic Controllers: Programming Methods and Applications – Pearson, New Delhi, 2004 ISBN-10: 0130607185 ISBN-13: 978-0130607188
5. F. Petruzella – Programmable Logic Controllers – MGH, UK, 2014 ISBN10:9352602129 ISBN-13: 978-0073510880
6. G. D. Anderson – PLC programming using RS Logix 500: Ladder Logic Diagnostics and Troubleshooting (Vol 1-3)   ISBN-10: 1511770341 ISBN-13: 978-1511770347

7. www.plcs.net

8. www.plcwashinton.org

9. www.plctutor.com

VOC-412: PROCESS CONTROL

(02 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Classify control system, describe a through block diagram, define terminologies related to industrial process control and interpret process control drawings
2	Define process characteristics, Explain and contrast discontinuous, continuous and corrective control actions
3	Explain constructional features and basic operations of control elements and instrumentation at actuation end
4	Explain overview of multivariate control system and define terminologies related to control system quality
5	Explain methods leading to stability and tuning of process loops

Course Contents:

Module -I: Introduction to Process Control **(6 Hrs)**

Control System (Process Control Principles, Servomechanism, Discrete State Control System), Process Control Block Diagram, Control System Evaluation Criteria, Analog and Digital Process, Units, Standards and Definitions in Process Control, Process Control Drawing

Module -II: Controller Principles **(6 Hrs)**

Introduction, Process Characteristics (Process Equation, Process Load, Process Lag, Self Regulation), Discontinuous Controller Modes, Advanced Control Techniques (Cascade Control, Ratio Control, Feed-Forward Control, Adaptive Control), Composite Control Modes

Module -III: Final Control Elements **(06 Hrs)**

Final Control Operation, Signal Conversions (Analog Signal, Digital Signal, Pneumatic Signal), Actuators (Electrical Actuators, Pneumatic Actuators, Hydraulic Actuators), Control Elements (Mechanical, Electrical, Fluid Valve)

Module – IV: Control Loop Characteristics **(06 Hrs)**

Control System Configuration (Single Variable, Cascade Control) , Multivariable Control Systems (Analog Control, Supervisory and Direct Digital Control),Control system Quality (Definition of Quality, Measure of Quality), Stability (Transfer function Frequency Dependence,

Stability Criteria, Process Loop Tuning (Open Loop Transient Response method, Ziegler-Nichols method, Frequency Response Methods)

Module – V: Tutorials, assignments and presentation based on Module I to IV

References:

1. Terry Bartelt; 2006; Industrial Electronics: Circuits, Instrument and Control Technique (INDIA EDITION) ; Cengage Learning India PVT LTD; Delhi (India)
2. Curtis D. Johnson; 2012 ; Process Control Instrumentation Technology (EIGHTH EDITION); PHI Learning PVT LTD; New Delhi (India).
3. William Dunn; 2005; Fundamentals of Industrial Instrumentation and Process Control; McGraw-Hill; USA

4. N. P. Lieberman, E. P Lieberman; 2014; A Working Guide to Process Equipment (Fourth Edition), Mcgraw-Hill Book CoMyke King; 2010; Process Control: A Practical Approach; Wiley International
5. I.J.Nagrath, M.Gopal; 2009; Control Systems Engineering (Fifth Edition); New Age International Publishers; India
6. N. Barapate; 2006; Control System; Tech Max publications; Pune (India)
7. http://nptel.ac.in/courses/103103037/#
8. www.pacontrol.com/download/process-control-systems.pdf
9. www.learnerstv.com/Free-Engineering-Video-lectures-ltv689-Page1.htm

VOC-413: Fundamentals of Pneumatics

(02 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Identify the actuators used in pneumatic technology and describe their individual operation
2	Identify the flow control valves, direction control valves and logic function valves used in pneumatic technology and describe their individual operation
3	Describe constructional features and operation of air compressors, FRL units and other servicing units for compressed air
4	Relate application specific pneumatic components, and will be able to apply them for basic automated actuations
5	Illustrate design concepts to develop basic pneumatic circuits using Automation Studio/ AutoSIM software and implement the designs

Course Contents:

Module -I: Introductory Concepts in Pneumatics   (05 hrs)

Atmospheric pressure, Gas laws, Units of pressure, Measurement of volume, SI units for fluid power engineers.
Basic pneumatic system, generation of compressed air, selection of pipeline for pneumatic system, pressure rating for pipe materials, pipeline fittings, tube sizes, connectors, pressure loss in pneumatic line, line fittings.Air compressors, air receiver.

Module -II: Servicing of Compressed Air and Pneumatic Actuators   (06 hrs)

FRL unit, pressure gauge monometer, installation of FRL unitDrying of compressed air, humidity, refrigerated dryers, chemical dryers, dew point suppression, adsorption dryers, regeneration methods, heatless regeneration, selection of dryers
Pneumatic cylinders- types, construction and working; Considerations of piston speed, piston force, air consumption, and size of pneumatic cylinders; Maintenance aspects; Air motor

Module -III: Control Elements in Pneumatics   (06 Hrs)

Pneumatic controls, directional control valves- basic construction and control operation; Impulse valve, Speed Regulators, Quick Exhaust valve, Time delay valve. Logic function- Shuttle valve, Twin pressure valve; Solenoid operated valves

Module -IV: Pneumatic Circuits   **(07 Hrs)**

Revision of Symbols for pneumatic devices, Basic considerations for pneumatic circuits design, Example(s) on pneumatic circuit design; Circuit examples - Impulse operation, Speed control, Sequencing of motion, Vacuum Handling

Module – V:

 Tutorials, assignments and presentation based on Module I to IV

References:

1. S R Majumdar; 2006 (Sixteenth Reprint); Pneumatic Systems (Principal and maintenance); Tata McGraw - Hill Publishing Company Limited; ISBN 0-07-4602314
2. K. Shanmuga Sundaram; 2006; Hydraulic and Pneumatic Controls; S.CHAND Limited; ISBN 8-12-192635-1
3. P. Joji; 2008; Pneumatic Controls; Willey India Pvt. Ltd., ISBN 978-81-265-1542-
4. Antony Barber; 1997 (Eighth Ed.); Pneumatic Handbook; Elsevier Science Ltd.; ISBN 978-81-265
5. Andrew Parr; 2011 (Third Ed.); Hydraulics and Pneumatics-A Technician's and Engineer's Guide; Elsevier Ltd. (Butterwoth-Heinemann); ISBN-13: 978-0-08-0966748
6. hydraulicspneumatics.com
7. nptel.ac.in/courses/112103174/pdf/mod6.pdf
8. resources.hkedcity.net/res_files/201101/20110128101153_259037.pdf

VOC – 414: Embedded System Applications

(02 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Describe techniques and develop program to interface LEDs, 7 segment displays, 16X2 LCD matrix to 8051 microcontroller
2	Describe techniques and develop program to interface DAC, ADC and Sensors to 8051 microcontroller
3	Describe techniques and develop program to interface standard keypad and DC, stepper and servo motor to 8051 microcontroller
4	Describe MAX 232 features and apply MAX 232 for serial communications with 8051
5	Describe DS12887 RTC features and develop necessary program to interface DS12887 RTC to 8051

Course Contents:

Module -I: Interfacing of Display Devices to 8051   **(06 Hrs)**

Different types of display units - basic theory of the LED, Interfacing circuit of LED; 7 Segments & its types, Principle of Operation, Interfacing circuit of 7 segments; Basic theory of 16x2 LCD, Pin diagram of 16x2, working mechanism LCD using Arrays & Pointers, Interfacing of 16X2 LCD

Module -II: DAC, ADC and sensor interfacing to 8051   **(06 Hrs)**

Introduction to DAC, PIN Description for any standard DAC and its interfacing; Basic concepts of ADC interfacing, PIN Description of any standard ADC and its interfacing, Concept of Encoders and Decoders; Interfacing of sensors

Module -III: Keypad and Motor interfacing to 8051   **(06 Hrs)**

Keypad interfacing concepts, Standard Keypad interfacing; Relay interfacing concepts, Relay interfacing; DC motor interfacing concepts, DC motor interfacing; Stepper motor interfacing concepts; Stepper motor interfacing; Servo motor interfacing concepts, Servo motor interfacing

Module -IV: Serial Communication and RTC interfacing with 8051   (06 Hrs)

Concept of Serial Communication, Hardware Description of MAX 232, Interfacing of MAX 232 to 8051 and serial communication; Concept of RTC, Hardware Description of DS12887 RTC, Interfacing of DS12887 RTC to 8051

Module – 5:

Tutorials, assignments and presentation based on Module I to IV

References:

1. M. A. Mazidi, J. G. Mazidi, and Rolin D. McKinlay; 2006; 8051 Microcontroller and Embedded Systems - using assembly and C; Pearson Education; ISBN-13: 978-01-311-9402-1

2. S. Ghosal; 2010; 8051 Microcontroller: Internals, Instructions, Programming and Interfacing; Pearson Education; ISBN 978-81-317-3143-7

3. James W. Stewart, Kai X. Miao; 1999; The 8051 Microcontroller: Hardware, Software, and Interfacing; Prentice Hall; ISBN 0-13-531948-X

4. S. Yeralan, A. Aluhwalia; 1993; Programming and Interfacing the 8051 Microcontroller; Addison-Wesley Publishing Company; ISBN 0-13-531948-X

5. www.engineersgarage.com/microcontroller/8051projects

6. www.electronicshub.org/8051-microcontroller-projects-engineering-students

7. circuitdigest.com/8051-microcontroller-projects

VOC 415: Laboratory Coursework–XIII
(PLC based Automation)

(02 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Apply inbuilt PLC timers for basic application
2	Apply inbuilt PLC counters for basic applications
3	Integrate Allen Bradley PLCs with different sensors and actuators for automated industrial operations
4	Develop Ladder diagram for Allen Bradley PLCs with different sensors and actuators for automated industrial operations

List of Experiments:

1. Hardware Implementation of 'Latch and Hold' concept
2. PLC ladder programming with Simulator (logical instruction) and hardware implementation
3. PLC ladder programming with Simulator (program control instructions) and hardware implementation
4. PLC ladder programming with Simulator (Timer Instruction) and hardware implementation
5. PLC ladder programming with Simulator (Counter Instruction) and hardware implementation
6. Implementation of sequential operation of PLC with basic output devices
7. PLC ladder programming for interfacing with conveyor belt (hardware implementation)
8. PLC ladder programming for water level control (hardware implementation)
9. PLC ladder programming for elevator control (hardware implementation)
10. PLC ladder programming for linear bottle filling station (hardware implementation)

VOC- 416 :Laboratory Coursework–XIV
(Process Control)

(02 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Set parameters of a PID controlled level control loop to stabilize the same
2	Set parameters of a PID controlled flow control loop to stabilize the same
3	Set parameters of a PID controlled pressure control loop to stabilize the same
4	Set parameters of a PID controlled temperature control loop to stabilize the same
5	Illustrate characteristics of linear, equal percentage or on-off type control valves
6	Illustrate components of basic level, pressure, flow feed back control loop

List of Experiments:

1. Study of PI,PD and PID control using Computer Simulator
2. Study of characteristics of linear, equal percentage or on-off type control valves
3. Implementation of ON/OFF control in a closed loop system
4. Study of level feedback control loop
5. Study of flow feedback control loop
6. Study of temperature feedback control loop
7. Study of pressure transmitter
8. Study of I/P converter

(Fundamentals of Pneumatics)

(02 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Design basic pneumatic circuits using actuators and Valves
2	Design sequential circuits using basic pneumatic components and/or sensors
3	Design logic based pneumatic circuits

List of Experiments:

1. Implementation of a 3/2 way palm operated NC Direction Control valve to operate SAC & DAC.
2. Implementation of a 5/2 way spring returned pilot operated valve to operate a DAC & 3/2 way single pilot operated valve to operate a DAC.
3. Study of 'OR' and 'AND' logic using pneumatic components & Study of 5/2 way push button actuation valve.
4. Implementation of 3/2 and 5/2 roller level operated valve for automated sequential operations.
5. Implementation of foot level operated valve and disc rotary valve to operate a DAC.
6. Implementation of solenoid operated direction control valve in pneumatic circuits
7. Implementation of a unidirectional flow control valve to control speed of a pneumatic motor.
8. Automated actuation of a DAC (Using limit switch/ Proximity sensor)

VOC – 418 : Laboratory Coursework–XVI
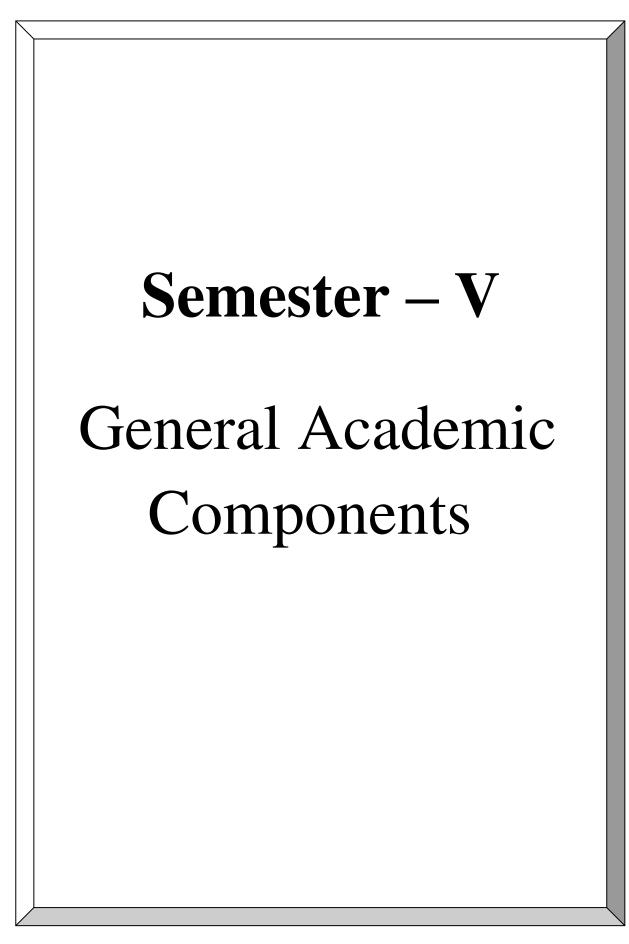
(Embedded System Application)

(02 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Illustrate interface electronics for basic input-output devices with 8051 microcontroller
2	Develop simple programs to operate basic input-output devices and actuators by 8051 microcontroller
3	Troubleshoot 8051 microcontroller circuits developed with basic inout-output devices

List of Experiments:

1. Study the interfacing of LED with 8051 microcontroller
2. Study the interfacing of Seven segment display with 8051 microcontroller
3. Study the interfacing of LCD with 8051 microcontroller
4. Study the interfacing of Relay with 8051 microcontroller
5. Study the interfacing of ADC with 8051 microcontroller
6. Study the interfacing of DAC with 8051 microcontroller
7. Study the interfacing of Stepper motor with 8051 microcontroller
8. Study the interfacing of Servo motor with 8051 microcontroller
9. Study the interfacing of DC motor with 8051 microcontroller
10. Study the interfacing of Keypad with 8051 microcontroller

Semester – V

General Academic Components

General Education Components

VOC 501: Personality Development and Stress Management

(04 credits – 100marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Describe basic traits of personality, discover individual strength and weakness, and plan corrective and developmental exercises
2	Administer communication skills for debates, elocution, convincing skills etc., point out necessities for personal grooming, and compare among various modes of etiquettes
3	Identify stress and its various forms, relate it with physiological and psychological illness.
4	Defend necessities for stress management
5	Demonstrate measures for stress management

Course Contents:

Module- I: Personality Development   (10 hrs)

Basic traits of personality - Dress, address, gestures and manners; Self evaluation and development- identification of strengths and weaknesses; Overcoming hesitation and fear of facing the public; Corrective and developmental exercises - confidence building, role plays.

Module- II: Communication and Personal Grooming   (12 hrs)

Advance communication skills- debates, elocution, persuasive communication, convincing Skills, conversations. Personal grooming and business etiquettes, corporate etiquette, social etiquette and telephone etiquette, role play and body language, impression management.

Module- III: Stress   (10 hrs)

Meaning - Approaches to stress, Good Stress Vs Bad Stress, The individual and work. Manifestations of Stress - Stages of Stress, Signs of Stress at work, Personal types and Stress. General sources of Stress - Stress and Health - Physiological and psychological illness.

Module- IV: Stress Management   (12 hrs)

Stress Diary, Becoming change skilled, Adopting a healthy life style, Right attitude, Thought Awareness, Imaginary (Auto-genic Therapy), Learning to relax, Correct breathing, Value and goal planning, Time Management, General advice - The individual's ten Commandments for effective Stress management.

Module- V:

Tutorials, assignments and presentation based on Module I to IV

References:

1. Interpersonal Skills for Travel and Tourism - Jon & Lisa Burton - Longman Group Ltd.
2. Business Communication - Rayon and V. Lesikar, John D. Pettit, JR. - Richard D. Irwin, INC
3. Managing Stress, Ann Edworthy, Open University Press, Buckingham, Phildephia.
4. Organizational Stress, K.Hari Gopal, University Press.

VOC-502: Operation Management

(2 Credits: 50 Marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Define Operation Management, Operations Strategy, Describe Basics of Work Study, Job Design and Work Measurement, Basics of ISO 14000 / 9000, Basics of Value Engineering & Analysis
2	Summarise Aggregate Planning, Scheduling, Project Management, express Supply Chain Management and Just-in-Time/Lean Operations, Classification of production system,
3	Illustrate Capacity Planning, Waiting Lines, Demand Management-models, , Total Quality Management, , Batch Sizing- Models- Optimization, Batch Scheduling-models-optimization ,
4	Explain Evolution of Production Systems Competitive Advantage and Time Based Competition
5	Discuss Product Decision and Analysis, Product Development, Process Selection, Process Design, Process Analysis, Process-Product Matrix, and Capacity Decisions
6	Develop Facility Location, Facility Layout, and Resource Planning-models

Course Contents:

Module- I: Introduction to Operation Management (8 hrs)

Introduction to Operation Management, Operations Strategy, Role of Operations Strategy, Importance of Operation strategy, Classification of production system – Job shop, Batch, Mass, Continuous production, Competitive Advantage, Time Based Competition.

Module- II: Product Decision and Analysis (6 hrs)

Product Decision and Analysis, Product Development, Process Selection, Process Design, Process Analysis, Process-Product Matrix, Evolution of Production Systems, Batch Sizing-Models- Optimization, Batch Scheduling-models-optimization

Module- III: Demand and Supply (8 hrs)
Demand Management-models, Resource Planning-models, Total Quality Management, Supply Chain Management and Just-in-Time/Lean Operations.

Module IV: Introduction to Planning and Scheduling (8 hrs)
Aggregate Planning, Basics of MRP / ERP, Basics of Scheduling, Job Design and Work Measurement, Basics of ISO 14000 / 9000, Basics of Value Engineering & Analysis

Module- V:

Tutorials, assignments and presentation based on Module I to IV

References:

1. Production & Operations Management -S. N. Chary
2. Operations Management – S.Anil Kumar, N.Suresh- New age International Publishers
2. Operations Management – Andrew Greasley - SAGE Publications
3. Modern Production Management -By E. S. BUFFA
4. Production and Operations Management -By Norman Gaither
5. Theory and problem in Production and operations Management -By S. N. Chary
6. Production and operation Management - By Chunawalla Patel
7. Production & operation Management – KanishkaBedi– Oxford
8. Production & operation Management – R.C. Manocha
9. Production & operation Management – Muhlemann

VOC- 503: Business Communication

(04 credits – 100marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Explain characteristics of successful communication, communication structure in organization
2	Apply communication as a tool to resolution of conflicts
3	State and use principles of effective writing
4	Discuss analyze and present a case study
5	Categorize communication areas and construct monologues/ dialogues for effective communication as per situation

Course Contents:

Module- I: Introduction (10 hrs)

Meaning & Definition, Classification, Role; Characteristics of successful communication – Importance of communication in business – Communication structure in organization – Communication in conflict resolution - Communication in 31 crisis. Communication and negotiation. Communication in a cross-cultural setting. Personality and Emotion interference.

Module- II: Writing Skill and Case Analysis (12 hrs)

Principles of effective writing – Approaching the writing process systematically: The 3X3 writing process for business communication: Pre writing – Writing – Revising – Specific writing features – Coherence – Electronic writing process. Writing routine and persuasive letters – Positive and Negative messages Writing Reports, Writing memos

Different types of cases – Difficulties and overcoming the difficulties of the case method – Reading a case properly (previewing, skimming, reading, scanning) – Case analysis approaches (Systems, Behavioural, Decision, Strategy) – Analyzing the case – Dos and don'ts for case preparation – Discussing and Presenting a Case Study

Module- III: Employment Communication and Negotiation (12 hrs)

Introduction – Composing Application Messages - Writing CVs – Group discussions – Interview skills Impact of Technological Advancement on Business Communication – Technology-enabled Communication - Communication networks – Intranet – Internet – e mails – SMS – teleconferencing – videoconferencing

Negotiation – Nature and need for negotiation – Factors affecting negotiation – Stages of negotiation process – Negotiation strategies

Module- IV: Group Communication (10 hrs)

Meetings – Planning meetings – objectives – participants – timing – venue of meetings – leading

meetings. Meeting Documentation: Notice, Agenda, Resolution & Minutes. Seminars – workshop – conferences Media management – The press release – Press conference – Media interviews Etiquette Advantage in Business Communication

Module- V:

Tutorials, assignments and presentation based on Module I to IV

References :

1. Business Communication : Concepts, Cases And Applications – Chaturvedi P. D, & Mukesh Chaturvedi ,2/e, Pearson Education, 2011
2. Business Communication: Process And Product – Mary Ellen Guffey, 3/e, Cengage Learning, 2002.
3. Communication – Rayudu C. S, Himalaya Publishing House
4. Business Communication – Lesikar, Flatley, Rentz & Pande, 11/e, TMH, 2010
5. Advanced Business Communication – Penrose, Rasberry, Myers, 5/e, Cengage Learning, 2004
6. BCOM – Lehman, DuFrene, Sinha, Cengage Learning, 2/e 2012
7. Business Communiacation – Madhukar R. K, 2/e, Vikas Publishing House.
8. Effective Technical Communication - Ashraf Rizvi M, TMH, 2005.
9. Business Communication - Sehgal M. K & Khetrapal V, Excel Books.
10. Business Communication – Krizan, Merrier, Jones, 8/e, Cengage Learning, 2012.
11. Basic Business Communiaction – Raj Kumar, Excel Books, 2010

VOC 504 Production Engineering

(2 credits-50 Marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Define Types of production systems, describe Productivity and its Importance , memorize the concept of cost- Fixed cost, Variable Cost etc.
2	Interpret Break even analysis, observe techniques of improving productivity, discuss material handling devices, judge factors affecting Site Selection, review Government Policies, demonstrate work Measurement and time Study, classify allowances,
3	Calculate of Breakeven point, Calculation of EOQ, list methods of Inventory Management, Recording techniques of Process Chart, calculation of standard time
4	Distinguish between production and productivity , selection of plant layout,
5	Describe Economic Batch Quantity, EOQ Model, recommend stores function , storage system , justify FIFO
6	Design simple Plant Layout, design principles, characteristics of Plant Layout, Symptoms of Bad Plant Layout, modify Storage systems like One bin , Two bin system etc

Course Contents:

Module -I: Production System   (6 Hrs)

Definition , Types of production systems, Productivity - Importance , Measurement of Productivity, Techniques of improving productivity, Elements of cost- Fixed cost, Variable Cost, Break even analysis, Calculation of Breakeven point.

Module- II: Plant Location, Plant Layout and Material Handling   (8 Hrs)

Plant Location - Importance of Site Selection, Factors affecting Site Selection, Government Policies, and relaxation for Backward Areas. Plant Layout - Objectives, types, design principles, characteristics of Plant Layout, Symptoms of Bad Plant Layout. Group Technology, Cellular layout. Material handling – Need, Principles and Types of material handling devices – conveyors , Hoist & cranes , forklift truck, trolleys, Pipes, Automated Guided Vehicles (AGV's) Selection of Material Handling systems and Devices.

Module- III: Work Study and Work Measurement   (8 Hrs)

Method Study- Definition, Objectives, Procedure, Selection of work. Recording Techniques:- Process Charts – Outline process chart, Flow process chart, Two Hand process chart, Multiple activity chart, Flow diagram, String diagram, Travel chart. Micro motion study-Critical Examination, Principles of Motion Economy, Concept of ergonomics and workplace layout.

Work Measurement -Objectives, procedure, Time Study, Time Study Equipments. Stop Watch Time Study, Standard Time, Work Sampling, Analytical Estimating, Predetermined Motion Time Study, Allowances, Calculation of Standard Time, Concept of Merit Rating.

Module- IV: Inventory Control
(6 Hrs)

Methods of Inventory Management Inventory Cost relationship, Deciding Economic Batch Quantity, EOQ Model, Calculation of EOQ, Concepts of discounts, Introduction of Material Requirement Planning. Stores Function – Storage systems – One bin , Two bin system, Material Issue Request (MIR), Bin card.FIFO

Module V-

Tutorials, assignments and presentation based on Module I to IV

References:

1. L.C. Jhamb, Industrial Management, Everest Publication.
2. James C. Rigs Production System, Planning, Analysis & Control, N.Y.Wiley& Sons.
3. O.P. Khanna Industrial Engineering and Management DhanpatRai& Sons.
4. P.C. Sharma Production Engineering
5. Kempster, Introduction to Jigs and Fixtures Design.
6. BaffnaSarin ,Modern Production and Operations Management
7. Terry Wireman, Total Productive Maintenance, Industrial press inc.
8. Taiichiohno, Toyota Production system, Productivity Press.

Semester – V

Industrial Automation

(Skill Development Components)

Industrial Automation

VOC- 511: Workshop Technologies

(02 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Categorize welding processes, cutting and cutting tools, basic operations in sheet metal working
2	Describe functions and operations of lathe machine and apply concepts of turning to perform operations on lathe machine
3	Discuss drilling, reaming and grinding processes, choose operation specifications of drilling machines/ grinding machines for specific operations
4	Describe functions and operations of milling machine and classify attachments of milling machines for specialized operations
6	Describe basic practices and safety measures of a machine shop

Course Contents:

Module –I: Welding, Metal Cutting, and Sheet Metal Work (8 hrs)

Welding – Introduction and classification of welding processes; Gas welding, carbon arc welding, Shielded metal arc welding, TIG welding, MIG welding, Resistance welding, Laser beam welding, welding defects

Basic Elements of Machining, Types of Cutting, Classification of Cutting Tools, Important Terminologies, Principal Angles of Single Point Tools, Tool Signature, Reference Planes; Chips – Formation, Types, Brakers; Cutting speed, Feed and depth of Cut, Sources of heat in metal cutting, Tool Failure, Tool Life and factors affecting tool life, Cutting tool materials; Dynamometry: Measurement of Cutting Forces

Introduction to sheet metal work, Metals used in sheet metal work, Tools and Machines, Basic operations in sheet metal working

Module- II: Lathe and Lathe Work (7 hrs)

The Lathe and its Principle of Working, Types of lathe, Parts of Lathe, Standard Lathe Operations- Plain and Step Turning, Facing, Taper Turning, Screw Cutting, Drilling, Boring, Reaming, Knurling, Grooving and parting off, Form Turning; Lathe tools, Tool geometry, Speed, Feed and Depth of Cut, Cutting Tool materials, Coolants

Module –III: Drilling, Reaming and Grinding Operation (8 hrs)

Drilling overview, Tools for Drilling, Classification of Drills, Parts and terminologies in twist drill, Important drill dimensions and angles, Special purpose drills, Drill size and specifications, Types of drilling machines (portable, Bench, Upright, Radial) Operations on drilling machine, Tool holders, Work holders

Reaming overview, Terminologies, Types, Reaming operation, Cutting speed and feed

Overview of grinding process, Forms of abrasive tools, Abrasive materials, Grinding materials, Grinding wheels (grain, grade, structure, shapes, selection, mounting, loading, glazing, trueing, dressing) Grinding Machine types, Grinding methods, Speed , feed and depth of cut

Module- IV: Milling Machine and Milling work   (7 hrs)

 Introduction, Working Principle, Types on Milling machine, Principal parts of column type milling machine, Main attachments for milling machine, Milling methods, Milling cutters (principal types), Angles of a plain milling cutter, Number of teeth in cutter, Milling operations (Broad classification), Cutting speed and feed, Coolants, Concept of indexing.

Module –V:

Presentations, case studies, Assignments, Tutorials based on Module I to IV.

References:

1. A Course in Workshop Technology (Vol -2): Dhanpat Rai and Co Pvt. Ltd., B.S. Raghuwanshi; Edition: 10th, 2017
2. Workshop Technology (Volume – 1 and 2): Media Promoters & Publishers Pvt. Ltd.; S. K. Hajra Chowdhury, A. K. Hajra Chowdhury, N. Roy ; Edition : 16th
3. Workshop Technology (Part - 2): W. A. J. Chapman; CBS Publisher Edition: 4th
4. Manufacturing Processes: Pearson Publication., Serope Kalpakjian and Steven Schmid; Edition Fifth; ISBN 978-81-317-0566 -7
5. Manufacturing Technology- Material Processes and Equipment: CRC Press., H.A. Youssef and M.H. Ahmed; ISBN-13:978-1-4398-9708

VOC 512- Introduction to Robotics

(2 Credits: 50 Marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Define basic terminologies of robotics ,describe development in robotic aspects, and various applications of industrial robots
2	Define the needs acquire necessary information and select appropriate robots for various industrial applications
3	Explain the robot anatomy and apply robot kinematics, dynamics, motion planning, trajectory generation and control
4	Describe features of a robot software and discuss robot programming languages
5	Discuss various sensors and actuators employed in robotics
6	Recognize the responsibility of engineers for the safety issues and the importance associated with the use of robots for various applications

Course Contents:

Module -I: Introduction to Robotics   (6 hrs)

Evolution of Robot and Robotics, Laws of Robotics, Progressive advancement in Robotics, Types of Robot, Selection of Robot- Payload, speed, Reach, Sensors in robots, Actuators, Major parts of Industrial robot

Module -II: Anatomy of Robot   (7 hrs)

Links, Joints and Joints Notation Scheme, Degree of Freedom (DOF), Required DOF in a Manipulator, Work Cell, Work Envelope, and Work Volume, Robot End Effectors – Definition, Classification of End Effectors, Types of Grippers, General structure of Robot and Specifications of Robots.

Module- III: Robot Motion Analysis   (7 hrs)

Introduction, link description, Joint link connection description, Kinematic modeling of manipulator, Direct and Inverse manipulator Kinematics – Basics, Manipulator dynamics- Basics, Trajectory planning – Basics, **Robotic Vision System-** Robot Sensors, Function & use of sensors in robotics, Definition & Concept-Robotic vision system,

Module- IV: Robot Software and Programming& Robot Applications   (7 hrs)

Introduction, Robot software features, Concept of programmability and related languages, Robot programming languages and Robotic Functions, Control functions of a Teach box, Robot Coordinate Systems, Jogging of a Robot, Robot Applications, Robot Maintenance, Robot Safety systems, Present state of safety technology

Module- V: Tutorials, assignments and presentation based on Module I to IV

References:

1. Robotics and Control by Mittal & NagrathTata McGraw-Hill Education, 2003: ISBN 10: 0070482934 / ISBN 13: 9780070482937
2. Industrial Robotics By Michel P Groover **1St Edition Edition**; ISBN-13: 978-0070249899 / ISBN- 10: 007024989X

3. Robotic Engineering By Dr. Surender Kumar, Dr.S K. Mukherjee (TMH)

1. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education., 2009
2. Robotics control, sensing, vision and intelligence, Fu. K. S., Gonzalez. R. C. & Lee C.S.G., "", McGraw Hill Book co, 1987
3. Robots and Manufacturing Automation, Ray Asfahl. C., John Wiley & Sons Inc.,1985
4. Introduction to Robotics mechanics and control, by Craig. J. J., Addison- Wesley, 1999

VOC- 513 Networking Essentials

(02 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Describe and classify various modes of data communication and explain basic networking concepts
2	Classify communication techniques in Industries and explain various Networking Models
3	Explain communication hierarchy in factory automation
4	Classify and explain I/O bus networks and protocol standards
5	Describe architecture and topologies for fieldbus

Course Contents:

Module I – Data Communication   **(06 hrs)**
Introduction, Comparison between Digital and Analog, Data Communication, Data Types, Data Transfer Characteristics, Data Flow Methods, Transmission Modes: parallel, serial, asynchronous, synchronous, isochronous, Use of Modems, Power Spectral Density

Module II – Network Models   **(07 hrs)**
Introduction, Three-Layer Model, OSI Model- Physical Layer, Data Link Layer, Network Layer, Transport Layer, Session Layer, Presentation Layer, Application Layer, TCP/IP Protocol Suite-Introduction, Protocol Architecture, Operation, PDUs in Architecture, Addressing-Physical, Logical, Port, Specific.

Module III – Networks in Process Automation   **(07 hrs)**
Introduction, Communication Hierarchy in Factory Automation, I/O Bus Networks – Types, Network and Protocol Standards, Advantages. OSI Reference Model, Networking at I/O and Field Levels, Networking at Control Level, Networking at Enterprise/Management Level

Module IV – Fieldbuses   **(06 hrs)**
What Is a Fieldbus?- Evolution, Architectural Progress, Types, Expanded Network View, Topologies- Point-to-Point, Bus with Spurs, Tree (Chicken Foot), Daisy Chain, Mixed Topology, Terminators, Fieldbus Benefits, Foundation Fieldbus.

Module V:

Presentations, case studies, Assignments, Tutorials based on Module I to IV.

References:

1. Fieldbus and Networking in Process Automation – Sunit Kumar Sen may 14, 2014 by CRC Press Reference - 461 Pages - 15 Color & 279 B/W Illustrations ISBN 9781466586765 - CAT# K20308
2. Industrial Automation IDC Engineering pocket guide first Edition *ISBN* 1 875955 09 7
3. Data Communications Networking (McGraw-Hill Forouzan Networking) 4th Hardcover Import, 1 Feb 2006 by Behrouz A Forouzan (Author) □ ISBN-10: 0073250325 ISBN13: 978-0073250328

VOC- 514: Advance Embedded Systems

(02 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Explain differences between 8051 and PIC family of microcontrollers and describe various registers, data format and directives
2	Explain and apply instruction sets to perform assembly language programming with PIC 18 microcontroller
3	Interpret simple branching, mathematical, and logic related Programming with PIC 18 microcontrollers using Assembly language
4	Interface of real world device through I/O programming with PIC 18 family microcontrller
5	Apply arduino uno controller for real world device interfacing

Course Contents:

Overview:
Difference between 8051 and PIC, Overview of the PIC18 family: PIC18 features, Simplified view of PIC, Members of PIC family, Comparison of 8051 and PIC Family

Module– I: PIC Microcontrollers and Assembly Language Programming   (07 hrs)

Introduction to PIC microcontrollers and embedded processors, Assembly Language Programming : WREG Register in PIC, PIC File Register, PIC Status register, PIC data format and directives, Introduction to PIC Assembly Programming: Structure of Assembly language, Assembling and linking a PIC Program, Program counter and program ROM space in the PIC, RISC architecture in PIC

Module – II: Addressing Modes and Instruction Set   (07 hrs)

Branch Instructions, Looping, Call instructions and Stack, PIC 18 Time delay and Pipeline concepts Arithmetic Instructions and operations, Logic and Compare Instructions, Rotate operation and Data serialization,

Module – III: Hardware connections, I/O programming and Interfacing   (06 hrs)

Pin connection, PIC configuration registers, I/O port programming in PIC 18, I/O port bit manipulation programming
Real World device interfacing: LCD, ADC, DAC, Relay, Stepper Motor, DC motor

Module – IV: Introduction to Arduino Programming   (07 hrs)

Arduino Structure, Variables, Data types, Arithmetic , Constants, Flow Control, Digital i/o, Analog i/o, time, math, random, serial, Arduino Programming

Module – V:

Presentations, case studies, Assignments, Tutorials based on Module I to IV.

References:

1. PIC microcontrollers and embedded systems- M.A. Mazidi, R. D. Mc. Kinlay, C, Causy; Pearsn, 2008, fourteenth impression ISBN-13: 978-0131194045 ISBN-10: 0131194046
2. Basic for PIC microcontrollers- N. Matic; webmaster, 2001
3. Getting started with arduino - Massimo Banzi, 2nd edition ISBN: 978-1-449-309879
4. Arduino notebook v1-1-Brian W Evans,1st edition
5. Intro Arduino Book- Alan G Smith, ISBN: 1463698348, ISBN-13: 978-1463698348
6. John B. Peatman, "Design with PIC microcontroller", McGraw Hill International Ltd., 1997
7. Han-way Huang, "Using the MCS-51 microcontroller", Oxford University Press, 2009
8. Getting Started with Aurduino 3rd Edition by M. Banzi and M. Shiloh

VOC- 511A: Fundamentals of Microprocessor 8086

(02 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Explain architecture of 8086 microprocessor
2	Describe operation of each pin of 8086 microprocessor
3	Interpret simple branching, mathematical, and logic related Programming with 8086 microprocessor microcontrollers using Assembly language

Course Contents

Module - I 8086 microprocessor architecture   **(8 hrs)**

Overview of Microcomputer structure and operation, memory, input / output, CPU, address bus, data bus, control bus, 8086 microprocessor family overview, 8086 internal architecture: execution unit, (flag register, general purpose register, ALU), Bus interface unit, segment register, stack pointer register, pointer and index register [Refer Douglas and Hall book for above articles],

Module - II 8086 microprocessor hardaware aspects and addressing modes   **(7 hrs)**

Pin out and pin functions of 8086 : The pin out, power supply requirements, DC characteristics, input characteristics, output characteristics, pin connections   (common pins, maximum mode pins and minimum mode pins) **Addressing Modes:** Data addressing modes: Register addressing, Immediate addressing, Direct addressing, register indirect addressing, base plus index addressing, register relative addressing, base relative plus index addressing, Programme memory addressing modes: Direct program memory addressing, relative program memory addressing, indirect program memory addressing; stack memory addressing modes.

Module- III :Data Movement Instructions with 8086 microprocessor   **(5 hrs)**

MOV revised: machine language, the opcode, MOD field, register assignments, R/M memory addressing, special addressing, **PUSH/POP :** PUSH, POP, initializing the stack**; Miscellaneous data transfer instructions:** XCHG, IN and OUT,

Module IV :Arithmatic and Logic Instructions with 8086 microprocessor   **(7 hrs)**

Arithmetic and Logic Instructions: Addition, subtraction and comparison: Addition: Register addition, immediate addition, memory to register addition, array addition,increment addition, addition with carry**; Subtraction:** Register subtraction, immediate subtraction, decrementsubtraction, subtraction with barrow**; Comparison, Multiplication and division: Multiplication:** 8 bitmultiplication, 16 bit multiplication; **Division:** 8 bit division,16 bit division; **Basic Logic**

Instructions: AND, OR, Ex-OR,TEST, NOT, NEG**; Shift and Rotate: Shift:** left shift, rightshift; **Rotate:** Rotate left, rotate right

Module – V:

Presentations, case studies, Assignments, Tutorials based on Module I to IV.

References:

1. The Intel Microprocessors, Architecture Programming and interfacing, Barry B Brey ; Sixth Edition ; Prentice Hall International, Publications, (2002), ISBN-10: 0130607142, ISBN-13: 978-0130607140
2. The Intel Microprocessors, Architecture Programming and interfacing, Barry B Brey ;Eighth Edition ; Prentice Hall International, Publications (2009), ISBN 0-13-502645-8
3. Microprocessors and Interfacing : Programming and Hardware, Douglas V Hall : II Edition ; Tata McGraw-Hill(1990), ISBN-10: 0070257426, ISBN-13: 978-0070257429.
4. Microcomputer Systems : The 8086 / 8088 Family; Architecture, Programming and Design, Yu-Cheng Liu and Glenn A. Gibson,Prentice Hall International, Publications (1986), ISBN-10: 013580499X, ISBN-13: 9780135804995.
5. The 8086/8088 Family: Design, Programming and Interfacing, John, Uffenbeck, Prentice Hall International, Publications (1986), ISBN-10: 0132467526, ISBN-13: 978-0132467520

VOC- 512A: Interfacing with Microprocessor 8086

(02 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Write assembly language routines employing program control instructions
2	Describe Assembly Language Program Directives for 8086 microprocessor
3	Explain interface protocols with 8086 microprocessor through 8255 PPI

Course Contents

Module - I: Program Control Instructions (6 hrs)

The Jump Group: **Unconditional jump:** short jump, near jump, far jump, indirect jumps using an index; **Conditional Jumps:** LOOP, conditional LOOPs; **Procedures**: CALL, near CALL, far CALL, indirect memory address, RET; **Machine Controland Miscellaneous Instructions:** Controlling the carry flag bit, wait, HLT, NOP ;

Module – II: Assembly Language Programming (6 hrs)

Assembly Language Programming: Assembler directives: ASSUME, DB, DD, DQ, DT, DW, END, ENDP, ENDS,EQU, EVEN, EXTRN, GLOBAL, GROUP, INCLUDE,LABEL, LENGTH, NAME, OFFSET, ORG, PROC, PTR,PUBLIC, SEGMENT, SHORT, TYPE [Refer Douglas andHall book for above articles **Assembly Language Programming:** Sum of an array, factorial, largest / smallest from given array, sorting of numeric array, square root.

Module -III : Input / Out Interfacing-I (with reference to 8086 Microprocessor)   (6 hrs)

Introduction to I/O interface, I/O instructions, isolated and memory mapped I/O, basic input and output interfaces, handshaking, **I**/O port address decoding: decoding of 8-bit I/O addresses, decoding of 16 – bit I/O address;

Module -IV :Input / Out Interfacing-II (with reference to 8086 Microprocessor)   (6 hrs)

The programmable peripheral interface: basic description of 8255, programming the 8255, mode 0 operation, an LCD display interfaced to 8255, a stepper motor interfaced to 8255, Mode 1 strobed input, mode1 strobed output , Mode 2 bisectional operation

Module – V:

Presentations, case studies, Assignments, Tutorials based on Module I to IV.

References:

1. The Intel Microprocessors, Architecture Programming and interfacing,   Barry B Brey ; Sixth Edition ; Prentice Hall International, Publications, (2002), ISBN-10: 0130607142, ISBN-13: 978-0130607140
2. The Intel Microprocessors, Architecture Programming and interfacing,   Barry B Brey ;Eighth Edition ; Prentice Hall International, Publications (2009),   ISBN 0-13-502645-8
3. Microprocessors and Interfacing : Programming and Hardware, Douglas V Hall : II Edition ; Tata McGraw-Hill(1990), ISBN-10: 0070257426, ISBN-13: 978-0070257429.
4. Microcomputer Systems : The 8086 / 8088 Family; Architecture, Programming and Design, Yu-Cheng Liu and Glenn A. Gibson,Prentice Hall International, Publications (1986), ISBN-10: 013580499X, ISBN-13: 9780135804995.
5. The 8086/8088 Family: Design, Programming and Interfacing, John, Uffenbeck, Prentice Hall International, Publications (1986), ISBN-10: 0132467526, ISBN-13: 978-0132467520

VOC – 515: Laboratory Coursework -XVII

(Lab Course pertaining to VOC 511 and 512)

(03 Credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Apply basic machine shop tools to perform simple machine operations
2	Apply DC geared motor and stepper motor as motion control elements
3	Illustrate operation of a gantry robot
4	Operate a six axis articulated robot in fundamental modes of operation

List of Experiments:

Visit to a machine tool shop and to get introduced to various machines, work practices, types of jobs, job roles, safety measures.

1. Grinding a job in a given angle
2. Drilling and reaming operation on a given job
3. Welding operation on a given job (either of lap or butt joint)
4. Study of a centre lathe machine
5. Facing and taper turning operation on a given job in centre lathe
6. Grooving and knurling operation on a given job in centre lathe
7. Study of a milling machine
8. Machining of a hexagonal head with slot on a given job in milling machine
9. Study of position control with a DC geared motor for different values of forward gain at different values of angular position
10. Study of effect of loading on the speed of a DC motor in the open loop and closed loop using variable gain error amplifier
11. Study of various operational modes of a stepper motor
12. Study on individual control of each axis of a six axis pick and place robot (2 axes stepper coupled belt driven and 4 axes servo driven) and program the robot for a pick-place operation.
13. Study of a robotic platform with different sensors integrated onto it and build one project by integrating at least one sensor on similar platform (self study mode – one project to be submitted by a batch of three students)
14. Introductory programming of industrial Cartesian robot (six axis) for pick/place operation
15. Jogging of Robot (Axis Mode, World Coordinate Mode)
16. Referencing / Zeroing / Mastering of Robot
17. TCP Calibration
18. Base / Frame Coordinate Calibration
19. Creating a new simple motion program with PTP, Lin and Cir motion with calibrated tool base. Speed of each point to be specified
20. Creating a program for pick and place including opening and closing of grippers
21. Backup and Restoring of Robot

VOC – 516: Laboratory Coursework -XVIII

(Lab Course pertaining to VOC 513 and 514)

(03 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Illustrate various interfacing protocols
2	Apply PIC microcontroller to control basic input –output devices and actuators
3	Apply Arduino Uno platform to control basic input –output devices and actuators

List of Experiments:

1. Study of Addressing in TCP/IP and Ping Command
2. Study & Implementation of cable designs in Networking
3. Implementation of Peer to Peer Network and Client- Server Network
4. Implementation of Star topology using 100Base Tx
5. Implementation of Bus topology using 10Base2
6. To create the scenario and study the performance of token bus protocols through simulation
7. Implementation of Ring topology using DB9
8. To create the scenario and study the performance of token ring protocols through simulation
9. Implementation of Data Encryption and Decryption
10. Study of fieldbus protocol.
11. Comparision of Star, Bus, and Ring Topologies

12. Study on a interfacing of Relay and Stepper Motor with PIC microcontroller
13. Study on a interfacing of LCD and ADC with PIC microcontroller
14. Study on a interfacing of DAC and DC motor with PIC microcontroller
    (Self study mode – one application utilizing any one of the experiments from sr.
    no. 12-14 has to be demonstrated by a group of three students)
15. Study of Aurduino interfacing with real world devices.

(Students will be introduced with Aurduino interfacing for at least two applications. Thereafter, in self study mode- a group of three students will have to submit at least one project using aurduino platform

VOC – 515A: Laboratory Coursework -XVIIA

(Lab Course pertaining to VOC 511A and 512A)

(03 credits – 50 marks)

Course Outcomes:

On completion of the course, students should be able to –

1	Develop Assembly Language Program with 8086 microprocessors for data movement, arithmetic and logic instructions
2	Develop Assembly Language Program with 8086 microprocessors for program control instructions
3	Interface real-time devices with 8086 microprocessors through 8255 PPI

List of Experiments using 8086 Kit

1. Data transfer, addition, subtraction, multiplication, division and sum of series
2. Factorial and square of the number
3. Sorting of data (ascending / descending), square root of a number
4. Arithmetic mean of N- numbers and sum of square of Numbers
5. Interfacing of SPDT switches and 7 segment display as a position encoder / decoder
6. Interfacing of stepper motor
7. Interfacing of DC motor
8. Interfacing of DAC to generate ramp wave, triangular wave and square wave.
9. Interfacing of 8-bit ADC
10. Interfacing of LCD display

List of xperiments Using 8086 Assembler

11. Data transfer, addition, subtraction, multiplication, division and sum of series
12. Factorial and square of the number
13. Sorting of data (ascending / descending), square root of a Number
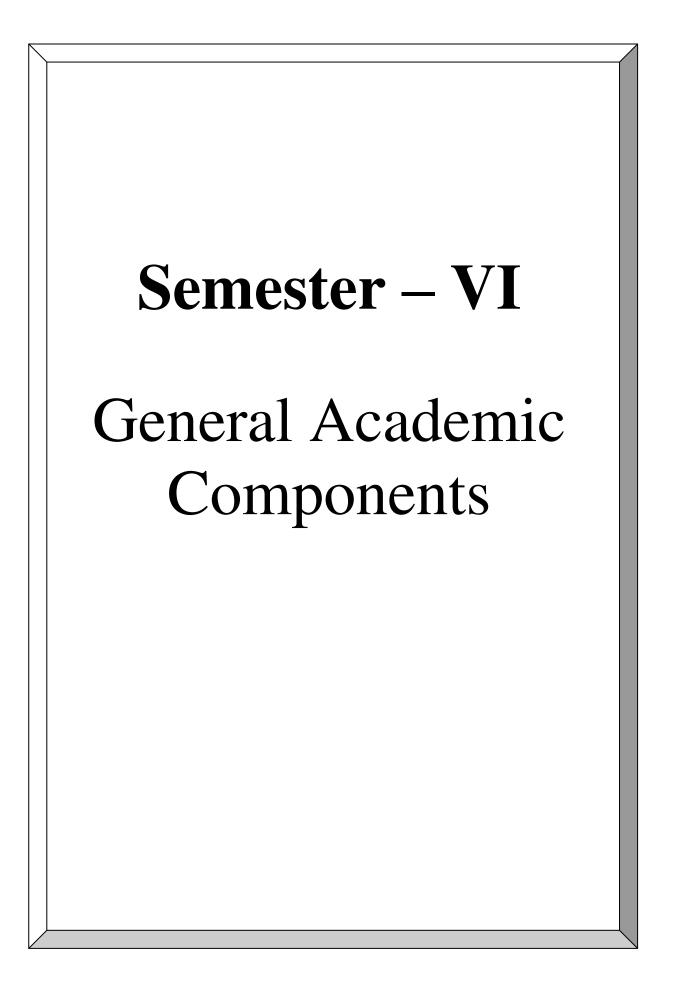14. Arithmetic mean of N- numbers and sum of square of Numbers

(Students will be introduced with Aurduino interfacing for at least two applications. Thereafter, in self study mode- a group of three students will have to submit at least one project using aurduino platform

VOC 517:Major Project – Phase I
(04 credits – 100 marks)

(Review of Literature/ Industrial Orientation, Formulation of Topic, Experimental Plan)

Students are expected to go through review of literature on a particular technical aspect and/or pay industrial visit to identify a point of further study and research/investigation. The student (or group of students), thereafter, would propose a subject on basis of literature review and/or industrial orientations and will have to present a short seminar on his/her proposal to the board of examiners constituted by faculties of the department. If approved, he/she will be allowed to work on that particular project. Within a week after this approval, the student(s) will have to finalize their topic/subject of project and duly officiate it. During phase – I of Research/Industrial Project, it is expected that the student(s) will –

1. build up a concrete fundamental of the concept on which they are going to work,
2. carry out thorough literature survey to find out scope of work in the particular field,
3. thereby, finalizing the topic of further study/investigation
4. and finally, draft a systematic experimental plan to achieve projected goal
5. deliver regular presentations
6. systematically document the above activities in bound volume and submit one copy to the department, one copy to concerned faculty and retain one copy with him/herself

Semester – VI

General Academic Components

General Education Components

VOC 601: Foreign Language (German/Chinese/Japanese/Russian)

(4 Credits: 100 Marks)

Course Outcomes:

After completion of the course, students are expected to be able to: read, write Hiragana and Katakana, know basic kanjis, can participate in simple conversation.

Course Contents:

Module 1:   **(10 Hrs)**
Scripts in Japanese- Hiragana, katakana and introduction to Kanji Self introduction, Daily used greetings,expressions used in the classroom Introduction to Japanese Grammer

Module 2:   **(12 Hrs)**
Day,date,nos.,grammer related to place and time Counters

Module3:   **(12 Hrs)**
Introduction to adjectives and verbs

Module 4 :   **(12 Hrs)**
Forms of adjectives,verb tense forms

Module 5:

Tutorials, assignments and presentation based on Module I to IV

References:

Minna no nihongo I
Japanese for Busy People Kyoukasho wo tsukuro

VOC-602: ENTREPRENEURSHIP DEVELOPMENT

(4 Credits: 100 Marks)

Course Outcomes

After completion of this course, students should be able to-

1	Discern distinct entrepreneurial traits
2	Interpret the parameters to assess opportunities and constraints for new business ideas
3	Summarize a systematic process to select and screen a business idea
4	Design strategies for successful implementation of ideas
5	Prepare a business plan

Course Contents:

Module I: (12 Hrs)

Entrepreneur - meaning - importance - Qualities, nature types, traits, culture, Similarities and differences between entrepreneur and entrepreneur. Entrepreneurship and economic development - its importance, Role of entrepreneurship, entrepreneurial environment. Evolution of entrepreneurs - entrepreneurial promotion: Training and developing motivation: factors - mobility of entrepreneurs - entrepreneurial change - occupational mobility - factors in mobility - Role of consultancy organizations in promoting entrepreneurs

Module II: (10 Hrs)

Small Business : Concept & Definition, Role of Small Business in the modern Indian Economy, Small entrepreneur in International business; Steps for starting a small industry, registration as SSI, Role of SIDBI; advantages and problems of SSIs; Institutional Support mechanism in India; Incentives & Facilities, Govt. Policies for SSIs

Module III: (10 Hrs)

Setting MSMEs- location of enterprise - steps in setting - Problems of entrepreneurs - Sickness in small industries - reasons and remedies - Incentives and subsidies - Evaluating entrepreneurial performance - Rural entrepreneurship - Women Entrepreneurship.

Module IV: (12 Hrs)

Project finance: Sources of finance – Institutional finance - Role of IFC, IDBI, ICICI, LIC, SFC, SIPCOT, and Commercial Bank - Appraisal of bank for loans. Institutional aids for entrepreneurship development - Role of DST, DICS, SIDCO, NSICS, IRCI, NIDC, SIDBI, SISI, SIPCOT, Entrepreneurial guidance bureau - Approaching Institutions for assistance.

Module 5:

Tutorials, assignments and presentation based on Module I to IV

References:

1. Vasanth Desai ―Dynamics of Entrepreneurial Development and Management‖ Himalaya Publishing House, New Delhi, India, ISBN 10: 8184884974 ISBN 13: 9788184884975
2. N.P.Srinivasan & G.P. Gupta ―Entrepreneurial Development‖ S. Chand & Sons, New Delhi, India. ISBN 10: 8170148014 ISBN 13: 9788170148012
3. P.Saravanavelu ―Entrepreneurship Development‖ Eskapee publications.
4. S.S.Khanka ―Entrepreneurial Development‖ S.Chand & Company Ltd.,

Satish Taneja ― Entrepreneur Development‖ ; New Venture Creation.

VOC-603: Production Management

(4 Credits: 100 Marks)

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Course Outcomes

After completion of the course, students are expected to be able to:

1.	Students would describethe nature of how production management is carried out in an organization
2.	Describe the nature of products or services in the organization..

Course Contents:

Module 1: Introduction: An overview of Production Management   **(9 Hrs)**

Production Management: Introduction and overview, Production Management Strategy framework, Understanding similarities and difference among products, goods and services, Historical evolution of production management-Changes & Challenges

Module 2: Product development & production strategy   **(10 Hrs)**

Product Strategy and integrated product development, Determining Product Concept, Determining Commonality, Requests for Deviation from Customer Requirements, Developing Design-to-Cost Goals, Determining Production Philosophy and Location, Process Strategy, Capacity Planning Decisions, Facilities Location Strategies

Module 3: System Design   **(10 Hrs)**

Facilities Layout and Material Handling Strategy, Develop Preliminary Manufacturing Plan, Identify New Manufacturing Technologies, Determine Product-Packaging Requirements, Develop Prototype Assembly Tooling, Determine Logistical Support Requirements,Group Technology, Flexible manufacturing system, Assembly line balancing, Project Management-CPM PERT, Line of Balance (LOB)

Module 4: Planning and managing operations   **(10 Hrs)**

Productivity Concepts: Quality Circle, Kaizen and other SGA, Statistical Quality Control, Maintenance Planning and Control (Reliability, availability, maintainability),Forecasting, Queueing Theory,
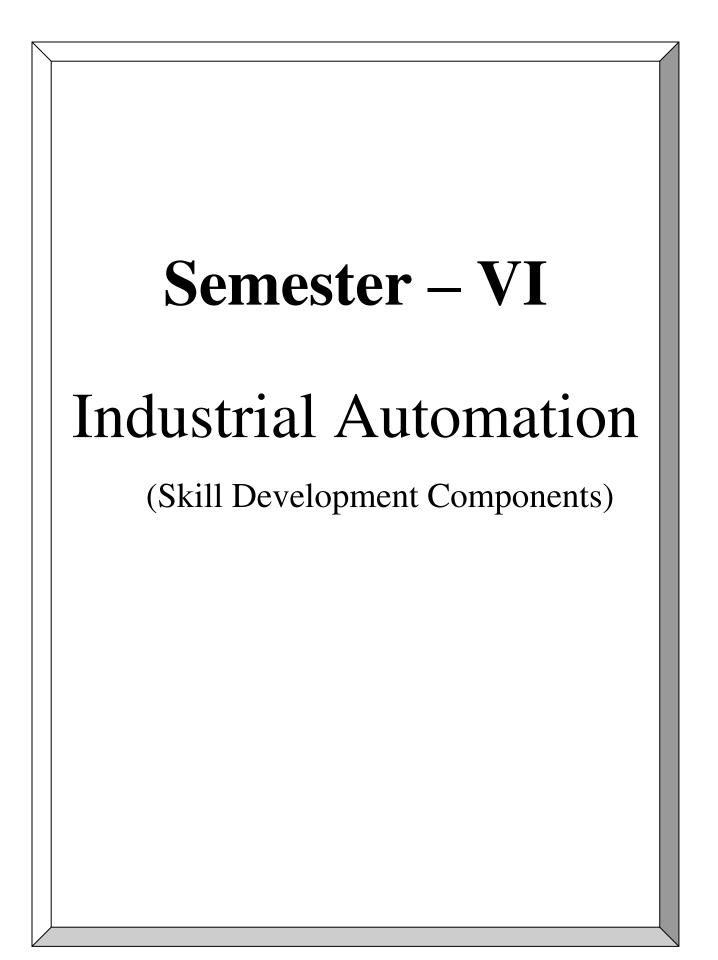
Module – V:

Tutorials, assignments and presentation based on Module I to IV

References:

1. Aggarwal L.N, ParagDiwan (1997), Management of Production Systems, Global Business Press.
2. Alan Muhlemann, John Oakland, Keith Lockyer (1978), Production and Operations Management, Mac Milan , India, IV Edition.
3. Artiba and S.E Elmaghaby(1997), The Planning and scheduling of production Systems methodologies and Applications, Chapman & Hall.
4. Aswanthappa K, Sridhar Bhatt K(2005), Production and Operations Management, Himalya Publishing House.

Semester – VI

Industrial Automation

(Skill Development Components)

VOC 611- Flexible Manufacturing System

(2 Credits: 50 Marks)

Course Outcomes:

On completion of the course, students should be able to-

1	State the basic concepts of FMS, cell, JIT, KANBAN system and CMM
2	Classify and compare different types of FMS, machining centers, Kanban, CMM, AGVS, AS/RS; also differentiate between FMS and FMC
3	Illustrate area of applications of a FMS, CMM, JIT, various equipments and their functions required for an FMS
4	Analyze the reasons for adopting group technology, analyze the AGV Systems, AS/RS as well as distinguish between Axes and Format of Machining Centers, Horizontal and Vertical Machining Centers
5	Explain the visual inspection aspects

Course Contents:

Module – I: Introduction to FMS **(5 Hrs)**

Introduction and Definition, Basic Components of FMS, The Significance of FMS in the 1990s, Different Types of FMS, Types of FMS Layouts, Factors Influencing the FMS Layouts, Seeking Benefits on Flexibility, FMS—An Example of Technology and an Alternative Layout, Objectives of an FMS, Aims of FMS, The Principle Objectives of FMS, Advantages and Disadvantages of FMS Implementation, Advantages and Disadvantages of FMS, Area of Application of a FMS in Industry, Various Equipments and their Functions Required for an FMS, Innovations that have Advanced the Manufacturing Industries, CIM Technology, Hierarchy of CIM, Direct Real Time Schedule Control, FMS Concepts

Introduction of manufacturing cell, Definition of Cell, Classification of Cell, Unattended Machining, Differences between FMC and FMS

Module – II: JIT , KANBAN System, and Group Technology **(6 Hrs)**

Introduction and Definition, Big JIT, Little JIT, JIT Concept, Goals of JIT, JIT Reality, Objectives of JIT, JIT Ingredients, Quality and Quantity Principles of JIT, The Primary Quantity JIT Principles, Benefits of JIT, JIT Implementation
Introduction to Kanban/Card System, Push vs. Pull System , Types of Kanban

Introduction , Definition, Reasons for Adopting Group Technology, Visual Inspection , Part Classification and Coding, Production Flow Analysis , Benefits of Group Technology Affecting Many Areas of a Company, Obstacles to Application of GT

Module – III: FMS Elements – I   (7 Hrs)

Machining Centers: Introduction, Types of Machining Centers , Machining Center Innovations and Developments, Axes and Format of Machining Centers, Horizontal and Vertical Machining Centers, Automated Features and Capabilities of Machining Centers.

Coordinate Measuring Machines: Introduction, CMM Construction, Probe, Mechanical Structure, Types of CMM, Functions of CMM Computer, Operational Cycle Description , CMM Applications , CMM Advantages

Module – IV: FMS Elements – II   (7 Hrs)

Automated Material Movement and Storage System: Introduction, Types of AGVS, Unit Load Carriers, ASRS Systems, Analysis of AGV Systems, Automated Storage and Retrieval Systems (AS/RS), Unit Load AS/RS, Mini Load AS/RS, Carousel AS/RS, Advanced Automated Storage and Retrieval System, Analysis of AS/RS, Quantitative Analysis, Industrial Robots Case Studies

Module V:

Tutorials, assignments and presentation based on Module I to IV

References:
1. Flexible Manufacturing System Author : H. K. Shivanand, M. M. Benal, V. Koti Publisher : New Age Pub. ISBN-10: 8122418708 ISBN-13: 978-8122418705
2. Automation, Production Systems and Computer Integrated Manufacturing by Author : Groover M.P
3. Approach to Computer Integrated Design and Manufacturing Author : Nanua Singh Publisher : John Wiley and Sons ISBN-13: 978-0471585176 ISBN-10: 0471585173
4. Principles Of Computer - Integrated Manufacturing, Author : Vajpayee, S K Book Code : 9788120314764
5. Flexible Manufacturing Cells and Systems Author : Luggen ISBN-13: 978-0133217384 ISBN-10: 0133217388
6. Ian Gibson 2009, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer [ISBN: 9781441911193]
7. Serope Kalpakjian 2013, Manufacturing Engineering & Technology., 7th Ed., Pearson [ISBN: 9780133128741]
8. Mikell P. Groover 2012, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems., 5th Ed., Wiley [ISBN: 9781118393673].

VOC 612- Industrial Robotics

(2 Credits: 50 Marks)

Course Outcomes

On completion of the course, students should be able to-

1	Define the automation and robotics, robotics market and future prospects, robot anatomy , safety implementation principles of industrial robotics, social issues and future of robotics
2	Classify and compare machine loading and uploading, processing operations
3	Demonstrate application of robotics in manufacturing
4	Analyze the robot cell layouts, economic aspects of robot manufacturing
5	Test the operation of pick and place robot
6	Develop programs for industrial robotic application

Course Contents:

Module I: Review of Robotics   (6 HRS)

Automation and Robotics, Robotics Market and Future Prospects, Review of Robot Anatomy and Robot Motion analysis,

Module II: Application Engineering for Manufacturing   (7 HRS)

Robot Cell Design: Robot Cell Layouts, Multiple Robots and Machine interface, Workcell Control;

Economic Analysis for Robotics: Methods for economic analysis, Differences in Production rates, Robot project analysis form.

Module III: Robot application in Manufacturing   (7 HRS)

Material Transfer and Machine loading/unloading: material transfer applications, machine loading and unloading ;

Processing Operations: Spot Welding, Spray coating, other processing operations using Robots;

Assembly and Inspection.

Module IV: Implementation Principles and Issues   (7 HRS)

An approach for Implementing Robotics: Plant Survey, Selection of Robot, Planning and Engineering the installation;

Safety, Training, Maintenance and Quality; Social Issues and Future of Robotics.

Module V:

Tutorials, assignments and presentation based on Module I to IV

References:

1. Robotics and Control by Mittal &NagrathTata McGraw-Hill Education, 2003: ISBN 10:   0070482934 / ISBN 13: 9780070482937
2. Industrial Robotics By Michel P Groover1St Edition Edition; ISBN-13: 978-0070249899 / ISBN-   10: 007024989X
3. Robotic Engineering By Dr. Surender Kumar, Dr.S K. Mukherjee (TMH)
4. "Robotic Engineering - An Integrated Approach" by Richard D. Klafter, Thomas A. Chmielewski and Michael Negin, Prentice Hall India, 2002
5. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education., 2009
6. Robotics control, sensing, vision and intelligence, Fu. K. S., Gonzalez. R. C. & Lee C.S.G., "", McGraw Hill Book co, 1987
7. Robots and Manufacturing Automation, Ray Asfahl. C., John Wiley & Sons Inc.,1985
8. Introduction to Robotics mechanics and control, by Craig. J. J., Addison- Wesley, 1999

VOC-613: SCADA

(2 Credits: 50 Marks)

Course Outcomes

On completion of the course, students should be able to –

1	State the basic features of SCADA, HMI
2	Explain the importance of SCADA in critical industrial control and supervision
3	Demonstrate system graphic designing, data acquisition, messages and alarms, Software requirement for HMI Specifications and Selection Criteria with respect to process demands
4	Analyze the theory and applications of SCADA
5	Execute, debug and test the programs developed for digital and analog operations.
6	Develop projects with SCADA and HMI

Course Contents:

Module – I: Introduction To SCADA   (7 hrs)

SCADA: Need, Concept and Basic Features of SCADA, Hardware and Software (Specification & Configuration) requirements for SCADA
Window's Control Center (WinCC) Software for SCSDA (WinCC- Advanced): Introduction, Getting Started and Creation of New Project, Components, Tag Concept and various Tags in WinCC Advanced, Creation and Linking of Tags with PLC

Module – II: System Graphic Design and Data Acquisition   (8 hrs)

System Graphic Designing: Digital and Analog Supervision & Control through Graphic Screen, Graphic Object Pallets and Library (Standard, Smart and Windows), Creating Process Pictures with Active X Control and Methods Objects Dynamic, Navigator and Face Plate Designing
Data Acquisition, Messages and Alarms: Archiving Various Tags and On Line and Historical Trending and Table Display, Displaying , acknowledging and Resetting Messages & Alarms (Digital and Analog)

Module – III : Special Supportive Features and HMI   (7 hrs)

Special Supportive Features: Recipes Generation & Selection; Standard Report Generation, User Administration
Cross References and Project Backup

Human Machine Interface (HMI): HMI Types (OP / TP) and Software requirement for SIEMENS make HMI Specifications and Selection Criteria WinCC Flexible System Overview and its installation, HMI Configuration and Application

Module – IV: Project Development and HMI   **(7 hrs)**

Project Development: Creating Project , Screens project Configuration, Device Settings, Communication Configuration and Defining Tags

Graphic Control: Planning Graphic Design, Screen Preparation and Navigation Control, Graphic Elements and Libraries and Linking Objects with Tags

Other HMI Features: Tag Logging, On Line and Historical Trending, Alarm System – Designing and Handling and Recipes- Designing and Handling, User Administration and Transferring Project to HMI

Module V: Tutorials, assignments and presentation based on Module I to IV

Module V:

Tutorials, assignments and presentation based on Module I to IV

References:

1. Scada: Supervisory Control And Data Acquisition 4th Edition by Author Stuart A. Boyer ISBN-13: 978-1936007097 ISBN-10: 1936007096
2. PLC & SCADA SYSTEMS: Quick Reference ; Francis G.L
3. A Guide to Utility Automation: Amr, Scada, and: it Systems for Electric PowerPaperback – Import, 15 Jan 1999 by Author Michael Wiebe
4. Power System SCADA and Smart Grids 1st Edition by Mini S. Thomas (Author), John Douglas McDonald (Author) ISBN-13: 978-1482226744 ISBN-10: 148222674X
5. Behrouz A. Forouzan 2005, Data Communications Networking, McGraw-Hill Education [ISBN: 9780071254427]
6. Kevin Collins 2007, PLC Programming for Industrial Automation, Exposure Publishing [ISBN: 1846854962]
7.   David Bailey 2003, PRACTICAL SCADA FOR INDUSTRY, NEWNES [ISBN: 13: 978-0-7506-5805-8]
8. Srinivas Medida 2008, Pocket Guide on Industrial Automation, 1st Ed., IDC Technologies

VOC 614- IOT (Internet of Things)

(2 Credits: 50 Marks)

Course Outcomes:

On completion of the course, students should be able to -

1	Descibe the basic building blocks of Internet of Things (IoT), their characteristics and applications
2	Compare physical and logical design of IOT, IOT model specifications
3	Interpret the concepts of IOT in Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle
4	Explain Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification
5	Evaluate the IOT systems in specific application e.g. Weather Monitoring

Course Contents:

Module- I: Introduction to IOT   (7 hrs)

Introduction, Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels and Development Template

Module- II: Domain Specific IOTs   (7 hrs)

Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle

Module- III: IOT Design Methodology   (7 hrs)

Purpose & Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device & Component Integration, Application Development

Module- IV: Various Case Studies   (7 hrs)

Case Study on IoT System for Weather Monitoring, Case Studies illustrating IOT Designs.

Module- V:

Tutorials, assignments and presentation based on Module I to IV

References:

1. Internet of Things: A Hands-on Approach by Arshdeep Bahga and Vijay Madisetti; Universities   Press; ISBN- 978-81-7371-954-7
2. Designing The Internet of Things by Adrian Mcewen and Hakin Cassimally; Willey (2015); ISBN-10: 8126556862
3. The Internet of Things: Enabling Technologies, Platforms, and Use Cases by Pethuru Raj, Anupama C. Raman (2017) by Auerbach Publications: ISBN 9781498761284

VOC 611A- Numerical Control

(2 Credits: 50 Marks)

Course Outcomes:

On completion of the course, students should be able to -

1	Describe the fundamental concepts NC technology
2	Explain broad-based features of CNC software
3	Analyze NC positioning systems
4	Develop basic concepts of NC part programming

Course Contents:

Module- I: Fundamentals of NC Technology   (7 hrs)

Basic components of an NC system, NC coordinate system, Motion Control systems
Features of CNC, Machine control unit for CNC, CNC software

Module -II: Distributed Numerical Control and NC applications   (7 hrs)

General Configuration of a distributed numerical control
Machine Tool Applications, Advantages and Disadvantages of NC

Module -III: Analysis of NC positioning systems   (7 hrs)

Open-loop positioning systems, Closed loop positioning system, Precision in NC positioning

Module - IV: NC part programming   (7 hrs)

Manual part programming, computer-assisted part programming, NC part programming using CAD/CAM, Manual Data input

Module -V:

Tutorials, assignments and presentation based on Module I to IV

References:

1. Automation, Production Systems, And Computer Integrated Manufacturing : M. P. Grover Publisher : Pearson ISBN-978 -93-325-4981-4
2. Computer Numerical control: Warren Seames, Delmar Cengage Learning; 4th edition edition ISBN 978-0766822900
3. CNC Programming Techniques: Peter Smid, Industrial Press Inc.,U.S.; 1 edition ISBN-13**:** 978-0831131852

612A- Single Station Manufacturing Cells

(2 Credits: 50 Marks)

Course Outcomes:

On completion of the course, students should be able to -

1	Describe the fundamental concepts Single Station Manufacturing Cells
2	Distinguish Applications of Single Station Manned and Automated Cells
3	Analyze Single Station Manufacturing Cells
4	Interpret Parts Storage Subsystem and Automatic Parts Transfer

Course Contents:

Module I: Fundamental of Single Station Manufacturing Cell   (06 HRS)

Basic of Single Station Manufacturing Cell, Classification if single station manufacturing cells, Single station manned cells, Cases of Single station manned cells

Module II: Single Station Automated Cells   (04 HRS)

Single Station Automated Cells, Advantages of Single Station Automated Cells,
Enablers for Unattended Cells Operation, Parts Storage Subsystem and Automatic Parts Transfer

Module III: Applications of Single Station Cells   (07 HRS)

Applications of Single Station Manned Cells, Applications of Single Station Automated Cells, CNC Machining Centers and Related Machine Tools

Module IV: Analysis of Single-Station Systems   (07 HRS)

Analysis of Single-Station Systems, Number of Workstations Required, Machine Clusters

Module V: Tutorials, assignments and presentation based on Module I to IV

References:

1. Automation, Production Systems, And Computer Integrated Manufacturing : M. P. Grover Publisher : Pearson ISBN-978 -93-325-4981-4
2. Simply Complex Mechanical Engineering, Abrams M, January 2006,pp.28-31
3. Turnings Just The Begininning Manufacturing Engineering, Aronson, June 1999,pp 42-53

VOC 615 : Laboratory Coursework – XIX

(Pertaining to VOC 611 and VOC 612)

(2 Credits: 50 Marks)

Course Outcomes:

On completion of the course, students should be able to -

1	Illustrate distinct parts of a flexible manufacturing system
2	Develop part projects with modular flexible manufacturing system
3	Develop projects with modular flexible manufacturing system

List of Experiments:

1. Study of different parts of a flexible colour sorting station

2. Experiment with retrieval of modular workpieces from cartridge assembly

3. Experiment with linear transport station

4. Sorting of finished products on basis of their shape/ contour.

5. Sorting of finished products on basis of their material of construction

6. Sorting of finished products on basis of their colour

7. Experiments with combining (iv), v, vi at different difficulty levels

8. Study with Linear transport and material station (Linear movement of Object and sequential/batch wise placing)

9. Study pick and place Robot on Rotating station.

10. Programming of Robot as in for pick and place operation

11. Study of Cartesian robot customized for AS/RS.

12. Programming of a Cartesian robot for AS Operation.

13. Programming of a Cartesian robot for Retrieval Operation.

VOC 616 : Laboratory Coursework – XX

(Pertaining to VOC 613 and VOC 614)

(2 Credits: 50 Marks)

Course Outcomes:

On completion of the course, students should be able to -

1	Develop simple projects employing PLCs and SCADA
2	Illustrate components of IOT based system
3	Develop simple projects by implementing basic concepts of IOT

List of Experiments:

1. PLC interfaced with SCADA and status read/command transfer operation.

2. Parameter reading of PLC in SCADA

3. Alarm annunciation using SCADA

4. Reporting and trending in SCADA System

5. Tank Level control using SCADA System

6. Temperature monitoring using SCADA System

7. Speed control of machine by SCADA System

8. Study of physical and soft component in a IOT System

9. Study of Linux operating system (introduction, managing files and directories, working with command line and shell managing user access security)

10. Shell scripting programming for IOT

11. Study of Python programming

12. Hardware (Sensors and Actuators) interfacing protocol for IOT

13. Study of Communication protocols (at least 2)

14. System development for agriculture/ ambient atmospheric condition.

VOC 615A : Laboratory Coursework – XIXA

(Pertaining to VOC 611A and VOC 612A)

(2 Credits: 50 Marks)

Course Outcomes:

On completion of the course, students should be able to -

1	Develop simple projects employing Robots and CNC lathe machine
2	Develop simple projects employing Robots and CNC milling machine

List of Experiments:

1. Study of a different parts of CNC lathe machine
2. Study of different parts of CNC milling machine
3. Study of different parts of 5-axis Industrial grade Robot
4. Perform any three operation on CNC lathe Machine (Grooving, Knurling, Turning etc)
5. Study various programming techniques of CNC
6. Study various positioning system of CNC (Point-to-point/ Continuous path)
7. Study Various co-ordinates system of Robot loaded on Linear transfer station
8. Programming of Robot loaded on Linear transfer Station to load object in CNC Milling Machine and perform any one operation

VOC 617 Major Project – Phase II

(2 Credits: 50 Marks)

Students will have to submit major project (in continuation to Phase – I) either individually or in a group under supervision and approval of concerned teacher.

VOC 618 In-plant Training/Field work/Mini Project – IV (IA)

(2 Credits: 50 Marks)

Students will have to Undergo In-plant Training/Field work/Mini Project individually or in a group under supervision and approval of concerned teacher.