2017

Dr. Babasaheb Ambedkar Marathwada University,

Aurangabad (MS) – 431004

Deen Dayal Upadhyay KAUSHAL Kendra

(A University Grants Commission Centre)

CURRICULA

INDUSTRIAL AUTOMATION AND AUTOMOBILE
(BACHELOR AND MASTER PROGRAM IN VOCATION)

Dr. Babasaheb Ambedkar Marathwada University
Aurangabad- 431004 (MS) India

NAAC Reaccredited with Grade - A

Deen Dayal Upadhyay KAUSHAL Kendra

Bachelor of Vocation
(B. Voc.)

Course Structure and Curriculum

(As per UGC guidelines for implementing B. Voc. program)

Industrial Automation (Semester I – VI)
&
Automobile (Semester- I to VI)

(Choice Based Credit System)

(Effective from June 2015 and onwards)

(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 the sectors of Industrial Automation, Automobile, Travel and Tourism,

Preamble:

Dr. Babasaheb Ambedkar Marathwada University (BAMU) proposes to offer at 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 a 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 Outcomes:

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.

i. Students with vocational training can find work in several state and central government organizations, non-profit groups, academic institutions and in private sectors.

ii. This programme prepares students for specific types of occupations and frequently for direct entry into the labour market.

iii. After completion of this programme students will have enough competences, to get benefit from labour market opportunities.

iv. This programme would enable students to update their knowledge and professional skills for entering the work force executing in come generating activities or occupying better positions;

v. At each exit level of this programme, students will be able to
   a) Apply knowledge of general education subjects and skill development subjects to the conceptualization of engineering models.
   b) Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
   c) Conduct investigations of complex problems including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
   d) Create, select and apply appropriate techniques, resources, and modern engineering tools, including prediction and modeling, to complex engineering

activities, with an understanding of the limitations.

e) Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.

f) Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

g) Demonstrate understanding of the social, health, safety, legal and cultural issues and the consequent responsibilities relevant to science and engineering practice.

h) Understand and commit to professional ethics and responsibilities and norms of science and engineering practice.

i) Understand the impact of science and engineering solutions in a societal context and demonstrate knowledge of and need for sustainable development.

j) Demonstrate a knowledge and understanding of management and business practices, such as risk and change management and understand their limitations.

k) Recognize the need for, and have the ability to engage in independent and life-long learning.

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.

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 50: 50 ratio of continuous internal assessment (CIA) and semester end examination (SEE). Separate and independent passing in CIA and SEE will be mandatory. In case of failure in CIA of a particular course, students will have to 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. However, in case of failure in SEE in particular course(s), exam will be conducted in immediate subsequent semester.

- 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 50 marks for Continuous Internal Assessment. Distribution of 50 marks will be as follows- 05 marks for tutorials, 05 marks for assignment, 10 marks for seminar presentation and 30 marks for weekly tests. Weekly tests of 10 marks each based on objective and/or subjective short questions will be conducted every week during the semester as a part of continuous assessment. At the end of the semester average of all weekly tests will be converted into 30 marks. The setting of the question papers and assessment will be done by concerned teacher.

(B) For 2 credit courses-

- There will be 25 marks for Continuous Internal Assessment. Distribution of 25 marks will be as follows- 05 marks for tutorials, 05 marks for assignment, 05 marks for seminar presentation and 10 marks for weekly tests. Weekly tests of 10 marks each based on objective and/or subjective short questions will be conducted every

week during the semester as a part of continuous assessment. At the end of the semester, average of all weekly tests will be considered for calculation of final marks. 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 50 marks, whereas, for 2 credit theory course, the same will be of 25 marks. Therefore, the total marks shall be 100 for 4 credit theory course (50 marks semester end exam + 50 marks CIA) and 50 for 2 credit theory course (25 marks semester end exam + 25 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-

- The semester end examination of theory course will have two parts (10+40 = 50 Marks)
- Part A will be consisting of 10 questions having 1 marks each (multiple choice questions / fill in the blanks/ answer in sentence) as compulsory questions and it should cover entire course curriculum (10 Marks)
- Part B will carry 8 questions (02 questions from each of 04 units and students will have to attempt any one). Therefore, students will have to attempt 04 questions out of 08 (40 Marks).
- 20 to 30% weightage can be given to problems/ numerical (wherever applicable) wherein use of non-programmable scientific calculator may be allowed.
- Number of sub questions (with allotment of marks) in a question may be decided by the examiner.

(A) For 2 credit courses-

- The semester end examination of theory course will have two parts (05+20 = 25 Marks)
- Part A will be consisting of 05 questions having 1 marks each (multiple choice questions / fill in the blanks/ answer in sentence) as compulsory questions and it should cover entire course curriculum (05 Marks)
- Part B will carry 8 questions (02 questions from each of 04 units and students will

have to attempt any one). Therefore, students will have to attempt 04 questions out of 08 (20 Marks).

- 20 to 30% weightage can be given to problems/ numerical (wherever applicable) wherein use of non-programmable scientific calculator may be allowed.
- Number of sub questions (with allotment of marks) in a question may be decided by the examiner.

- Assessment of laboratory courses and project will also have 50 % internal and 50 % semester end assessment. Semester end practical examination will be of 25 marks and 25 marks will be for internal examination. 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

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

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	Linguistic Proficiency-I (English& Marathi) with Language lab training	4
VOC 102	Computer Fundamentals-I (Information Technology) : Theory	2
VOC 103	Computer Fundamentals-I (Information Technology): Laboratory Coursework	2
VOC 104	Professional Ethics and Management Practices	4
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
VOC 119	In-plant Training – I (IA) (MCC and PCC panel Wiring)	2
Skill Development Components - Automobile (B)		
VOC 131	Automobile Technology	2
VOC 132	Automotive Tools and Equipments	2
VOC 133	Workshop Technology	2
VOC 134	Engineering Drawing	2
VOC 135	Laboratory Course –I (AU)(Automobile Technology)	2
VOC 136	Laboratory Course –II (AU) (Automotive Tools and Equipments)	2
VOC 137	Laboratory Course – III (AU) (Workshop Technology)	2
VOC 138	Laboratory Course – IV (AU) (Engineering Drawing)	2
VOC 139	In-plant Training – I (AU)	2
Total Credits = General Education Components + Skill Development Components (A/B)		12+18= 30
Semester - II		
General Education Components		
VOC 201	Linguistic Proficiency-II(English & Hindi) with Lang. lab training	4
VOC 202	Computer Fundamentals-II (Basic Computer Hardware System) : Theory	2
VOC 203	Computer Fundamentals-II (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 – II (IA)((Control Panel Design and Wiring)	2
Skill Development Components - Automobile (B)		
VOC 231	Engine Systems	2
VOC 232	Engineering Materials	2
VOC 233	Manufacturing Processes	2
VOC 234	Engineering Drawing -II	2
VOC 235	Laboratory Coursework – V(AU) (Engine Systems)	2
VOC 236	Laboratory Coursework – VI (AU)(Engineering Materials)	2
VOC 237	Laboratory Coursework – VII (AU)(Workshop Practice)	2
VOC 238	Laboratory Coursework – VIII (AU)(Engineering Drawing –II)	2
VOC 239	In-plant Training – II (AU)	2
Total Credits = General Educational Components + Skill Development Components(A/B)		12+18= 30
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
VOC 319	In-plant Training/Field Work/Mini Project – III (IA)	2
Skill Development Components – Automobile (B)		
VOC 331	Machine Drawing	2
VOC 332	Thermodynamics	2
VOC 333	Automotive Petrol Engines	2
VOC 334	Automotive Diesel Engines	2
VOC 335	Laboratory Coursework based on Machine Drawing	2
VOC 336	Laboratory Coursework based on Automotive Petrol Engines	2
VOC 337	Laboratory Coursework based on Automotive Diesel Engines	2
VOC 338	Laboratory Coursework based on Two-wheeler Overhauling	2
VOC 339	In-plant Internship/Field Work/ Mini-Project-III	2
Total Credits = General Education Components + Skill Development Components (A/B/C)		**12+18= 30**

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–IX (IA)(PLC based Automation)	2
VOC 416	Laboratory Coursework–X(IA) (Process Control)	2
VOC 417	Laboratory Coursework – XI (IA) (Fundamentals of Pneumatics)	2
VOC 418	Laboratory Coursework – XII(IA)(Embedded System App.)	2
VOC 419	In-plant Training/Field work/Mini Project – IV (IA)	2
Skill Development Components - Automobile (B)		
VOC 431	Fundamentals of Mechanisms	2
VOC 432	Automobile Transmission	2
VOC 433	Auto Electrical systems	2
VOC 434	Automobile Systems	2
VOC 435	Laboratory Coursework based on Automobile Transmission	2
VOC 436	Laboratory Coursework based on Auto Electrical systems	2
VOC 437	Laboratory Coursework based on Automobile Systems	2
VOC 438	Laboratory Coursework based on Auto-CAD	2
VOC 439	In-plant Internship/Field Work/ Mini-Project-IV	2
Total Credits = General Education Components + Skill Development Components (A/B)		12+18= 30
Semester – V		
General Education Components		
VOC 501	Personality Development and Stress Management	4
VOC 502	Labour Laws and Taxation	4
VOC 503	Business Communication	2
VOC 504	Product Costing	2
Skill Development Components - Industrial Automation (A)		
VOC 511	Voc-IX (Embedded Systems and PLCs-II)	4
VOC 512	Voc-X (Manufacturing processes and Mechatronics)	4
VOC 513	Laboratory Course –IX (IA;Old)	3
VOC 514	Major Project (Phase – I)	3
VOC 515	In-plant Training/ Field Work	4
Skill Development Components - Travel and Tourism (B)		
VOC 521	Voc-IX(Entrepreneurship in Tourism)	4
VOC 522	Voc-X(Contemporary Issues in Tourism)	4
VOC 523	Laboratory Course –IX (TT;Old)	3
VOC 524	Major Project (Phase – I)	3

VOC 525	In-plant Internship/Field Work	4
Skill Development Components – Automobile (C)		
VOC 531	Engine Performances and Vehicle Testing	4
VOC 532	Engine Diagnostics and Troubleshooting	4
VOC 533	Laboratory Course –IX (AU;Old)	3
VOC 534	Major Project (Phase – I)	3
VOC 535	In-plant Internship/Field Work	4
Total Credits = General Education Components + Skill Development Components (A/B/C)		12+18=30
Semester – VI		
General Education Components		
VOC 601	Human Resource Management	4
VOC 602	Entrepreneurship Development	4
VOC 603	Workshop Management (for Industrial Automation and Automobile) / Outdoor Management (for Travel & Tourism)	4
Skill Development Components - Industrial Automation (A)		
VOC 611	Voc-XI (Motion Control and Robotics)	4
VOC 612	Voc-XII (Process Control and Tools)	4
VOC 613	Laboratory Course –X (IA;Old)	3
VOC 614	Major Project (Phase – II)	3
VOC 615	In-plant Training/ Field Work	4
Skill Development Components - Travel and Tourism (B)		
VOC 621	Voc-XI(Tourism Policy & Planning)	4
VOC 622	Voc-XII (Tourism Administration in India)	4
VOC 623	Laboratory Course –X (TT;Old)	3
VOC 624	Major Project (Phase – II)	3
VOC 625	In-plant Internship/Field Work/ Project	4
Skill Development Components - Automobile (C)		
VOC 631	Automobile System Diagnostics and Troubleshooting	4
VOC 632	Transport Management Safety Regulation	4
VOC 633	Laboratory Course based on Automobile System Diagnostics and Troubleshooting	3
VOC 634	Major Project (Phase – II)	3
VOC 635	In-plant Internship/Field Work/ Project	4
Total Credits = General Education Components + Skill Development Components(A/B/C)		12+18=30
Total Credits (Semester I to VI)		180

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

2 - Refers to Travel and Tourism

3 - Refers to Automobile

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

Learning Objectives:

1. To facilitate the students to understand the fundamental of communicative English and Marathi
2. To facilitate the students to develop skills of communication in English and Marathi.

Learning Outcomes:

1. Expression power, and communication skill of the students in English and Marathi will improve
2. Students will be able to identify the necessities of behavioral and expressive attitudes as per situations.

Part A: BASIC STRUCTURE OF THE ENGLISH LANGUAGE

Module - I

Tenses:

1.Present tense (includes all four types of tenses each)
2. Past tense
3. Future tense

Module - II

Spoken English:

1. Basic of pronunciation : Vowels, diphthongs,
2. Certain basic sounds including th, dh, gh sounds, fricatives etc.
3. Differences in the sounds of the letters, especially, w/v, f/ph etc.
4. Phonetic transcriptions.
5.

Module - III

1. Introducing yourself (The communicator)
2. Introducing people to others
3. Giving personal information
4. Getting people‘s attention and interrupting
5. Giving instructions and seeking clarifications
6. 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 पुस्तकेः

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 - सोSहं 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: Computer Fundamentals–I (Information Technology)

Learning Objectives:

1. To facilitate the students to study Instructional Designing theories, basic IT skills using application software tools,
2. To facilitate the students to make functional use of IT skills in teaching – learning process.

Learning Outcomes:

1. Students will have command on basic IT skills
2. Students will be able to use computer and internet facilities for their academic and holistic development purpose

Software for Hands-on:

- Windows Vista
- MS Office 2007
- Internet Explorer
- Online collaboration tools

This course offers the following modules:

Module - I: Word Processing

- 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

- 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

- 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

- 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

VOC 103: Computer Fundamentals-I (Information Technology)

Laboratory course work

1. Experiment(s) based on word processing
2. Experiment(s) based on spread sheet
3. Experiment(s) based on presentation graphics
4. Experiment(s) based on Database Management
5. Experiments based on Internet

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 104: Professional Ethics and Management Practices

Learning Objectives:

1. Clarify personal and professional values and recognize their impact on decision making and professional behavior.
2. To appreciate ethical dilemma while discharging duties in professional life.
3. To know the need of business ethics.
4. To be aware of the need for Corporate Social Responsibility.
5. To orient students to Corporate Citizenship; thereby instilling in them Organizational Understanding, principles of Management & behavior that favor Corporate Citizenship Behavior.

Learning Outcomes:

1. Students will become aware of professional ethics and fundamentals of management practice
2. Students will acquire understanding of responsibilities of corporate sector towards the society
3. This course will improve the leadership quality in the students

Pre-requisite:

The students are expected to come prepared with the basic conceptualization & searching for relevant data through the web / References.

Module – I: Moral Values and Ethics:

Morals Values: Definition – Need for Values, Kinds of Values, Value conflicts, value clarification and value acceptance .**Ethics:** Definition and meaning, Elements/components— Autonomy, Integrity, Work ethics, Service Learning, Civic Virtue, Respect of others, Living peacefully, Caring, Sharing, Honesty, Courage, Valuing at Time, Co-operation, Commitment, Empathy, Self Confidence, Character, Spirituality.

Module – II: Profession and Ethical Practices:

Meaning of Profession: Two models of Professionalism; Three types of Ethics or morality; Ethics in different professions, Code of Professional Ethics, Implementation of Ethical code in Organization, **Ethical Practices and Issues:** Professional organization statement, positions, Barriers to ethical practices, Strategies for individuals. Ethical Decision making; Corporate Social responsibilities.

Module – III: Management Practices - Conceptualization:

Concept, Management as a function of various Social Sciences, Evolution of Management Thought, Managerial Processes, Functions, Skills & Roles of a Manager organization; Management by Objectives (MBO).

Module –IV: Individual Behavior, Group Dynamics and Social Citizenship:

Perception, Personality Types, Values & Ethics, Attitudes, Individual Learning Behaviors Individual Motivation & Work Motivation, Individual & Group Decision Making, Group Communication, Decision Making & Problem Solving, Organizational Leadership, Understanding & managing group processes, Organizational Design & Structure, Recreation & Work Stress, Corporate Social Responsibility; Social Leadership

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

References:

1) The Professional by Subroto Bagchi
2) Mike Martin and Roland Schinzinger, ―Ethics in Engineering‖, McGraw-Hill, New York 1996.
3) Govindarajan M, Natarajan S, Senthil Kumar V. S, ―Engineering Ethics‖, Prentice Hall of India, New Delhi, 2004.
4) Charles D. Fleddermann, ―Engineering Ethics‖, Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint now available).
5) Charles E Harris, Michael S. Protchard and Michael J Rabins, ―Engineering Ethics – Concepts and Cases‖, Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available)
6) John R Boatright, ―Ethics and the Conduct of Business‖, Pearson Education, New Delhi, 2003.
7) Edmund G Seebauer and Robert L Barry, ―Fundamentals of Ethics for Scientists and Engineers‖, Oxford University Press, Oxford, 2001.
8) Principles of management - Suri, Sontakki and Deshpande, Mcgrow Hill publishing co. Ltd.
9) Principles of management - Dr. Davar
10) Organization and Management Practices - P. Drucker
11) Organization behavior - By Dwivedi
12) Management Principles and Practices, By Dr M. Sakunthivel Murugan; New age International Publishers, New Delhi
13) Consumer Behaviour, By Matin Khan New Age International Publishers, 2nd Edition, New Delhi
14) Fundamental of Management, Concept, Functions, Role and Profiles : By M. W. Samarth and Pratibha M. Siriya; S. Chand and Co. Ltd
15) John R Boatright, ―Ethics and the Conduct of Business‖, Pearson Education, New Delhi, 2003.
16) Edmund G Seebauer and Robert L Barry, ―Fundamentals of Ethics for Scientists and Engineers‖, Oxford University Press, Oxford, 2001.

Semester – I

Industrial Automation

(Skill Development Components)

Skill Development Components

Industrial Automation

VOC 111: Analog and Digital Electronics

Learning Objectives:

1. To introduce students with basic concepts of electronics components, semiconductor devices, power supply and digital electronics
2. To introduce students with the scopes of above components/concepts in practical applications.

Learning Outcomes:

1. Students will able to understand the functioning of basic semiconductor devices, digital components.
2. Students will be able to apply the same for designing of simple applications.

Module -1: Basic Electronic Components

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 -2: Power Supply Fundamentals

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 -3: Number system and Logic gates

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 – 4: Combinational Logic

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 – 5:

Tutorials, assignments, demonstrations 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

Learning Objectives:

1. To introduce students with basic concepts of single and three phase AC and electrical machines.

Learning Outcomes:

1. Students will be able to perform basic circuit analysis.
2. Students will be able to understand the operation of transformers and different variants of motors.
3. Students will have basic knowledge of electricity generation through non-conventional sources.

Module -1: Basic Circuit Elements and D.C. Network Analysis

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 -2: Electrical Fundamentals and Transformer

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 -3: Electric Motors

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 -4: Energy Sources

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 – 5:

Tutorials, assignments, demonstrations 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

Learning Objectives:-

1) To introduce students with concept of Industrial Electronic system. Why it is needed, What are various parts in it, how they work.

2) Understand classifications of various Power devices and know their construction, working principle, how they are controlled by small power, advantages, disadvantages.

3) Understand how the Power devices are used to make various industrial electronic systems like controlled rectifier, chopper, inverter etc.

Learning Outcomes:-

1) Students will acquire terminologies in Industrial electronic systems.
2) Students will be able to understand which device to be used for what applications.
3) Students will be able to understand how various industrial electronic systems work.

Module- 1: Power Electronic Devices

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- 2: Turn ON and Turn OFF methods of SCR

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 -3: Phase Controlled Rectifiers

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 - 4: Choppers & Inverters

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 – 5:

Tutorials, assignments, demonstrations 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

Learning Objectives:-

1) To introduce students with concept of Instrumentation system. Why it is needed, what are various parts in it, how they work.

2) Understand classifications of various transducers and know there construction, working principle, advantages, disadvantages.

3) Understand how the transducer output is conditioned, processed, displayed and controlled.

4) Study the various systems for measurement of different physical parameters.

Learning Outcomes:-

1) Students will acquire terminologies in Instrumentation systems.

2) Students will be able to understand which transducer to be used for what applications.

3) Students will be able to understand how to select transducer for specific application.

Module - 1: Displacement and Detection Sensors

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 – 2: Temperature and Pressure Sensors

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 – 3 : Flow and Level Sensors

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 – 4 : Special Purpose Sensors

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 – 5:

Tutorials, assignments, demonstrations 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 (IA) (Analog and Digital Electronics)

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).
4. Study of Transistor as switching device.
5. Study of SCR characteristics.
6. Study of Zener diode characteristics.
7. Study of rectifiers (half wave, full wave, bridge rectifier)
8. Study of Series and shunt Voltage regulator using transistor
9. Study of Sener diode as voltage regulator
10. Study of Voltage regulator IC-78XX & IC-79Xx
11. Study of adjustable voltage regulator using IC-317
12. Study of digital logic gates
13. Study of De‘morgans theorem using logic gates
14. Study of discreet components (diodes and transistors) as logic gates
15. Study of universal logic gates NAND & NOR gates

At least six experiments should be performed from above list

VOC 116: Laboratory Coursework – II (IA) (Electrical Systems)

1. Study of Series and parallel resistive circuit
2. Study of Charging and discharging of Capacitor
3. Study of KCL and KVL
4. Study of Superposition Theorem
5. Study of Norton‘s Theorem
6. Study of Thevenin‘s Theorem
7. Study of Maximum Power Transfer Theorem
8. Study of Single Phase Transformer
9. Study of Three phase power supply configurations
10. Study of voltages and currents in passive loads in Three phase star Configuration
11. Study of voltages and currents in passive loads in Three phase star Configuration
12. Study of three phase circuits with balanced load
13. Study of three phase circuit with unbalanced load
14. Study and verify Load Characteristics of DC Shunt Motor
15. Study and verify Load Characteristics of DC Series Motor
16. Study of single Phase Induction motor
17. Study of three phase squirrel cage motor
18. Study of solar power generation
19. Study of Wind Power generation

At least six experiments should be performed from above list

VOC 117: Laboratory Coursework – III (IA) (Industrial Electronics)

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)

At least six experiments should be performed from above list

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

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

At least experiments should be performed from above list

VOC 119: In-plant Training

In-plant coursework on MCC and PCC panel wiring

Semester – I

Automobile Technology

(Skill Development Components)

Skill Development Components

Automobile Technology

VOC-131: Automobile Technology

Learning Objectives:

1. To introduce students basics of automobile and related terms.
2. To introduce students with various automobile components and working principles of them

Learning Outcomes:

1. Students will gain knowledge of automobile components, engine components.

Module I: Introduction to automobile

History of automobile, Indian and worlds leading automobile Industries, Introduction to the Components of automobile, Classification of automobile, (Two wheeler and four wheeler) engine, Clutch, gear box, differential, axle, wheel, brake, suspension, steering, electrical components, frame, body etc.

Module II: Engine and its components

Construction and working principle of I.C engine, classification of I.C engine, Construction and working of two stroke petrol engine, Construction and working of four stroke petrol engine; Difference between two stroke and four stroke engine; Petrol and diesel engine, Various rule and road signs for safety driving.

Module III: Driving Technique Technical details and vehicle

Driving hints, Driving technique Technical details and vehicle specification, engine specifications and driving safety Technical details included in owners and service manual. Work, power, energy, efficiency, bore, stroke, displacement, compression ratio, IHP, BHP.

Module IV: Basic Concept of Electricity

Current, Ampere, Volt, Resistance, Ohm law, potential difference, parallel circuit, series circuits Introduction of material. Classification, properties & uses of materials. Basic concept of electricity.

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

References:

1)Automotive Mechanics: William H. Crouse. Donald L. Anglin: Tata McGraw Hill 10th edition.

2) Automotive Electrical Equipment: P L Kolhi: Tata McGraw Hill.

3) Basic Automobile Engineering: C P Nakara: Dhanpatrai publication.

4) Automotive Mechanics: S Shrinivasan: Tata McGraw Hill Second edition

5) Automobile engineering Vol-I: Dr. Kripal Singh: Standard Publisher distributers.

6) Automobile engineering Vol-II: Dr. Kripal Singh: Standard Publisher distributers.

7) Internal Combustion Engine: V. Ganesan: Tata McGraw Hill Third edition.

8) Automobile engineering: R. B. Gupta: SatyaPrakashan

9) Automobile Engineering Vol-I: K. M. Gupta: Umesh Publication

10) Automobile Engineering Vol-II: K. M. Gupta: Umesh Publication

VOC-132: Automotive Tools and Equipments

Learning Objectives:

1. To acquaint students with general and special tools.
2. To introduce student with various equipments and Measuring tools.

Learning Outcomes:

After successful completion of course student will have knowledge about various general and special type automotive tools moreover the knowledge of measuring and marking tools used in automotive industries.

Module I: Introduction of work shop, General Tools and Equipments:-

Introduction of work shop, work shop ethics, discipline, safety precaution, elementary first aid, workshop lay out, 5's' techniques. Introduction and use of various tools and equipment used in work shop.

Module II: General and Special Tools

Hammers, Chisels, Screw drivers, Torque Wrench, Adjustable wrenches, Wheel nut spanners, Punches, Pliers, Files, Spanner, Allen keys, Taps, Hacksaws, Dies, Reamers, Scrapper, Cleaning tools

Module III: Measuring and Marking Tools

Inside caliper, outside caliper, Vernier caliper (Inside/Outside), Micrometer (Inside/Outside), Height gauge, bore gauge, Compression gauge, Vacuum gauge, Try square, Feeler gauge, Tachometer, AVO meter, Surface plate, Angle plate, Scribing block, Height gauge, Dial indicator, 'V' Block etc.

Module IV: Automotive Equipments

Mechanical & Hydraulic Jack, Piston ring compressor, Piston ring expander, Stud extractor, Valve spring lifter, Tap extractor, Tyre remover, Wheel balancing Equipment, Brake testing equipment, Pullers, Filter wrench, Battery tester, Growler, Hydrometer spark plug tester, coil and condenser tester, Bench vice, Spray gun, Painting process and Tools etc.

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

References:

1. Workshop Technology Vol-I: B. S. Raghuwanshi: DhanpatRai& Co.
2. Automobile engineering Vol-I: Dr. Kripal Singh: Standard Publisher distributers.
3. Engineering Metrology, R.K. Jain, Khanna Publisher Delhi.
4. Workshop Technology Vol- I , W.A.J. Chapman.

VOC-133: Workshop Technology

Learning Outcomes:

1. Students will gain knowledge about basic and heavy machine tools, manufacturing processes.

They can start work in any automobile shop or industry

Module I: Introduction of General machineries:-

Introduction, working, Construction and use of machines: - Lathe, Milling, Shaper, Drilling, Grinding, Welding machine (Arc/Gas), Soldering and Brazing, air Compressor, Fly press, Pipe bending Machine, Wheel alignment machine, Wheel balancer Machine, F.I pump testing bench, Tyre changer Machine, Tyre inflection Machine, Decarburizing Machine.

Module II: General Purpose Machines

Lathe machine, types of Lathe machine, Construction of Lathe, Thread cutting mechanism, Accessories and attachments, Lathe operations, Taper turning, Milling machine, Milling Methods, Types of Milling machine, operations on milling machine

Module III: Special Purpose Machines

Drilling machine, Construction of drilling machine, Types of drilling machines, operations on drilling machine, Shaper machine, working principle of shaper machine, Types of shaper, operations on shaper machine, Planer machine, Working principle, Types of planer.

Module IV: Metal Joining Methods

Welding, Electrodes, Gas Welding, Oxy fuel gas welding, MIG, TIG, SAW, SMAW, Thermit welding, Electroslag welding, Types of joints, Riveting, Soldering, Brazing.

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

References:

1) Workshop Technology Vol-I: B. S. Raghuwanshi: DhanpatRai& Co.
2) Workshop Technology Vol-II: B. S. Raghuwanshi: DhanpatRai& Co.
3) Workshop Technology Vol-I: S. K. Hajra Choudhari. A. K. Hajra Choudhari. NirjharRoy :Media Promoters and Publication Pvt.Ltd.
4) Workshop Technology Vol-III: W.A.J. Chapman.

VOC 134: Engineering Drawing

Learning Objectives: The subject mainly focuses on use of drawing instruments, developing imagination and translating ideas. Developing the sense of drawing sequence and use of drawing instruments effectively.

Learning Outcomes: After successful completion of this course students are in position to prepare engineering drawings manually with given geometrical dimensions using prevailing drawing standards and drafting instruments.

Module I: Introduction to engineering drawing
Drawing equipments, instruments and materials, instrument types, specifications, Lines, Lettering and dimensioning, types of lines, Geometric construction, Numerals and Greek alphabets, Dimensioning methods.

Module II: Projections of point, Lines and Planes
Introduction to projection, Reference planes, orthographic projections, 1st angle and 3rd angle projection and their symbols, projections of point, projections of lines, Projections of planes, Projection of planes parallel to one of the reference planes, Projection of plane inclined to one reference plane and perpendicular to another.

Module III: Orthographic Projections
Types of projections-orthographic, perspective, isometric and oblique: concept and applications, Methods of projections, Conversion of simple pictorial views into Orthographic views, B.I.S. code of practice.

Module IV: Isometric Projections
Isometric axis, lines and planes, Isometric scales, Isometric view and isometric drawing, Difference between isometric projection and isometric drawing, isometric view from orthographic views of objects.

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

References:

1. "Elements of Engineering Drawing" , N.D. Bhatt, Charotar Publishing House.
2. "Engineering Drawing" , P.J.Shah, S.Chand, New Delhi.
3. "Fundamentals of Engineering Drawing" , W.J.Luzzadar, Prentice-hall of India Pvt. Ltd.-New Delhi.
4. "Fundamentals of Drawing" , K.R.Gopalkrishna, Subhash Publications, Banglore.
5. "Engineering Drawing" , M.B.Shah, B.C.Rana, Pearsons.
6. "Fundamentals of Engineering Drawing" , French & Vierck, McGraw-Hill Publication.

VOC-135: Laboratory Course-I (AU) (Automobile Technology)

1) Demonstration on difference in two wheeler & four wheeler.
2) Demonstration of various automobile parts used in Two wheeler, Three wheeler, Four wheeler their basic function, construction & location etc.
3) Demonstration of various engine components their function, construction, location, material etc. Sketching of Various engine components.
4) Demonstration on working of two strokes and four stroke engine on cut section Model (petrol & diesel engine also used of).
5) Demonstration on difference in petrol engine and diesel engine.
6) Demonstration on difference in two stroke and four stroke engine.
7) Practice on road safety and use of road sings. Draw sketching of various road sings, prepare chart of registration code.
8) Practice on driving techniques, importance of safe driving.
9) Collection of vehicle information broacher from authorized dealer and prepare chart on technical details.
10) Prepare chart of various two and four wheeler dealers available in city - Dealer name, address, contact number, manufacturer details and their various Models.
11) Study on service manual on any one automobile vehicle model.
12) Study of electrical circuit - parallel and series.
13) Practice on using various electrical measuring equipment.
14) Visit to automobile garages/ automobile industries.

At least 08 practical should be performed above list

VOC-136: Laboratory Course-II (AU)

1) Practice on health & safety - importance of safety precaution, Shoes, Dressing, safety symbol, safety equipments. (In relation with practical No.8) Practice on how to use first aid & fire extinguishers.
2) Practice on 5.s technique.
3) Demonstration on how to use various tools used in work shop, their free hand sketching. General tools –
   Measuring tools,
   Marking tools,
   Special tools,
4) Demonstration on how to use various Tools and equipments used in two wheeler garage , Tools and equipments used in four wheeler garage.
5) Practice on checking the battery for charging, connecting the battery for charging
6) Demonstration on painting equipments, coating and polishing.
7) Demonstration of Decarburizing Process, smoke tester, FI pump testing, car washing, hydraulic hoist, air compressor etc.
8) Visit to Garage for usage of Tools &Equipments Used in two, three and four wheeler garage. To Various automobile dealers/ authorized work shop.
   -To Automobile Industry/ Automobile components manufacturing industries.

VOC-137: Laboratory Course-III (AU)

1. Introduction to the work shop , types of work done in work shop , job opportunity (Organization chart with duties and responsibility).
2. Demonstration on various machine used in automobile industries - Compressor, Drilling, Grinding, Welding (Arc & Gas), Hand Operated & Hydraulic Operated Press, lathe, milling, shaper machine, crank shaft grinding, cylinder boring, cylinder head refacing, honing, Wheel Alignment, Tyre changer, Wheel balancing M/c.
3. Study of General Purpose machines
4. Study of Special Purpose machines
5. Two Jobs on Machining operations
6. Visit to Machining center to study various special purpose machines.

VOC-138: Laboratory Course-IV (AU)

1. Sheet based on types of lines, types of dimensioning, Numerals and Alphabets.
2. Projections of points and lines (4 problems).
3. Projection of different planes with different conditions (triangle, square / rectangular, pentagonal / hexagonal).
4. Orthographic projections of different objects. (Two problems)
5. Isometric drawings from given orthographic views (Three problems)
6. Introduction to AutoCAD Software.

VOC-139: In-Plant Internship / Field Work/ Project

Semester – II

General Academic Components

Semester II

General Education Components

VOC - 201: Linguistic Proficiency-II

Part - A: English

Learning Objectives:

To improve the writing skills of students

Learning Outcomes:

1. Students will be able to write formal letters
2. Presentations skill of students will improve
3. Students will be able to face interviews

Module –I: Introducing written communication

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

(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

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……..)

Part-B: Hindi

संप्रेषणमूलक व्यावसायिक हिंदीः

Module- IV:

वाणिज्य व्यवसाय और हिंदीः

- वाणिज्य व्यापार से तात्पर्य एंव व्यावसायिक व्यापार के साधन
- वाणिज्य व्यापार और भाषिक प्रकार्य
- वाणिज्य-व्हावसायिक संरचनात्मक विशेषताएँ
- भाषा कौशल्यः

  श्रवण, भाषण, वाचन, लेखन

व्यावसायिक - संप्रेषणः

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

क) व्यापारिक- व्हावहारिक सामाण्यपत्रा, आवेदनपत्र, यासाखपत्रा, संदर्भ तथा साखपत्रा के जॉचपत्रा, मुल्य ज्ञापनपत्र, आदेशोके निरसन सम्बंधीपत्रा, शिकायतपत्रा, 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 - व्हावसायके भाषिक प्रकार्या कासर्वेक्षण
- व्यापरिक 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 Fundamentals-II
(Basic Computer Hardware System)

Learning Objectives:

To introduce students with computer hardware system, troubleshooting techniques

Learning Outcomes:

1. Students can solve general hardware related issues
2. They can install various devices as well as operating system in the computer
3. Students can build their own computer system

Module-I:

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:

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:

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

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

Text Books:

(01) Hardware bible By : Winn L Rosch, Techmedia publications

(02) Trouble shooting, maintaining and repairing PCs By : Stephon J Bigelow Tata McGraw Hill Publication

(03) Modern All about printers By :Manohar Lotia, Pradeep Nair, BijalLotia BPB publications.

REFERENCES:

(01) The complete PC upgrade and maintenance guide By : Mark Minasi, BPB Publications.

VOC – 203: Computer Fundamentals-II (Basic Computer Hardware System)

Laboratory Coursework

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

Learning Objectives:

1. To create awareness between the students about our ecosystem, related problemsand our role in that.
2. To encourage students to solve the environment related problems

Learning Outcomes:

1. Students will think on ecosystem and environment problems.
2. They can make other people aware about environment problems
3. They will be introduced to environmental policies a regulations

Module - I: Ecosystems and Natural Resources

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 and Role of Human being

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

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

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 Co. Pvt. Ltd.

Semester – II

Industrial Automation

(Skill Development Components)

Skill Development Components

Industrial Automation

VOC-211: INTERFACING AND SIGNAL CONDITIONING

Learning Objectives:

1. To introduce students with basic concepts of interfacing and signal conditioning and timers.
2. To introduce students with the scopes of above concepts in practical applications.

Learning Outcomes:

1. Students will able to understand the functioning of OP-AMP, converters and timers.
2. Students will be able to apply the same for designing of simple applications.

Module -1: Introduction to Interfacing and Signal Conditioning

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 -2: Operational Amplifier as Signal Conditioner I

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 -3: Operational Amplifier as Signal Conditioner II

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 – 4: Integrated Timing Circuits

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

Module – 5:

Tutorials, Assignments, Demonstrations and Presentation Based On Module I to IV

References:

Text:

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

Learning Objectives:

1. To introduce students to the classifications of control system, controllers and complex modes of operation
2. To make students understand the advantages and limitations of various types of control systems

Learning Outcomes:

1. Students will acquire terminologies in control systems
2. Students will be able to understand which control system to be used for specific applications

Module -1: Introduction to Industrial Control Systems

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 -2: **The Controller Operation**

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 -3: Industrial Process Techniques

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

Module – 4: Industrial Process Instrumentation

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 – 5:

Tutorials, Assignments, Demonstrations and Presentation Based On Module I To IV

References:

Text:

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

Suggested Reading:

1. I.J.Nagrath, M.Gopal; 2009; Control Systems Engineering (Fifth Edition); New Age International Publishers; India
2. N. Barapate; 2006; Control System; Tech Max publications; Pune (India)
3. A. Nagoorkani; 2006; Control System; RBA publications; Chennai (India)
4. K. Ogata; 2002; Modern Control Engineering; Prentice Hall; New Delhi(India)
5. Richard Dorf , Robert Bishop; 2005; Modern Control System; Pearson Education ; New Jersey

VOC-213: FUNDAMENTALS OF DRIVES

Learning Objectives:

1. To acquaint students of fundamental AC and DC drive modes.
2. To make student to understand starting and braking of Drives.

Learning Outcomes:

1. Students will be able to understand how to select drive for specific application.
2. Students will able to understand speed controlling of Motors.

Module -1: Electrical Drives- An Introduction

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 -2: Starting and Braking Of Motors

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

Module -3: Electrical Drives I

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 – 4: Electrical Drives II

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 – 5:

Tutorials, Assignments, Demonstrations and Presentation Based On Module I To IV

References:

Text:

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/

Suggested Reading:

1. N. K. DE, P. K. SEN; Electrical Drives; Prentice Hall of India Private Limited; New Delhi (India)
2. Veltman André, Pulle Duco W.J., de Doncker R.W.; Fundamentals of Electrical Drives; Springer Netherlands
3. www.mpoweruk.com/motorcontrols.htm
4. www.completepowerelectronics.com/electrical-drives-introduction-classif...

VOC-214: PLC FUNDAMENTALS

Learning Objectives:

1. To teach students fundamental of PLC programming.
2. To make them capable to develop Ladder Programming.

Learning Outcomes:.

1. Students will be able to develop Ladder Programming.
2. Students can interface basic input and output devices to PLC

Module -1: Introduction to PLCs

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

Module -2: **Number System and I/O Processing**

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 -3: Ladder and Functional Block Programming

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

Module – 4: Programming Methods and Internal Relays

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

Module – 5:

Tutorials, Assignments, Demonstrations and Presentation Based On Module I to IV

References:

Text:

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

Suggested Reading:

1. John W. Webb, Ronald A. Reis;2013; Programmable Logic Controllers, Principles And Applications; Fifth Edition; Prentice Hall India; New Delhi, India
2. Frank Petruzella; 2014; Programmable Logic Controllers; Fifth Edition; Mc Graw Hill Publishing Company; UK
3. Gary D. Anderson; 2013; PLC Programming Using RSLogix 500: Ladder Logic Diagnostics & Troubleshooting Vol 1-3.
4. www.plcs.net
5. www.plcwashington.org
6. https://www.udemy.com/nfi-plc-online-leaning/
7. www.plctutor.com
8. electrical-engineering-portal.com › Resources

VOC - 215: Lab course V

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.

At least six experiments from above list should be performed.

VOC-216: Lab Course VI

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 close 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.

At least six experiments from above list should be performed.

VOC - 217: Lab course VII

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.

At least six experiments from above list should be performed.

VOC-218: Lab course VIII

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.

At least six experiments from above list should be performed.

VOC 219: In-plant Training – II (IA)

In-plant coursework on Control Panel Design and Wiring

Semester – II

Automobile Technology

(Skill Development Components)

Skill Development Components

Automobile Technology

VOC-231 Engine System

Learning Objectives: The subject mainly focuses on various systems pertaining to the engine. It emphasizes on Ignition, Cooling and Lubrication system.

Learning Outcomes: After successful completion of this course students are in position to understand the construction and functioning of ignition, cooling and Lubrication system used in Automobile effectively.

Module – I : Engine and various types of Engine
Introduction to engine, Heat Engine, Classification of Engine; with respect to cylinder arrangements; with respect to ignition; with respect to method of charging, Engine components and nomenclature, Valve timing for four stroke engine, Engine performance parameters.

Module – II : Ignition System
Introduction, Requirements of an Ignition system, Battery Ignition system; Battery, Ignition switch, Ballast resistor, Ignition coil, Contact breaker, Capacitor, distributor, spark plug, Operation of battery ignition system; Limitations, Magneto ignition system, Modern ignition systems, firing order, spark advance mechanism, Ignition timing.

Module – III : Cooling System
Need for cooling system, Characteristics of efficient cooling system, types of cooling systems, Thermosyphon system, Pump cooling, Water pump, Radiator, Air cooled system, Comparison of Air cooled and Liquid cooled system, advantages and limitations.

Module – IV : Lubrication System
Introduction, Need for Lubrication, significance of Lubrication, Pumping loss, Blowby losses, Mechanism of Lubrication, Lubrication of engine components, Types of lubrication system, Mist lubrication, Wet sump lubrication, dry sump lubrication, types of lubricants and their properties, Crankcase dilution, SAE Rating of Lubricants.

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

References:

1) Automotive Mechanics: William H. Crouse. Donald L. Anglin: Tata McGraw Hill 10th edition.

2) Automotive Electrical Equipment: P L Kolhi: Tata McGraw Hill.

3) Basic Automobile Engineering: C P Nakara: Dhanpatrai publication.

4) Automotive Mechanics: S Shrinivasan: Tata McGraw Hill Second edition
5) Automobile engineering Vol-II: Dr. Kripal Singh: Standard Publisher distributers.
6) Internal Combustion Engine: V. Ganesan: Tata McGraw Hill Fourth edition.
7) Automobile engineering: R. B. Gupta: SatyaPrakashan
8) Internal Combustion Engines: Shyam K. Agrawal, New Age International Publishers.

VOC - 232 Engineering Materials

Learning Objectives: To get acquainted with the fundamentals of material. To learn the various properties and applications of material.

Learning Outcomes: After successful completion of this course students are in position to understand the mechanical properties and applications of various material.

Module-I: Classification and Properties of Material

Introduction, Classification of Materials, Mechanical properties of metals – Strength, Elasticity, Stress, Strain, Plasticity, Malleability, Ductility, Toughness, Hardness, Brittleness, Resilience, Creep, Fatigue, Tensile test, Rockwell Hardness test, Brinell Hardness Test, Bend Test.

Module-II: Ferrous Metal and their Alloys

Cast iron, Types of cast irons, properties, structures, compositions and applications, plain carbon steels, low alloy steels and effects of alloying elements like Nickel, Silicon, Chromium, Tungsten, and Molybdenum on the properties of steel, high alloy steels, stainless steel types, heat resistance steels, Shock resistance steel and their composition, application, Designation of cast iron and steel, Heat treatment- Annealing, Quenching, Normalizing, Tempering.

Module-III: Non Ferrous Metals and their Alloys

Copper Alloys: Brasses – Muntz metal, Cartridge brass, Admiralty brass, Naval Brass, Bronzes – Gun Metal, Phospher Bronze, Aluminium Bronze, Copper-Nickels alloys. Bearing metals-Babbit, Copper lead alloys, Bronze bearing alloys. Light metal alloys: Aluminium alloys-Duralumin, Cast Aluminium alloys, Aluminium Silicon Alloys. Sintered Carbide., properties, applications

Module-IV: Composites and Non Metallic Materials

Types of composites, plastics, Ceramics, abrasives, polymers: thermosetting and thermoplastics, Fibre, rubber and their properties and application, Smart materials, Composite materials.

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

References:

1. V.D.Kodgire, S.V.Kodgire "Material Science and Metallurgy for Engineers"
2. Swarup D. and Saxena M.N., "Elements of Metallurgy", Rastogi Publishers, Meerut, 1994
3. Daniel Yesudian C., "Materials Science and Metallurgy", Scitech Publications (India), 2004.
4. Srinivasan N.K. and Ramakrishnan S.S., "The Science of Engineering Materials", Oxford and IBH Pub. Co., New Delhi, 1993
5. Guy A.G," Elements of Physical Metallurgy", Oxford & IBH Pub. Co., 1990
6. Van Vlack L.H., "Elements of Materials Science and Engineering", Addison Wesley, New York, 1991.

VOC - 233 Manufacturing Processes

Learning Objectives: The subject mainly focuses on various types of manufacturing processes used in industries. The students will learn the features of processes.

Learning Outcomes: After successful completion of this course students are in position to understand the different types of tooling required for manufacturing process as well as their applications.

Module-I: Metal Casting

Introduction to Foundry - Steps involved in casting, advantages, limitations and applications of casting process. Pattern types, allowances for pattern, pattern materials, color coding and storing of patterns, Sand castings, pressure die casting, permanent mould casting, centrifugal casting, precision investment casting, shell Moulding, CO_2 Moulding, continuous casting-squeeze casting, Fettling and finishing, defects in Castings.

Module-II: Forging and Rolling Processes

Forging principle, classification, equipment, tooling-processes, parameters ,defects (cause and remedy) & application; Principles of rolling processes, classification, types of rolling mills, rolling mill control, effects of friction. Form rolling, rolling defects, causes and remedies

Module-III: Extrusion and Drawing Processes

Classification of extrusion processes-tool, equipment, Hot working, cold working, principle of extrusion and drawing processes, influence on friction, defects, wire drawing-tool, equipment, defects(cause and remedy) & application -Tube drawing and sinking processes.

Module-IV: Powder Metallurgy

Introduction to Powder Metallurgy process, preparation of powders, types & function of binders, green compaction, sintering process and its effect on the product, application of powder metallurgy products, advantages of powder metallurgy products, Sintering equipment.

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

References:

1. Production Technology: R.K.Jain, Khanna Publishers.
2. Manufacturing Technology: Vol I, P.N.Rao, Tata McGraw Hill.
3. Manufacturing Technology: R.K. Rajput, Laxmi Publications.
4. Welding and Welding Technology: Richard L.Little, Tata McGraw Hill.
5. Principle of Metal casting- Rosenthal, Tata McGraw Hill.
6. Manufacturing Processes and Systems: Ostwald Phillip F., Munoz Jairo, John Wiley & Sons (Asia) Pvt. Ltd.
7. Material Science and Metallurgy for Engineers; V.D.Kodgire, S.V.Kodgire, Everest Publishing House

VOC - 234: Engineering Drawing - II

Learning Objectives: The subject emphasizes on projections of solids and sectional orthographic projection. Student will conversant in orthographic projections

Learning Outcomes: After successful completion of this course students are in position to prepare engineering drawings manually with given geometrical dimensions using prevailing drawing standards and drafting instruments.

Module – I Projections of Solids

Introduction, Type of solids, Projections of solids in simple position, Projection of solids with axes inclined to one of the reference planes and parallel to the other, Projections of solids with axes inclined to both H.P. and the V.P

Module – II Sections of Solids

Introduction, projection of sectional view, Types of section plane, Section plane perpendicular to V.P. and parallel to H.P., Section plane perpendicular to H.P. and parallel to V.P., Section plane perpendicular to V.P. and inclined to H.P., Section plane perpendicular to H.P. and inclined to V.P., Section plane perpendicular to both H.P. and V.P.

Module – III Sectional Orthographic Projections

Introduction, Cutting plane line, types of sectional view, Different types of Holes, problem on sectional orthographic projections.

Module – IV Development of Surfaces

Introduction, Application of Development of surfaces in engineering products, Methods of development: Parallel line method, Radial line method, Development of prism, cylinder, pyramid and Cone.

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

References:

1. “Elements of Engineering Drawing” , N.D. Bhatt, Charotar Publishing House.
2. “Engineering Drawing” , P.J.Shah, S.Chand, New Delhi.
3. “Fundamentals of Engineering Drawing” , W.J.Luzzadar, Prentice-hall of India Pvt. Ltd.-New Delhi.
4. “Fundamentals of Drawing” , K.R.Gopalkrishna, Subhash Publications, Banglore.
5. “Engineering Drawing” , M.B.Shah, B.C.Rana, Pearsons.
6. “Fundamentals of Engineering Drawing” , French & Vierck, McGraw-Hill Publication.
7. “Engineering Drawing”, N.H. Dubey, Nandu Publication, Fifteen Edition

VOC-235: Laboratory Course-V (AU) (Engine System)

1. Assembly and Disassembly of 2 Stroke petrol Engine
2. Assembly and Disassembly of 4 Stroke diesel Engine
3. Demonstration of Battery Ignition System
4. Demonstration of Electronic Ignition System
5. Demonstration of Cooling system used in 4 wheeler
6. Demonstration of Lubrication System used in 2 wheeler
7. Assembly and Disassembly of Alternator
8. Overhauling of Crank case; Oil filling and replacing.

VOC-236: Laboratory Course-VI (AU) (Two Wheeler Servicing)

1. Cleaning and Washing of vehicle by using jet washer kit.
2. Assembly and disassembly of Multi plate Clutch.
3. Demonstration of Carburetor used in 2 Wheeler.
4. Assembly and Disassembly of Constant mesh gear box.
5. Overhauling of gearbox; replacing gear oil.
6. Overhauling of 4 stroke Engine; replacing engine oil.
7. Demonstration of Telescopic Shock Absorber.
8. Overhauling of Brake system used in 2 Wheeler.

VOC-237: Laboratory Course-VII (AU) (Workshop Practice)

1. Job on lap welding joint (50 mm x 50 mm)
2. Job on Step turning and Taper Turning operation on lathe machine
3. Job on fitting shop (‘V’ Fitting)
4. Job on butt welding joint.

VOC-238: Laboratory Course-VIII (AU) (Engineering Drawing - II)

1. Sheet based on Projections of Solids.(4 problems)
2. Sheet based on Sectional Orthographic view (2 problems).
3. Sheet based on Development o Surfaces (2 problems)
4. Sheet based on section of solids. (2 problems)
5. Drawing based on Autocad Software.

VOC-239: In-Plant Internship / Field Work/ Project

Semester – III

General Academic Components

Semester III

General Education Components

VOC: 301: Linguistic Proficiency - III

Learning Objectives:

To improve the presentation skills of students

Learning Outcomes

1. Students will become good English communicator
2. They can successfully present themselves in seminars, oral presentation, interviews etc.

Module- I: (1) Presentation skills:

(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: (2) Grammar in Use:

(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:

(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:

(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

Learning Objectives:

To introduce students with multimedia, World Wide Web, HTML and their applications

Learning Outcomes

Students can create and manage HTML documents

Module- I:

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:

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:

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:

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:

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

VOC 303: Statistical Tools: Probability and Statistics

Learning Objectives:

1. To apply the concept of probability and probability distributions in their field. To acquire the concept of estimation theory
2. To do testing of hypothesis that will be useful in solving engineering problems.
3. To design and analyze the statistical experiments.

Learning Outcomes:

Students will be able to use statistical models in various aspects of engineering, business, and analysis

Module- I: Probability and Random Variable

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

Module- II: Statistics

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

Module- IV : 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)

Skill Development Components

Industrial Automation

VOC – 311 Analog and Digital Circuit Design

(02 credits – 50 marks)

Learning Objectives

The course should enable students to:

1. To widen the knowledge of transistors, field effect devices, their biasing and applications
2. Understand the flip-flop and counters etc
3. Understand the important of Basic Memory Array, Basic Memory operation etc

Learning Outcome

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

1. Gain sufficient knowledge of biasing BJTs, JFETs and MOSFETs and apply them for fundamental applications
2. Gain sufficient knowledge to apply flip-flops and counters for simple to complex applications
3. Gain knowledge of registers and memory functioning

Course Contents:

Module – I: Transistor Biasing and application (08 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 (07 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 (04 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 (upto decade operation).

Module- IV: Registers and Memory **(05 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: **(06 Hrs)**

Presentation's, case studies, Assignments, Tutorials based on Module I to IV

Ref. Books :

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)

Learning Objectives:

The course will enable the students to:

Understand concepts of power transmission different fundamental mechanisms

Learning Outcomes:

After completion of the course, students are expected to have knowledge of:

(i) Fundamental kinetics and kinematics of motion
(ii) Simple power transmission mechanisms and their application areas

Course Contents:

Module – I: Kinetics and Kinematics of Motion and Simple Mechanisms (07 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 (06 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 (07 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 (06 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 cams.

Module -V: (**06 Hrs)**

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

Ref. Books:

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)

Learning Objectives:

The course will enable the students to:

Acquire knowledge about fluid power fundamentals, hydraulic pumps, hydraulic actuators and components and basic hydraulic circuits.

Learning Outcomes:

After completion of the course, students are expected to:

Effectively apply basic hydraulic components for simple system integration and automation

Course Contents:

Module – I: Fluid Power Fundamentals and Hydraulic Pumps (07 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 (06 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 (06 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 (07 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: **(06 Hrs)**

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

Ref. Books:

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)

Learning Objectives:

The course should enable the students to:

1. introduce students with 8051 family, 8051 hardware
2. Learn assembly language.
3. basic programming using a microcontroller
4. effectively utilize microcontroller peripherals

Learning Outcomes:

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

1. understand Architecture of 8051
2. Program a microcontroller to perform various tasks.

Course Contents:

Unit – I: Introduction to Computing and Microcontrollers (04 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

.

Unit – II: 8051 Microcontroller (08 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,

Unit – III: Addressing modes and Instructions (07 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

Unit – IV: 8051 Programming (05 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

Unit - V: (06 Hrs)

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

Ref. Books:

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 (IA)

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 (IA)

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

At least six experiments from above list should be performed.

VOC- 317
Laboratory Coursework–XI (IA)

List of Experiments:

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

At least six experiments from above list should be performed.

VOC- 318
Laboratory Coursework–XII (IA)

List of Experiments:

i. Write a program for studying data movement(array/sorting) operations using Atmel 89C51 trainer kit
ii. Write a program for hexadecimal addition/ subtraction of two numbers using Atmel 89C51 trainer kit.
iii. Write program for studying hexadecimal division/ multiplication using Atmel 89C51 trainer kit.
iv. Write a program to find biggest number in the set of numbers using Atmel 89C51 trainer kit.
v. Write a program to convert hexadecimal number to decimal using Atmel 89C51 trainer kit.
vi. Write a program to square a byte using Atmel 89C51 trainer kit.
vii. Write a program for Fibbonacci series using Atmel 89C51 trainer kit.
viii. Write a program for Logical operation (AND, OR & NOT) using Atmel 89C51 trainer kit.
ix. Write a program for Logical operation (NAND, NOR & XOR) using Atmel 89C51 trainer kit.
x. Write a program for finding even odd numbers using Atmel 89C51 trainer kit.

At least six experiments from above list should be performed.

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

(02 credits – 50 marks)

Semester – III

Automobile Technology

(Skill Development Components)

Skill Development Components

Automobile Technology

VOC 331 Machine Drawing

(02 credits – 50 marks)

Learning Objectives:

The course should enable students:

1. To gain knowledge about basics of Machine Drawing.
2. To gain knowledge about Assembly and part drawing.
3. To gain knowledge about the types of Screw and Fasteners.

Learning Outcomes:

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

1. Understand the Machine drawing and its conventions.
2. Know Applications of screw and Fasteners
3. Draw detail and assembly drawing of machine components

Course Content:

Module - I: Conventions in Machine Drawing (05 Hrs)

Introduction to machine drawing, Standards used in machine drawing, conventional representation of machine components and materials, method of designating and dimensioning metric thread, internal thread, external thread.

Module - II: Screw and Fasteners (07 Hrs)

Temporary and permanent fasteners, thread nomenclature and forms, thread series, designation, representation of threads, bolted joints, Riveted joints, locking arrangement of nuts, screws, washers, foundation bolts etc., keys, types of keys, knuckle joint.

Module - III: Limits, fits and tolerances (08 Hrs)

Limits, Types of tolerances and fits, hole basis and shaft basis of fits, and geometric dimensioning and tolerance, surface texture, indication of surface roughness, methods of placing machining symbols on orthographic views, Representation of geometrical and dimensional tolerance

Module - IV: Part and Assembly Drawing (04 Hrs)

Introduction to assembly drawing, steps in making of assembly drawing, assembly drawing of footstep bearing, Knuckle joint, Flange coupling ,Flexible coupling , part drawing of Piston, connecting rod , cross head, crank

Module -V Tutorials, case studies and presentation based on Module I to IV (06 Hrs)

References:

1. Textbook of Machine Drawing, K C John, PHI publisher (2009) ISBN: 8120337212
2. Machine Drawing, by N. Siddeshswar, P. Kannaiah, VVS Shastry, Tata McGraw Hill
3. Fundamentals of Machine Drawing, Dr Sadhu Singh & P L Shah, Prantice Hall India
4. Machine Drawing-K.L. Narayana, P. Kannaiah, KV Reddy-New Age
5. Machine drawing- N.D.Bhatt., published by R.C. Patel Charotar Book Stall Tulshi Sadan, StationRoad, Annad, India.
6. Machine drawing – P.S. Gill S.K. Kataria & Sons Delhi. ISBN: 9789350144169
7. Machine drawing – T.Jones. ISBN : 8170965969
8. Machine Drawing and Computer Graphics by Farazdak Haideri, Nirali Publication, fourth Edition, 2007

VOC 332 Thermodynamics

(02 credits – 50 marks)

Learning Objectives:

The course should enable students:

4. To gain knowledge about basics of thermodynamic processes.
5. To gain knowledge about the various power cycles.
6. To gain knowledge about the types and characteristics of fuels.

Learning Outcomes:

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

4. Understand the concept of various thermodynamic cycles and their applications,
5. Steam generators and their performance evaluation
6. Types of fuels and the process of combustion

Course Content:

Module - I: First Law Of Thermodynamics (05 Hrs)

System, thermodynamic equilibrium, state, thermodynamic property, process, cycle, zeroth law of thermodynamics, energy, work, heat, first law of thermodynamics, ideal gases, application of first law of thermodynamics to closed and open systems, pressure-volume diagrams, steady flow process, application of steady flow energy equation.

Module - II: Second Law Of Thermodynamics (05 Hrs)

Limitations of first law, statements of second law of thermodynamics, heat engine, heat pump, refrigerator, Carnot cycle, Carnot theorem, entropy, temperature–entropy diagram, entropy changes for a closed system.

Module - III: Thermodynamic Cycles (07 Hrs)

Basic Thermodynamic cycles, Air standard cycle, Rankine cycle, Carnot cycl, reversed Carnot cycle, T-S, P-H diagrams.

Module - IV: Fundamentals of Heat Transfer (07 Hrs)

Modes of heat transfer, Fourier's law of conduction, one dimensional steady state conduction through plane and composite walls, cylinders and spheres. Heat transfer co-efficient, simple problems in fins, heat exchangers, Stefan Boltzmann law, Black body and Grey body radiation

Module -V Tutorials, case studies and presentation based on Module I to IV (06 Hrs)

References:

1. R. K. Rajput – "A Textbook of Engineering thermodynamics"- Laxmi Publications (P) Ltd, New Delhi (2001).
2. Heat Transfer Principles and Applications, Biray K. Dutta, Printice hall of India, New Delhi (2003).
3. Thermal Engineering, R. Rudramoorthy, Tata McGraw Publishing Co. Ltd, New-Delhi (2003).
4. Engineering Thermodynamics, P. K. Nag, Tata McGraw Hill. (2005)
5. A textbook of Thermal Engineering, R. S. Khurmi, J. K. Gupta, S. Chand & company Ltd (2003)
6. Fundamentals of Engineering thermodynamics, E. Ratha Krishnan, Eastern Economy Edition-Prentice Hall of India Private Limited, New Delhi, (2000).
7. Thermodynamics: An Engineering approach, Yunus A. Cengel, Michael A. Boles, Third Edition (2002).
8. Heat transfer, Y. V. C. Rao, University press, Hyderabad (2001).

VOC 333 Automotive Petrol Engines

(02 credits – 50 marks)

Learning Objectives:

The course should enable students:

1. To learn the fundamental principles of automotive petrol engines.
2. To learn the construction and auxiliary systems of automotive petrol engines.
3. Understand the construction of petrol engines and its components.

Learning Outcomes:

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

1. To penetrate deep into construction and operation of S.I engines.
2. To get acquainted with the latest technologies in petrol engines.
3. Understand the performance parameters of petrol engines.

Course Content:

Module - I: S.I. Engine Construction and Operation (05 Hrs)

Constructional details of four stroke petrol engine, working principle, air standard Otto cycle, actual indicator diagram, two stroke engine construction and operation, comparison of four stroke and two stroke engine operation, firing order and its significance. Port Timing, Valve Timing of petrol engines

Module - II: Combustion and Combustion Chambers (07 Hrs)

Gasoline fuels and its properties, Combustion in SI engine; stages of combustion, flame propagation, rate of pressure rise, abnormal combustion, detonation, effect of engine variables on knock, knock rating. Combustion chambers; different types, factors controlling combustion chamber design

Module - III: SI Engine Fuel System (07 Hrs)

Carburetor working principle, requirements of an automotive carburetor, starting, idling, acceleration and normal circuits of carburetors, Compensation, maximum power devices, constant choke and constant vacuum carburetors, fuel feed systems; mechanical and electrical fuel feed pumps.

Module - IV: Advance S.I. Engine Techniques (05 Hrs)

Petrol injection system, MPFI system, Construction and working of TBI and PFI systems, Methods of fuel Injection: Sequential, Continuous, grouped, simultaneous injection, Comparison of carbureted engine fuel supply system with TBI and MPFI System, Sensors and Actuators, ECU, Electronic ignition systems, Variable Valve Timing

Module -V Tutorials, case studies and presentation based on Module I to IV (06 Hrs)

References:

1. Internal Combustion Engines, Ganesan.V, Tata McGraw Hill Publishing Co., New York, 4th Edition (2012), *ISBN*-0-07-049457-6.
2. A Course in Internal Combustion engine, Mathur-Sharma, Dhanpat Rai Publication (2010), ISBN-10: 8189928465, ISBN-13: 978-8189928469
3. Internal Combustion Engines, K. K. Ramalingam, SCITECH, 2nd edition (2011), *ISBN* 10: 8183711022 / *ISBN* 13: 9788183711029
4. High Speed Combustion Engines, Heldt. P. M, Oxford Publishing Co., New York, (1990).
5. Automotive Engines, William H. Crouse (Author), Donald Anglin (Author), Donald L. Anglin, McGraw-Hill Education (ISE Editions); (1994), ISBN-10: 0071138846, ISBN-13: 978-0071138840.
6. Internal Combustion Engine Fundamental, John B. Heywood., McGraw-Hill, 1988.
7. Engineering Fundamentals of the Internal Combustion Engines, Pulkrabek, Practice Hall of India, 2003.
8. Automotive Engines, Ellinger. H. E, Prentice Hall Publishers (1992).
9. Advanced Engine Technology, Heinz Heister, SAE, 1995.

VOC 334 Automotive Diesel Engines

(02 credits – 50 marks)

Learning Objectives:

The course should enable students:

1. To learn the fundamental principles of automotive diesel engines.
2. To learn the construction and auxiliary systems of automotive diesel engines.
3. Understand the construction of diesel engines and its components.

Learning Outcomes:

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

1. To penetrate deep into construction and operation of C.I. engines.
2. To get acquainted with the latest technologies in diesel engines.
3. Understand the performance parameters.

Course Content:

Module - I: C.I. Engine Construction and Operation (06 Hrs)

Diesel engine construction and operation, two stroke and four stroke diesel dual cycle engines, diesel cycle, fuel-air and actual cycle analysis, diesel fuel, ignition quality, cetain number, laboratory tests for diesel fuels, standards and specifications.

Module - II: Combustion and Turbocharging (06 Hrs)

Importance of air motion, swirl, squish and turbulence, swirl ratio, fuel air mixing, stages of combustion, delay period, factors affecting delay period, knock in CI engines. Types of Combustion chamber, Necessity and limitations, types of turbo charging, relative merits, matching of turbocharger, exhaust gas recirculation, charge cooling.

Module - III: Fuel Injection System (06 Hrs)

Requirements, air and solid injection, functions of components, jerk and distributor type pumps common rail system, PTFI system pressure waves, injection lag, unit injector, mechanical and pneumatic governors, fuel injector, types of injection nozzle, nozzle tests, spray characteristics, injection timing, pump calibration.

Module - IV: Advance C.I. Engine Techniques (06 Hrs)

Electronically Controlled Fuel injection system- Block diagram, Features of CRDI system, Major Components - Fuel injector, Block diagram of Electronic diesel control unit (EDC), High pressure fuel pump, High pressure accumulator, Variable Valve Timing

Module -V Tutorials, case studies and presentation based on Module I to IV (06 Hrs)

References:

1. Internal Combustion Engines, Ganesan.V, Tata McGraw Hill Publishing Co., New York, 4th Edition (2012), *ISBN*-0-07-049457-6.
2. A Course in Internal Combustion engine, Mathur-Sharma, Dhanpat Rai Publication (2010), ISBN-10: 8189928465, ISBN-13: 978-8189928469
3. Internal Combustion Engines, K.K. Ramalingam, SCITECH, 2nd edition (2011), *ISBN* 10: 8183711022 / *ISBN* 13: 9788183711029
4. High Speed Combustion Engines, Heldt.P.M, Oxford Publishing Co., New York, (1990).
5. Automotive Engines, William H. Crouse (Author), Donald Anglin (Author), Donald L. Anglin, McGraw-Hill Education (ISE Editions); (1994), ISBN-10: 0071138846, ISBN-13: 978-0071138840.
6. Internal Combustion Engine Fundamental, John B. Heywood., McGraw-Hill, 1988.
7. Engineering Fundamentals of the Internal Combustion Engines, Pulkrabek, Practice Hall of India, 2003.
8. Automotive Engines, Ellinger H. E, Prentice Hall Publishers (1992)
9. Advanced Engine, Technology, Heinz Heister, SAE, 1995.
10. Diesel Engine Operation and Maintenance, Maleev V. M, McGraw Hill (1974)
11. Diesel Engines, Dicksee C. B, Blackie & Son Ltd., London (1964)

VOC 335 Laboratory Coursework based on Machine Drawing

(02 credits – 50 marks)

List of Practical's: (Any 05 Practical can be performed)

1. Representation of Machine components and conventions.
2. Drawing of Screw, nut, bolt, fasteners and locking arrangements.
3. Representation of Fits, geometric tolerance and surface roughness on machine part.
4. Assembly and Detail drawing of Piston- connecting rod.
5. Assembly and Detail drawing of Knuckle joint.
6. Assembly and Detail drawing of Rigid and Flexible Flange coupling
7. Assembly and Detail drawing of Cotter joint.
8. Assembly drawing of Single plate Clutch.

VOC 336 Laboratory Coursework based on Automotive Petrol Engines

(02 credits – 50 marks)

List of Practical's: (Any 05 Practical can be performed)

1. Dismantling of Multi-cylinder Petrol Engine
2. Demonstration of MPFI system.
3. Demonstration and Calibration of Electric Fuel Pump.
4. Draw Valve Timing Diagram for Petrol Engine.
5. Injector cleaning and Testing.
6. Spark plug cleaning and Testing.
7. Engine Decarburizing.
8. Trial on Multi-cylinder Petrol Engine (Mores Test).
9. Heat Balance sheet for Multi-cylinder Petrol Engine.

VOC 337 Laboratory Coursework based on Automotive Diesel Engines

(02 credits – 50 marks)

List of Practical's: (Any 05 Practical can be performed)

1. Dismantling of Multi-cylinder Diesel Engine.
2. Demonstration of CRDI system.
3. Demonstration of Turbocharger and EGR system.
4. Draw Valve Timing Diagram for Diesel Engine.
5. Injector cleaning and Testing.
6. Engine Decarbonising.
7. Trial on Single cylinder Diesel Engine (Willians Line Test to calculate frictional power).
8. Heat Balance sheet for Multi-cylinder Diesel Engine.
9. Trial on willians line method to calculate frictional power.

VOC 338 Laboratory Coursework based on Two-wheeler Overhauling

(02 credits – 50 marks)

List of Practical's: (Any 05 Practical can be performed)

1. Overhauling of Clutch.
2. Overhauling of 4-stroke Engine.
3. Overhauling of Two Wheeler gear box.
4. Overhauling of suspension system.
5. Replacement of wheel bearings.
6. Overhauling of Braking system.
7. Carburetor Tuning and Emission testing.
8. Demonstration of Two Wheeler Electric System.

VOC-339: In-Plant Internship / Field Work/ Project

(02 credits – 50 marks)

Semester – IV

General Academic Components

Semester IV

General Academic Component

VOC 401: Industrial Ethics and Safety Management

Module I- Introduction to Industrial Ethics

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

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

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

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- Presentation's, case studies, Assignments, Tutorials based on Module I to IV

References:

Text:

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

Suggested Reading:

1. Grimaldi and Simonds, Safety management: ATTBS publishers, new Delhi 2001
2. Industrial safety and pollution control handbook; national safety council and associate publishers pvt. ltd; Hyderabad
3. Code of practice on Safety management :- PDF
4. http://www.saylor.org/books
5. The Business Ethics Workshop

VOC- 402: Business Software Tools

Learning Objectives:

To learn students various business software tools

Learning Outcomes

Students will able to use software such as CSS, Photoshop, dream ware, flash; as per their necessary applications

Module I: CSS and Photosho

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

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

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)

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

References:

Text:

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

Learning Objective:

The course aims to provide basic concepts and knowledge of a business enterprise and with the basic accounting principles and techniques of preparing and presenting the accounts for user of accounting information.

Learning Outcomes:

Students will get knowledge of fundamentals of business, basic accounting terms, financial accounting etc. This will help them if they start their business in any field

Module- I : Introduction to Business

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

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

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

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

VOC411- PLC Based Automation

Learning Objectives:

To introduce students with advance PLC functions, and interfacing of PLC to real world devices and processes

Learning Outcomes:

(i) Students will develop basic programming skills for process automation with PLCS
(ii) Students will be able to employ Allen Bradley PLCs for industrial applications

Module -I: Timer in PLCs (06 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 (06 Hrs)

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

Module -III: Data Manipulations and Arithmetic Instructions (06 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 (06 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, Demonstrations and Presentation Based on Module I to IV

References:

Text:

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

Suggested Reading:

1. 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
2. F. Petruzella – Programmable Logic Controllers – MGH, UK, 2014 ISBN10:9352602129 ISBN-13: 978-0073510880
3. G. D. Anderson – PLC programming using RS Logix 500: Ladder Logic Diagnostics and Troubleshooting (Vol 1-3) ISBN-10: 1511770341 ISBN-13: 978-1511770347
4. www.plcs.net
5. www.plcwashinton.org
6. www.plctutor.com

VOC--412: PROCESS CONTROL

Learning Objectives:

1. To introduce students with the classifications of control system, controllers, complex modes of process control and computer based controlling.
2. To introduce students with process instrumentation and control elements

Learning Outcomes:

1. Students will acquire understanding of terminologies in process control and ancillary tools.
2. Students will be able to identify process requirements for determination of control protocol.

Module -1: Introduction to Process Control **(06 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 -2: Controller Principles **(06 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 -3: 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 – 4: 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 – 5:

Tutorials, Assignments, Demonstrations and Presentation Based On Module I to IV

References:

Text:

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

Suggested Reading:

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

VOC-413 Fundamentals of Pneumatics

Learning Objectives:

1. To introduce students with the components of pneumatic technology and their individual operation
2. To introduce students with the application of pneumatic components for automization of industrial processes

Learning Outcomes:

1. Students will acquire understanding of basic terminologies in pneumatics.
2. Students will be able to identify application specific pneumatic components, and will be able to operate them for basic actuations
3. Students will be able to implement pneumatic components to build up low profile circuits for process automation

Module -1: 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 -2: Servicing of Compressed Air and Pneumatic Actuators (06 Hrs)

FRL unit, pressure gauge monometer, installation of FRL unit
Drying 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 -3: 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 -4: 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 – 5:

Tutorials, Assignments, Demonstrations and Presentation Based On Module I to IV

References:

Text:

1. S R Majumdar; 2006 (Sixteenth Reprint); Pneumatic Systems (Principal and maintenance); Tata McGraw - Hill Publishing Company Limited; ISBN 0-07-460231-4
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

Suggested Reading:

1. Antony Barber; 1997 (Eighth Ed.); Pneumatic Handbook; Elsevier Science Ltd.; ISBN 978-81-265
2. 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
3. hydraulicspneumatics.com
4. nptel.ac.in/courses/112103174/pdf/mod6.pdf
5. resources.hkedcity.net/res_files/201101/20110128101153_259037.pdf

VOC – 414 Embedded System Applications

Learning Objectives:

1. To introduce students with the concepts of interfacing 8051 microcontroller to real world elements
2. To introduce students with the protocols for interfacing 8051 microcontroller to real world elements

Learning Outcomes:

1. Students will acquire understanding interfacing concepts and protocols for 8051 microcontroller.
2. Students will be able to develop programs for interfacing real world elements to 8051 microcontroller
3. Students will be able to implement 8051 microcontroller for process automation applications

Module -1: 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 -2: 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 -3: 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 -4: 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, Demonstrations and Presentation Based On Module I to IV

References:

Text:

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

Suggested Reading:

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

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

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

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

5. circuitdigest.com/8051-microcontroller-projects

VOC 415 - Laboratory Course –VI (PLC based Automation)

i. Hardware Implementation of 'Latch and Hold' concept
ii. PLC ladder programming with Simulator (logical instruction) and hardware implementation
iii. PLC ladder programming with Simulator (program control instructions) and hardware implementation
iv. PLC ladder programming with Simulator (Timer Instruction) and hardware implementation
v. PLC ladder programming with Simulator (Counter Instruction) and hardware implementation
vi. Implementation of sequential operation of PLC with basic output devices
vii. PLC ladder programming for interfacing with conveyor belt (hardware implementation)
viii. PLC ladder programming for water level control (hardware implementation)
ix. PLC ladder programming for elevator control (hardware implementation)
x. PLC ladder programming for linear bottle filling station (hardware implementation)

At least six experiments from above list should be performed

VOC 416 – Lab course X (Process Control)

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

At least six experiments from above list should be performed

VOC – 417: Lab course XI (Fundamentals of Pneumatics)

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)

At least six experiments from above list should be performed.

VOC – 418 Lab course XII (Embedded System Application)

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

At least six experiments from above list should be performed.

VOC-419: In-Plant Training/ Field Work/Mini Project

(02 credits – 50 marks)

\

Semester – IV

Automobile Technology

(Skill Development Components)

Skill Development Components

Automobile Technology

VOC 431 Fundamentals of Machines and Mechanism

Learning Objectives:

1. To gain knowledge about fundamentals of Machine and various Mechanisms.
2. To get acquainted with Cams and Follower system.

Learning Outcomes: After successful completion of this course student should understand

1. The fundamentals about machine, machine element and Mechanism used in machines.
2. Working of Governor and Flywheel in automobile systems.

Module – I Introduction to Machine and Mechanism (6 Hrs)

Rigid body and resistant body, Kinematic link, Types of links, Kinematic pair, Types of constrained motions, Types of Kinematic pairs, Kinematic chain, Types of joints, Mechanism, Machine, Degree of freedom (Mobility), Four bar chain, Slider crank chain, Quick Return Mechanism, Double slider crank chain, Steering gear mechanisms

Module – II Gear (6 Hrs)

Introduction, Classification of gears, Functions of gears, Gear nomenclature: Center distance, Gear ratio, module, circular pitch, pitch circle, etc., Law of gearing, Forms of teeth, cycloidal profile, involute profile, path of contact, arc of contact, contact ratio, interference and undercutting

Module – III Flywheel and Governor (6 Hrs)

Introduction, Functions of fly wheel, Types of fly wheels, Co-efficient of energy, Co-efficient of speed, Governor, Functions of governor, Types of governor – Principle, construction and working of Watt governor Porter governor, Hartnell governor, comparison between a fly wheel and governor

Module – IV Cams and Followers (6 Hrs)

Introduction, Classification of cams, Followers and their classification, Brief description of different types of cams and followers with simple line diagram, Simple cam profile for uniform velocity, SHM and uniform acceleration and deceleration with Flat, knife edge and roller type follower.

Module -V Tutorials, case studies and presentation based on Module I to IV (6 Hrs)

References:

1. A Ghosh and AK Malik: "Theory of Mechanism and Machine"; East West Press (Pvt) Ltd., New Delhi.
2. J.S. Rao and Dukkipati; Mechanism and Machine Theory; Wiley Eastern, New Delhi
3. S.S. Rattan: Theory of Machines; Tata McGrawHill , New Delhi
4. R. S. Khurmi, J. K. Gupta; "Theory of Machines", S. Chand publication
5. Sadhu Singh, "Theory of Machines", Pearson
6. Dr.V.P.Singh, "Theory of Machine", Dhanpatrai and sons.

VOC 432: Automobile Transmission

(02 credits – 50 marks)

Learning Objectives:

The course should enable students:

1. To gain knowledge about basics of transmission system in automobile.
2. To gain knowledge about clutch, gearbox, differential.
3. To gain knowledge about the types of braking system and steering system.

Learning Outcomes:

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

1. Understand the transmission system in automobile.
2. Understanding the functional requirement of transmission component.

Course Content:

Module - I: Clutch, Gearbox, Propeller Shaft (08 Hrs)

Introduction to transmission system, **(A) Clutch-** principle operation of clutch, friction material, classification of clutch and working, clutch adjustment, troubleshooting of clutch. **(B) Gearbox-** gear ratio, types of gear boxes, gear shifting, lubrication of gear box, troubleshooting of gear box, Automatic transmission **(C) Propeller shaft-** General aspects, types of propeller shaft, troubleshooting of propeller shaft

Module - II: Universal Joint, Final Drive, And Differential (05 Hrs)

(A) Universal Joint- introduction, Construction and working of universal joint, types of universal joint, **(B) Final Drive-** introduction, classes of final drive, advantages, disadvantages **(C) Differential-** Introduction, construction, operation, types of differential, troubleshooting of differential

Module - III: Steering, Front Axle and Rear Axle (07 Hrs)

(A) Steering system- Purpose of steering system, function, general arrangement, working of steering mechanism, steering gears, steering ratio, steering geometry, types of steering gear box, steering linkages **(B) front axle-** introduction, construction, types of front axle,

(C) Rear axle – introduction, types, causes of axle failure, rear axle noises, maintenance of rear axle, troubleshooting of rear axle

Module - IV: Chassis and suspension (04 Hrs)

Introduction to chassis, classification of chassis, frame, body, vehicle dimension, introduction to suspension system, function, requirement and element of suspension system, spring, dampers, suspension systems, wheels and tyres

Module -V Tutorials, case studies and presentation based on Module I to IV (06 Hrs)

References:

1. Automotive Engines, William H. Crouse (Author), Donald Anglin (Author), Donald L. Anglin, McGraw-Hill Education (ISE Editions); (1994), ISBN-10: 0071138846, ISBN-13: 978-0071138840.
2. Automobile Technology, Volume II by Kripal Singh, 2009
3. Automobile engineering, Dr. R.K.Singhal ISBN:9788185749488 Reprint 2015
4. Automobile engineering, Dr. R.K.Rajput ISBN:81700089913 Reprint 2015
5. Modern transmission A.W.Judge Chapmen and Hall std 1989

VOC 433 Auto Electrical Systems

(02 credits – 50 marks)

Learning Objectives:

The course should enable students:

1. To gain knowledge about basics of electric system in automobile.
2. To gain knowledge about Starting system, charging system.
3. To gain knowledge about the ignition system, lighting and accessory system.

Learning Outcomes:

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

1. Understand the electrical system in automobile.
2. Know Applications component of electrical system.
3. Understanding the functional requirement of electrical component such as battery, starting motor, wiring switches, alternator, ignition system

Module - I: Starting System (03 Hrs)

Introduction to electrical system, fundamentals of electrical system, terminology in electrical system, starting system, battery, starting motor

Module - II: Charging System (07 Hrs)

Introduction to charging system, requirement of a charging system, Generator (dynamo), troubleshooting of dynamo, Alternator A.C. Generator, working, constructional details. Troubleshooting of alternator

Module - III: Ignition System (07 Hrs)

Introduction to ignition system, purpose of ignition system, requirement of ignition system, components of ignition system, types of ignition system, ignition timing, troubleshooting of ignition system

Module - IV: Lighting and Accessory system (07 Hrs)

Introduction, main circuit of automobile electrical system, lighting system, lighting switches, indicating light, Accessories, fuel gauge, horns, direction indicator, water temperature gauge, speedometer, odometer, ventilating system, air conditioning system, troubleshooting

Module -V Tutorials, case studies and presentation based on Module I to IV (06 Hrs)

References:

1. Automotive Engines, William H. Crouse (Author), Donald Anglin (Author), McGraw-Hill Education (ISE Editions); (1994), ISBN-10: 0071138846, ISBN-13: 978-0071138840.
2. Ken Layne , Automobile electrical system , vol I 1989 ISBN 0471617636
3. Automobile engineering, Dr. R.K.Rajput ISBN:81700089913 Reprint 2015
4. Narang GBS " Automobile Engineering Khanna publication New Delhi

VOC 434 Automobile Systems

(02 credits – 50 marks)

Learning Objectives:

The course should enable students:

1. To gain knowledge about basics of Fuel system in automobile.
2. To gain knowledge about lubrication system
3. To gain knowledge about the chassis and suspension system.

Learning Outcomes:

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

1. Understand the various system in automobile.
2. Know Applications and components of fuel system and cooling system.
3. Understanding the functional requirement of chassis and suspension system

Course Content:

Module - I: Fuel system- S.I. engine (06 Hrs)

Introduction to Carburetion and carburetors, induction system, factors influencing carburetion, distribution, simple carburetor, types of carburetor, theory of carburetor

Module - II: Fuel system- C.I. engine (06 Hrs)

Introduction to fuel injection system, functional requirement of a injection system, function of fuel injection system, fuel pump and fuel injector, types of nozzle and fuel spray pattern, engine starting system, trouble shooting of fuel system, troubleshooting of carburetors

Module - III: Lubrication system and cooling system (06 Hrs)

Effect of engine parameter on engine friction, determination of engine friction, lubrication and lubrication system, crankcase ventilation, necessity of engine cooling, cooling air and water requirement, specification of cooling system of an engine, troubleshooting of cooling system.

Module - IV: Braking System (06 Hrs)

Introduction, necessity, function, requirement, classification, factor controlling the stop of an automobile, arrangement of brake in different vehicles, Vacuum assisted brake, Eddy current brakes, brake tester, troubleshooting

Module -V Tutorials, case studies and presentation based on Module I to IV (06 Hrs)

References:

1. Automobile engineering, Dr. R.K.Rajput ISBN:81700089913 Reprint 2015

2. Automotive Engines, William H. Crouse, Donald Anglin Donald L. Anglin, McGraw-Hill Education (ISE Editions); (1994), ISBN-10: 0071138846, ISBN-13: 978-0071138840.

2. Automotive Engines, Ellinger. H. E, Prentice Hall Publishers (1992).

4. Advanced Engine Technology, Heinz Heister, SAE, 1995.

5. Narang GBS " Automobile Engineering Khanna publication New Delhi

VOC-435 Laboratory Course based on Automobile Transmission

(Any Five Practical) **(02 credits – 50 marks)**

1. Assembly and Disassembly of Single plate clutch: Coil Spring, Diaphragm type
2. Assembly and Disassembly of Gearbox: Synchromesh, Constant Mesh type
3. Assembly and Disassembly of Suspension System
4. Demonstration of power steering system and various types of steering gearbox.
5. Assembly and Disassembly of Steering gear box
6. Demonstration of Differential gearbox
7. Demonstration of different types front and rear axles.

VOC-436 Laboratory Course based on Auto Electrical System

(Any Five Practical) **(02 credits – 50 marks)**

1. Demonstration of battery charging and its precaution.
2. Demonstration of battery testing by different types of test.
3. Demonstration of battery ignition system.
4. Demonstration of Electronic ignition system.
5. Demonstration of different lighting and accessory system in automobile.
6. Demonstration of overall automobile electric wiring circuit
7. Troubleshooting of Starter Motor and Alternator

VOC-437 Laboratory Course based on Automobile System

(Any Five Practical) **(02 credits – 50 marks)**

1. Demonstration of SI engine fuel system.
2. Assembly and Disassembly of F.I.pump.
3. Demonstration of MPFI system.
4. Demonstration of CRDI system.
5. Demonstration of Air Brake system
6. Demonstration and Troubleshooting of Hydraulic Brake system
7. Troubleshooting of fuel system (SI and CI).

VOC-438 Laboratory Course based on Auto-CAD

(02 credits – 50 marks)

Any Six Autocad drawings of following machine/Automotive components

1. Coupling
2. Connecting Rod
3. Piston
4. Knuckle Joint
5. Crankshaft
6. Hexagonal headed bolt
7. Bracket
8. Hexagonal nut

VOC-439: In-Plant Internship / Field Work/ Mini Project

(02 credits – 50 marks)

Semester – V

General Academic Components

General Education Components

VOC 501: Personality Development and Stress Management

Learning Objective: (i) To enable the students to understand the necessity of a good personality and provide them to improve their personality
(ii) To make students understand the sources of stress and techniques to handle stress

Learning Outcome: (i) Students will be able to groom themselves to a good personality by owns SWAT analysis.
(ii) Students will be able to handle stress developed by dint of day to day activities

Module- I: Personality Development

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**

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

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

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: Labour Laws and Taxation

Learning Objective: (i) To enable the students to understand the evolution of labour standards, rights and Industrial regulations

(ii) To provide students with elementary knowledge of tax practice

Learning Outcome: (i) Students will be able to understand the term _labour‘ and handle related problems, disputes.
(ii) Students will be able to handle and understand tax related issues while working in industry

Module- I: Labour through ages

Historical Perspective on Labour: 1.1 Labour through the ages – slave labour – guild system – division on class basis – labour during feudal days; **1.2** Labour – capital conflicts: Profit motive, exploitation of labour, poor working conditions, poor bargaining power, unorganized labour, surplus labour, division of labour and super-specialization, lack of alternative employment; **1.3** Transition from exploitation to protection and from contract to status;**1.4** International Labour Standards and their implementation.

Trade Unionism: 1.5 Labour Movement as a counter measure to exploitation – Brief history of trade union movement in India; **1.6** Right to trade union as part of human right to freedom of association. **1.7** Role of trade unions in the changing economic scenario.

Module- II: Labour Laws

Law relating to service conditions: 2.1 Industrial Employment (Standing Orders) Act, 1946 - **2.2** Scope and object of the Act, Model standing orders, and matters to be incorporated in standing orders (schedule to the Act) **2.3** Concept of misconduct, disciplinary action and punishment for misconduct.

Law relating to Industrial disputes: 2.4 Industrial Disputes Act, 1947 - Conceptual conundrum: industry, industrial dispute, workmen; (Sec.2‘j‘k‘&‘s‘); **2.5** Dispute settlement machinery: Conciliation officers, Board of Conciliation, labour court, Industrial Tribunal and National Tribunal – duties and powers; (Sec3-10); **2.6** Reference for adjudication and Voluntary Arbitration (Sec.10 & 10A); Award and its binding nature and judicial review of awards. (Secs.18 & 11-A); **2.7** Statutory limitations on strikes and lock-outs; unfair labour practices – prohibition and penalties. (Sec.22-31&25-T, 25U); General and special provisions relating to lay-off, retrenchment & closure (Sections 25A-25S & 25K-25R); **2.8** Recommendations of Second Labour Commission on industrial disputes; **2.9** Statuatory rights & benefits applicable to labour/employees (epf, perks & benefits, concept of incentives for performance)

Module-III: Income Tax

General Perspectives, Income Tax rate Structure and its Role in Indian Economy, Basic concepts of Income Tax, Heads and Sources of Income, Exemptions & Deductions under the I.T. Act.

Module-IV: Indirect Taxes

Maharashtra Value Added Taxes (MVAT) 2002, Central Sales Tax Act 1956, Central Excise Act 1944,Custom Act 1962, Service Tax Act 1994, Wealth Tax Act 1957

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

References:

1. R.F. Rustomji: The Law of Industrial Disputes in India.
2. J.N. Malik: Trade Union Law.
3. Bagri: Law of Industrial Disputes, Kamal Law House, 2001.
4. Srivastava: Law of Trade Unions., Eastern Book Company, 4th Edition 2002.
5. Dr. V.G.Goswami, Labour and Industrial Law, Central Law Agency, Allahabad.
6. S. N. Mishra, Labour and Industrial Law, Central Law Agency, Allahabad.
7. Khan and Khan Labour Law, Asia Law House, Hyderabad.
8. Sampath Iyengar, Law of Income Tax (1998) Bharat Law House, New Delhi
9. Ramesh sharma, Supreme Court on Direct taxes (1998), Bharat Law House, New Delhi
10. Walter R. Mahher, Sales and Excise Taxation in India (1970)Orient Longman,Delhi
11. Dr. V.K. Singhania, Guide to Income Tax.
12. C.A. Gularickar, Law and Practice of Wealth and Valuation (1998), Gularickar, Mumbai.
13. R.V. Patel, Central Sales Tax Act (1966) Tripathi, Bombay
14. P.L. Malik, Commentaries on Customs Act 1962 (1982) 3rd Edn. Eastern Book Co.

VOC- 503: Business Communication

Learning Objectives: To acquaint students about practices in advance business communication

Learning Outcomes: Student will acquire effective skills for advance level business practices

Module- I: Introduction

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

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

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

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: PRODUCT COSTING

Learning Objective: To enable the students to understand the basic aspects of the design process and to apply them in practice. Also to train the student in the concept of product costing and other manufacturing economics in optimization of product design.

Learning Outcome: Students will be able to draft efficient planning towards market research and accordingly effect designing and product costing

Module I: Product Design and Development

Principles of creativity in design- integrated product development

Product analysis – Criteria for product design – Market research – Design for customer and design for manufacture – Product life cycle.

Module II: Economics of Design

Breaks even point - Selection of optimal materials and processes – Material layout planning – Value analysis – Re-engineering and its impact on product development.

Module III: Product Modelling

Product modeling – Definition of concept - fundamental issues – Role and basic requirement of process chains and product models –Types of product models – model standardization efforts – types of process chains – industrial demands.

Module IV: Product Costing

Bill of materials – Outline Process charts – Concepts of operational standard time - Work measurement by analytical estimation and synthesis of time – Budgets times – Labor cost and material cost at every stage of manufacture – W.I.P. costing –

Concept of per hour machine rate or per shift rate for machine & its calculation- Concept of overheads, profit margin;

Concept of quotation & tender- How to prepare quotation, rate calculation & decide other terms & conditions in quotation.

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

References:

1. SAMEUL EILON, ―Elements of Production Planning and Control‖, McMillan and Company, 1962.

2. JONES S.W., ―Product Dosing and Process Selection‖, Butterworth Publications, 1973.

3. KARL T. ULRICH, Stephen D. Eppinger, ―Product Design and Development‖, McGraw-Hill, 1994.

4. HARRY NYSTROM, ―Creativity and Innovation‖, John Wiley & Sons, 1979

5. GEORGE E. DIETER, ―Engineering Design – Materials and process approach‖, Tata McGraw-Hill, 1991
6. DONALD E. CARTER, ―Concurrent Engineering‖, Addison Wesley, 1992.

Semester – V

Industrial Automation

(Skill Development Components)

Skill Development Components

Industrial Automation

VOC- 511 Embedded Systems and PLCs-II

(04 credits – 100 marks)

Learning Objectives:

The course should enable the students to:

5. introduce students with PIC Microcontroller family, PIC hardware
6. Learn assembly language.
7. effectively utilize microcontroller peripherals
8. introduce students advance PLC functions, analog operations and interfacing of PLC to real world devices and processes

Learning Outcomes:

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

3. understand basics of PIC and apply knowledge for interfacing
4. Program a microcontroller to perform various tasks.
5. Students will be able to apply PLCs for industrial applications

Course Contents:

Unit – I: PIC Microcontrollers and Assembly Language Programming (14 Hrs)

Introduction to PIC microcontrollers and embedded processors: 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; Assembly Language Programming : WREG Register in PIC, PIC File Register, Using Register with default Access bank, 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, Viewing Register and Memory with MPLAB Simulator.

Unit – II: Addressing Modes and Instruction Set (10 Hrs)

Addressing Modes, Look-Up table and Table Processing, Bank Switching in PIC 18

Arithmetic Instructions and operations, Logic and Compare Instructions, Rotate operation and Data serialization,

Branch Instructions, Looping, Call instructions and Stack, PIC 18 Time delay and Pipeline concepts

Unit – III: Hardware connections, I/O programming and Interfacing (12 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

Unit – IV: Advance PLC Functions (12 Hrs)

PLC Number comparison and conversion functions, PLC SKIP and MASTER CONTROL RELAY Functions, Jump Functions, PLC Data Move Systems, PLC Digital Bit functions with applications, PLC sequencer functions, Analog PLC operation, Factors to consider in selecting a PLC for Industrial Process; Industrial Applications.

Unit - V: (12 Hrs)

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

Ref. Books:

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. Programmable Logic Controllers: Programming Methods and applications J.R. Hackworth, F.D. Hackworth Jr; PEARSON; 5th edition 2003 ISBN-10: 0130607185 ISBN-13: 978-0130607188
4. Industrial Electronics: Circuits, Instruments and Control Techniques- T. Bartlett; CENGAGE Learning; 2006 ISBN-13: 978-1401862923 ISBN-10: 1401862926
5. Programmable Logic Controllers: Principles and applications- J. W. Webb, R.A. Reis; 5th edition, 2013 ISBN-10: 013041672X ISBN-13: 978-8120323087

VOC – 512 Manufacturing Processes and Mechatronics

(04credits – 100 marks)

Learning Objectives:

The course will enable the students to:

(i) get introduced to the fundamental manufacturing processes pertaining to common industrial and workshop practice
(ii) get introduced to the fundamentals of CNC technology

Learning Outcomes:

After completion of the course, students are expected to:

(i) have an overall view of about industrial manufacturing processes
(ii) become familiar to CNC terminologies and structural aspects of CNC machine

Course Structure:

Module- I: Forming Processes and Press Working (13 Hrs)

Forging, Forging Processes, Types of Dies, Press Forging, Open and Closed Die forging
Rolling- Principle, Hot and Cold Rolling, Types of Rolling Mills Sections of rolled parts
Extrusion – Direct and Indirect extrusion, Advantages and Disadvantages

Press Working – Introduction, Classification of Press, Types of presses, Drive mechanism, Press working operations

Module- II: Machining Operations and Welding (15 Hrs)

Lathe Machine – Introduction, Classification and basic parts of central lathe - their functions, Lathe operations- facing, plain turning, Taper turning, Thread cutting, Chamfering, Grooving, knurling; Cutting tools, Cutting Parameters.

Drilling Machine – Introduction, Classification, Basic parts of radial drilling machine and their functions, Twist drill nomenclature, Drilling Machine Operations – Drilling, Reaming, Boring, Counter Sinking, Counter Boring; Cutting parameters

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

Module- III: Modern CNC machines - Introduction, Design and Mechatronic Elements (14 Hrs)

Introduction to the term mechatronics, Introduction to modern CNC machines, CNC machining centre developments, turning centre developments, tool monitoring on CNC machines, Basic

CNC machine structure, Guideways, Feed drives, Spindle, Measuring Systems, Controls, software, User interface, Gauging, Tool monitoring system

Module- IV: CNC Machines – Drives, electrical and system configuration (12 Hrs)

Drives- Spindle and Feed drive, Servo principle, Driver optimization, Drive protection, Selection criteria for AC drives, Electric elements and wiring, Power supply requirements, Electrical standard, electrical panel cooling

CNC system configuration, Interfacing, Monitoring, Diagnostics, machine Data, Compensations, Direct Numeric control (DMC)

Module -V: (10 Hrs)

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

References:

1. W.A.J. Chapman- Workshop Technology (Part I, II,II) - CBS, ISBN – 8-12-39-0401-0, ISBN – 8-12-39-0411-8 ISBN – 8-12-39-0412-6 (Part I, II and III respectively)
2. S.K. Hajra Choudhury, A.K. Hajra Choudhury, N. Roy - Elements of Workshop Technology (Volume I and II) - Media Promoters and Publishers Private Limited, ISBN – 8-18-50-9914-6, ISBN- 8-18-50-9915-4 (Part I, and II respectively)
3. Roy. A. Lindberg - Processes and Materials of Manufacture , Allyn and Bacon, ISBN – 0-20-50-7888-5
4. P.N. Rao - Manufacturing Technology (Vol I): Foundry, Forming and Welding, Tata McGraw Hill Publishing Company Limited, ISBN – 9-33-29-0100-7
5. P.N. Rao - Manufacturing Technology (Vol II): Metal Cutting and Machine Tools, Tata McGraw Hill Publishing Company Limited, ISBN – 1-25-90-2956-5
6. S. Gowri, P. Hariharan, A. Suresh Babu - Manufacturing Technology, Pearson Education,
7. HMT – Mechatronics, Tata McGraw Hill Publishing Company Limited, ISBN – 0-07-46-3643-X
8. HMT- Mechatronics, Tata McGraw Hill Publishing Company Limited, ISBN – 0-07-13-4634-1

VOC 513 Laboratory Course –IX (IA; Old)

i. Write a program for studying data movement (array/sorting) operations using PIC microcontroller.
ii. Write a program to perform logical operations using PIC microcontroller.
iii. Write a program to display DDUKK on LCD Display using PIC Microcontroller.
iv. Study the interfacing of seven segments Display.
v. Study and interfacing of ADC using PIC Microcontroller.
vi. Study and interfacing of DAC using PIC Microcontroller.
vii. To study and observe direction control of stepper motor using PIC.
viii. To study and implement stepper motor angle control using PIC.
ix. To study and observe direction control of DC motor using PIC.
x. To study and implement DC motor angle control using PIC
xi. Study and use of Latch- Unlatch and study of various timers (TON, TOFF, RTO, CTU) in PLC.
xii. Develop ladder programming to operate a conveyor based liquid vending station.
xiii. Develop a ladder programming to operate a density based traffic light arrangement.
xiv. Performance of at least two basic machining operations with lathe.
xv. Performance of at least two basic operation with radial drilling machine
xvi. Industrial orientation for demonstration of CNC based machining operations.

At least 08practical‘s should be performed from above list

VOC 514: Major Project (Phase- I)

VOC 515: In-plant Training/Fieldwork

Semester – V

Automobile Technology

(Skill Development Components)

Skill Development Components

Automobile Tchnology

VOC 531 Engine Performances and Vehicle Testing

(04 credits – 100 marks)

Learning Objectives:

1. To expose students to various performances parameter and it's Testing.
2. To learn the various types of vehicle tests.

Learning Outcomes:

8. Students will acquire knowledge about various performance test on engine
9. Students will acquire knowledge about Vehicle testing.

Course Content:

Module– I: Basics of Engine Performance Parameter (12 Hrs)

Introduction, Work, Energy, Power, Indicated power, Brake power, Friction power, Efficiency, Coefficient of performance, indicated thermal Efficiency, Brake thermal Efficiency, Mechanical Efficiency, Volumetric Efficiency, Relative efficiency or Efficiency Ratio, Mean Effective pressure, mean piston speed, Specific power output, specific fuel consumption, Fuel-Air Ratio, Calorific Value.

Module– II: Measurements and Engine performance Test (14 Hrs)

Measurement of Indicated power, Brake power, Friction power, Willan's Line method, Morse Test, Motoring Test, Retardation test, Dynamometers, Prony Brake, Rope Brake, Hydraulic Dynamometer, Eddy Current dynamometer, Transmission Dynamometer, Chassis Dynamometer, Air box method, Heat balance sheet.

Module– III: Numerical on Performance Test (10 Hrs)

Calculation of Brake power, Indicated power, Friction power, Specific fuel consumption, Brake thermal efficiency, Problems on mean effective pressure, Heat balance Sheet.

Module– IV: Vehicle Testing (12 Hrs)

Fundamentals of Testing, Track Test, Gradient Test, Crash Worthiness Test, Test Methodology, Circular Skid pad testing, scale model testing, Load distribution, stability on a curved track slope and a banked road.

Module -V Tutorials, case studies and presentation based on Module I to IV(12 Hrs)

References:

1. Heldt.P.M -"Automotive Chassis"- Chilton Co., New York- 1992
2. Ellis.J.R - "Vehicle Dynamics"- Business Books Ltd., London- 1991
3. Giles.J.G.Steering - "Suspension and Tyres", Illiffe Books Ltd., London- 1998
4. Ham B, Pacejka - Tyre and Vehicle Dynamics - SAE Publication – 2002
5. Gillespie T.D, "Fundamentals of Vehicle Dynamics", SAE USA 1992.

VOC 532 Engine Diagnostics and Troubleshooting

(04 credits – 100 marks)

Learning Objectives:

1. To expose students to various engine faults and its diagnosis.
2. To acquainted with troubleshooting of various systems.

Learning Outcomes:

1. Students can identify various faults in engine.
2. Students can do troubleshooting of engine effectively

Course Content:

Module - I: Engine Troubleshooting (14 Hrs)

Engine causes, Failure of Engine to start, Low power and Uneven running, High oil Temperature, Improper Engine acceleration, failure of engine to idle properly, Engine stops, Engine vibrate excessively.

Module - II: Engine system Troubleshooting (12 Hrs)

Troubleshooting of cooling system, Troubleshooting of Lubrication system, overheating, slow warm up, noisy coolant pump, thermostat fault, Low oil pressure, High oil pressure, Excess oil consumption, Defective oil filter

Module - III: Troubleshooting of fuel supply system (10 Hrs)

Idling Difficulty, High fuel consumption, Lack of power, Engine splits back, Defective fuel filter, Fuel pump troubleshooting, Testing fuel pressure regulator, Fuel injector cleaning, fuel pump leaks, excessive fuel pump pressure

Module - IV: Troubleshooting of Electrical and Ignition system (12 Hrs)

Pre ignition, ignition delay, Magneto fails to deliver any spark, Faulty spark, Engine runs but backfires, poor contact of terminals, starter does not stop running, Wiper failure, Battery discharges quickly, Alternator noise, Starter run but pinion will not mesh

Module -V: Tutorials, case studies and presentation based on Module I to IV(12 Hrs)

References:

1. Vehicle Body Engineering – Pawloski J., Business Books Ltd**.,** ISBN 10: 0220689164

2. The Automotive Chassis: Engineering Principles – Reimpell J., ISBN: 9781493302864
3. Vehicle Body Layout and Analysis – John Fenton, Mechanical Engg. Publications Ltd. London, ISBN: 9780852984451
4. Body Construction and Design – Giles J. G., Illife Books, Butterworth and Co., ISBN: 1-4051-5592-2.
5. Automobile Technology, by Kripal Singh, 2009.

VOC 533 Laboratory Coursework based on Engine Performances and Vehicle Testing (03 credits – 100 marks)

List of Practical's: (Any 08 Practical can be performed)

1. Trial on Willan's Line method to calculate Friction power
2. Trial on Morse Test
3. Trial on Motoring Test
4. Trial on Retardation Test
5. Trial on Heat balance Sheet
6. Demonstration of Eddy current dynamometer
7. Demonstration of Hydraulic dynamometer
8. Demonstration of Rope brake dynamometer
9. Demonstration of Air box method
10. Perform Gradient test
11. Perform Track Test

VOC 534 Major Project (Phase-I)

VOC-535: In-Plant Internship / Field Work

Semester – VI

General Academic Components

General Academic Component

VOC 601: Human Resource Management

Learning Objectives:-

- HRM functional capabilities used to select, develop, and motivate workers
- Strong analytical, communication, and decision making skills.
- Effectively manage and plan key human resource functions within organizations
- Examine current issues, trends, practices, and processes in HRM

Learning Outcomes:-

- Students should be able to know Problem-solving methods of human resource challenges
- students will Develop employability skills

Unit I: Introduction to Human Resource Management

Definition of HRM, Scope of HRM, Objectives of HRM, Functions of HRM, Role of HRM, and Organization of Personnel functions, personnel department.

Unit II: Job Analysis and Job Design

Introduction, Job Analysis, Job Description, Job Design, Recruitment, Meaning and Definition of recruitment, Process of Recruitment, Sources of Recruitment , Methods of Recruitment

Unit III: Training and Development

Introduction, Need for Employee Training, Types of Employee Training, Advantages of On the Job Training Methods, Career Planning and Development, Performance Appraisal, Need and Importance of Performance Appraisal, Methods of Performance Appraisal, MBO

Unit IV: Organization Development

Organization Structures, Re-engineering, multitasking, BPR, Management of Organizational change.

Unit V:

Tutorials, assignments, demonstrations, and presentation based on Module I to IV

References

Text:-

i. P. subba Rao /2009/ Human Resource management/ Himalaya Publishing House

ii. C.B. Mammoria, Gankar S.V/2002/Personnel Management/Himalaya Publishing House

iii. K. Aswathappa /1999/Human Resource and Personnel Management (2nd edition)/ Tata McGraw-Hill Publishing Company Ltd.

Suggested Text:-

i. Biswajeet Pattanayak/2001/ Human Resource Management/ Prentice Hall of India Pvt. Ltd.,New Delhi.

ii. D.K.Bhattacharya /Human Resource Management / (2^{nd} edition)/ (Excel books)/New delhi

iii. Dr. P. Jyoti and Dr D.N. Venkatesh/ Human resource Management (2^{nd} Edition)/ Oxford publications

iv. Gray Dessler/2014/ Human Resource Management (13^{th} Edition)/ PRENTICE HALL

v. DeCenzo & Robbins/2009/Fundamentals of Human Resource Management (10^{th} Edition)/Wiley/ (*pdf available)

General Academic Component

VOC-- 602: ENTREPRENEURSHIP DEVELOPMENT

- **Learning Objectives:**

i. Identify and apply the elements of entrepreneurship and to entrepreneurial processes
ii. Recognize the importance of entrepreneurship and identify the profile of entrepreneurs and their role in economic growth
iii. Use the entrepreneurial mind-set and behave responsibly and ethically in their roles as entrepreneurs.

- **Learning Outcomes:**

i. Students will be able to Demonstrate the ability to provide a self-analysis in the context of an entrepreneurial career
ii. Students will be able to Demonstrate the ability to find an attractive market that can be reached economically

UNIT I: 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

UNIT II: 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

UNIT III: 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.

UNIT IV: 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.

UNIT V: Meeting the entrepreneurs, interviewing them and making a presentation.

REFERENCE

Text:

1. Vasanth Desai ―Dynamics of Entrepreneurial Development and Management‖ Himalaya Publishing House, New Delhi, India

2. N.P.Srinivasan & G.P. Gupta ―Entrepreneurial Development‖ S. Chand & Sons, New Delhi, India

Suggested Reading:

1. P.Saravanavelu ―Entrepreneurship Development‖ Eskapee publications.
2. S.S.Khanka ―Entrepreneurial Development‖ S.Chand & Company Ltd.,
3. Satish Taneja ― Entrepreneur Development‖ ; New Venture Creation.

General Academic Component

VOC- 603: Workshop Management (for Industrial Automation and Automobile)

Learning Objective: To provide overall concept of management of a workshop

Learning Outcome: Students will be able to understand the planning and management concept of complete production cycle and functioning of a Workshop

Unit I: Fundamentals of Productivity

Introduction- Concept, Scope, Objective and role of Workshop Management

Productivity- Introduction, production system, Classification of production system, Production Management, Production strategy, Reasons of low productivity, Techniques to improve productivity, Functions of performance measurement system, Productivity index.

Unit II: Management Function:

Introduction, Function of Managers, Work Simplification – Process Charts: The Seven + Quality control, Management techniques, Motion and Time study, Production planning and control (PPC), Functions of Production Planning and Control

Unit III: Inventory Control and Supply Chain

Introduction to Inventory and Cost, Functions of Inventory, Factors affecting Inventory, Inventory control techniques, Single - item Inventory Models, Multi-item inventory models

Introduction of Supply Chain, Physical Manifestation, Elements of a supply chain model. Supply chain performance, Demand forecasting in supply chains.

Unit IV: Quality Control and Total Quality Management

Definitions of quality, Quality design, Quality of conformance, Qulaity standards, Quality controls, Quality control tools.

Definition of Total Quality Management (TQM), TQM concepts, The Deming"s philosophy, Guru"s of TQM, Five principles of TQM.

SWOT Analysis, Continuous Improvement strategies- Deming Wheel, Kaizen concept, Zero defect concept, Bench marking, Six sigma (6σ), Failure Mode and effect Analysis (FMEA), Time Management, Total Productive Maintenance.

Unit V:

Tutorials, assignments, demonstrations, and presentation based on Module I to IV

References:

Text:

1. Yadava A., Rana K., Arya S. C.; 2014 „Industrial Management" Global Academic Publishers and Distributors
2. Telsang Martand, 2009, "Industrial Engineering and Production Management", S. ChandPublishers Pvt. Ltd., India

Suggested Reading:

1. Chopra Sunil, Meindl Peter and Kalara D.V., 2007, "Supply Chain Management, Strategy, Planning and Operation", Pearson Education Inc,.
2. Suganthi L., A. Samuel Anand, 2203, "Total Quality Management", PHI Learning.
3. Juran J.M., M. Gryna Franic, 2005, "Quality Planning and Analysis", Tata McGraw Hill Edition.
4. Kumar S., 2008 "Total Quality Management", University Science Press.
5. Khanna O.P., 2006, "Industrial Engineering & Management", Dhanpat Rai & Sons. New Delhi.

Semester – VI

Industrial Automation

(Skill Development Components)

Skill Development Components

Industrial Automation

VOC -- 611: MOTION CONTROL & ROBOTICS

Learning Objectives:

1. Students should understand fundamentals of Robotics and its working.
2. Students can understand motion control devices.
3. They will come across basics of Industrial Robotics System.

Learning Outcomes:

1. Students will be able to handle motion control devices.
2. Students will be able to apply the same for designing of simple robotic applications.
3. Students will be able to apply their knowledge in programming robots for simple applications.

Module -1: Motion Control and Feedback Devices

Angular Velocity Feedback Devices, Angular Displacement Feedback Devices, Linear Displacement Feedback Devices, Motion Control Parameters, Motion Control Elements, Actuator Block, Hydraulic Actuator, Actuator Transmission System

Module -2: **Robots: A Formal Introduction**

Definitions of Robot, Brief History of Robot, Laws of Robotics, Automation And Robotics, Basic Fundamentals of Robots, Important Terminologies, Characteristics of Robot Performance, Classification of Robot

Module -3: Robot – Components, Working & Systematic Integration

Anatomy of Robot, Working of Robot, Basic Components of a Robot System, Kinematic Problems, Mechanical Structure of Robot and Axis Drive System, Trajectory Planning, Automation in Robotics, End Effector and Gripper System, Sensors, Robot Control System

Module – 4: Robotics Systems

Robot Hands, Criteria Of Gripper Selection, Mechanical Grippers, Vacuum Grippers, Sensor Integrated Gripper, Work Handling, Work Place Layout, Methods of Control, Trajectory, Coordinal Transformation, Structure of Robot Controller, Feedback Control System

Module – 5:

Tutorials, Assignments, Demonstrations and Presentation Based on Module I to IV

References:

Text:

1. Terry Bartelt; 2006; Industrial Electronics: Circuits, Instrument and Control Technique (INDIA EDITION) ; Cengage Learning India PVT LTD; Delhi (India)
2. E. Wise; 2005; Robotics Demystified; Mc. Graw Hill Demystified Series.
3. Dr. K.C. Jain, Dr. L.N. Aggarwal; 2005; Robotics, Principles & Practice; Third Edition; Khanna Publication; Delhi (India)
4. S.K. Saha; Introduction To Robotics; Tata McGraw-Hill Publishing Company Limited; New Delhi (India)

Suggested Reading:

1. R. H. Critchlow; 1985; Introduction to Robotics; Mc Millan Publishing Company, NY
2. J. L. Fuller; Robotics: Introduction, Programming and Project; Prentice Hall; NJ
3. A. Ghosal; 2006; Robotics: Fundamental Concepts and Analysis; Oxford University Press, New Delhi
4. A. J. Koivo; 1989; Fundamentals for control of Robotic Manipulatiors; John Willey and Sons, NY
5. P.E. Sandin; 2003; Robot Mechanisms and Mechanical Devices Illustrated; The Mc Graw Hill Companies limited
6. https://www.razorrobotics.com/
7. http://www.roboticslearning.com/
8. http://www.robots.org/GettingStarted.htm

Skill Development Components

Industrial Automation

VOC--612: PROCESS CONTROL AND TOOLS

Learning Objectives:

3. To introduce students to the classifications of control system, controllers, complex modes of process control and computer based controlling.
4. To make students understand the instrumentation and control of process control elements

Learning Outcomes:

3. Students will acquire terminologies in process control and tools.
4. Students will be able to understand which control system to be used for what applications

5.

Module -1: Introduction to Process Control

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

Module -2: Controller Principles

Introduction, Process Characteristics, Control System Parameters, Discontinuous Controller Modes, Continuous Controller Modes, Composite Control Modes

Module -3: Final Control Elements

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

Module – 4: Computer Based Control

Digital Applications, Computer Based Controller (Hardware Configuration, Software Requirement), Other Computer Applications (Data Logging, Supervisory Control), Control System Networks (Development, General Characteristics, Field Bus Type), Computer Controller Examples

Module – 5:

Tutorials, Assignments, Demonstrations and Presentation Based On Module I to IV

References:

Text:

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

Suggested Reading:

1. N. P. Lieberman, E. P Lieberman; 2014; A Working Guide to Process Equipment (Fourth Edition), Mcgraw-Hill Book Co
2. Myke King; 2010; Process Control: A Practical Approach; Wiley International
3. I.J.Nagrath, M.Gopal; 2009; Control Systems Engineering (Fifth Edition); New Age International Publishers; India
4. N. Barapate; 2006; Control System; Tech Max publications; Pune (India)

VOC – 613: Laboratory Course X

1. Study of Feedback control in pressure System
2. Study of Feedback Control in Flow system
3. Study of I to P Converter
4. Study of P to I Converter
5. Study of combination of I to P and P to I
6. Calibration of I to P Converter
7. Study of Rotary Index Table
8. Study of Pneumatic operated control Valve characteristics (any one type)
9. Study of Multi Process Control
10. Study of SCADA Application Software/ Computerized Control of Multi process control
11. Study of stepper motor
12. Study of DC position control (PID algorithm) using geared motor
13. Study of Line follower robot
14. Study of Obstacle Avoider robot
15. Pick and place application of a 6-axis robot
16. Pick and place application of a 5- axis robot
17. Study of fundamental FMS.

At least eight experiments should be performed.

VOC – 614: Major Project (Phase – II)

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.

Semester – VI

Automobile Technology

(Skill Development Components)

Skill Development Components

Automobile Technology

VOC-631: Automobile System Diagnostics and Troubleshooting

(04 credits – 100 marks)

Learning Objectives:

The course should enable students:

1. To gain knowledge of diagnose the fault of various system.
2. To gain knowledge of finding the proper cause of particular fault in vehicle system.
3. To gain knowledge of rectifying the faults of vehicle system.

Learning Outcomes:

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

1. Diagnose exact faults and rectify them.
2. Understanding the procedure of diagnose and rectification of faults.

Module - I: Troubles of Transmission System. (14 Hrs)

Procedure of diagnose fault, cause and rectifying faults like - clutch slips, clutch drag, noise in clutch operation, abnormal wear of clutch, poor vehicle acceleration.

Hard gear shifting, gear slips out of mesh, gear box operation noisy (at the time of gear engage and at the time of neutral),

Differential noisy in operation (at the time of neutral and at the time of turning), vehicle does not move even in gear, vehicle vibrate at the time of running, abnormal wear of tyre.

Module - II: Troubles of Steering System. (10 Hrs)

Procedure of diagnose fault, cause and rectifying faults like - Steering wheel hard, noise in steering system, vehicle pulls to one side, excessive ply in steering, vehicle wanders, vehicle does not self-centering.

Module - III: Troubles of Brake System. (10 Hrs)

Procedure of diagnose fault, cause and rectifying faults like – poor brake, brake judder, excessive play in brake pedal, spongy brake, vehicle pulls to one side when braking, brake binding, noise in brake, loose brake pedal,

Module - IV: Trouble of Suspension System and Electrical System. (20 Hrs)

Procedure of diagnose fault, cause and rectifying faults like – Shimmy front wheel, poor comfort while driving, vehicle sagging, vehicle wobbles while driving, noisy suspension rough riding, vehicle bouncing, Procedure of diagnose fault, cause and rectifying faults like -Battery does not charge, engine does not start, head light does not glow, horn is not working, fuel gauge does not work, indicator light does not work, power window does not work, wind shield wiper does not work.

Module -V Tutorials, case studies and presentation based on Module I to IV (06 Hrs)

References:

1. Automotive Engines, William H. Crouse (Author), Donald Anglin (Author), Donald L. Anglin, McGraw-Hill Education (ISE Editions); (1994), ISBN-10: 0071138846, ISBN-13: 978-0071138840.
2. Automobile Technology, Volume II by Kripal Singh, 2009
3. Automobile engineering, Dr. R.K.Singhal ISBN:9788185749488 Reprint 2015
4. Automobile engineering, Dr. R.K.Rajput ISBN:81700089913 Reprint 2015
5. Modern transmission A.W.Judge Chapmen and Hall std 1989

VOC-632: Transport Management and Safety Regulation

(04 credits – 100 marks)

Learning Objectives:

The course should enable students:

1. To gain knowledge of evolution of transport technology.
2. To gain knowledge of managing the organization, personal, and operational requirements for successful transportation department
3. To gain knowledge of theories of studying traffic flow and transport demand and supply.

Learning Outcomes:

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

1. Understand the current development in transportation and logistics system.
2. Understanding the critical analysis transport and logistic strategy.

Module - I: Motor Vehicle Act (16 Hrs)

Short titles and definitions, laws governing use of motor vehicle licensing and registration, taxation structure, insurance type, traffic rules, signals and control, different types of forms , government administrative structure

Module - II: Road Transportation and Cost of service (10 Hrs)

Road transportation, Advantages, significance, transport planning, transport terminology, Capital cost, operating cost, fixed cost, variable cost, direct cost and indirect cost.

Module - III: Infrastructure, productivity and efficiency (12 Hrs)

Garages, essential requirement, fleet maintenance record, bus station, bus shelter, bus stops, staffing, management of transport organization, structure of organization, motivation, productivity of road transportation organization, environment, fleet and vehicle utilization, fuel and oil economy, control of breakdown, effective traffic operation.

Module - IV: Road safety (12 Hrs)

Driving in comfort, avoiding fatigue, poisonous car fumes, drugs and driving first aid for motorist, first aid kits, braking and stopping, mist care and precaution, ice show skidding, emergencies and road observations. Definition of accident, legal obligation, causes of road accidents, analysis and prevention, insurance documentation, road safety, driver selection test, driver training, security devices

Module -V Tutorials, case studies and presentation based on Module I to IV (10 Hrs)

References:

1. Road transport in india, P.G.Patankar (C.I.T.T. Publication)

2. Productivity in road transportation, Santosh Sharma (A.S.R.T.V. publication)

2. Motor Vehicle Act. 1989

4. Compendum of transport Term- (C.I.R.T publication)

VOC-633 Laboratory Course based on Automobile System Diagnostics and Troubleshooting **(03 credits – 50 marks)**

(Any 08 practical)

1. Diagnosis of C.I. Engine Trouble by using engine scanner
2. Diagnosis of S.I. Engine Trouble by using engine scanner
3. Troubleshooting of Transmission System: Gear Shifting Hard, Noisy gearbox, Clutch Slipping, Clutch dragging or spinning
4. Troubleshooting of Steering System: Hard Steering, Steering wheel wobble, Vehicle wanders
5. Troubleshooting of Braking System: Poor brakes, Brakes dragging, Brake judder or squeal, Brake spongy, Noisy brake
6. Troubleshooting of Charging System: Discharge Battery, Ammeter shows no charge, Ammeter shows overcharge
7. Troubleshooting of Suspension System: Vehicle pulls to one side, Vehicle Sags to one side, Harsh suspension, Excessive tyre wear
8. Troubleshooting of Fuel supply system: Heavy fuel consumption, Lean Mixture in high speed, Hard starting when engine is cold, Hard starting when engine is hot.
9. Troubleshooting of Ignition system: Engine misfire on one cylinder, Engine misfires irregularly on all cylinder
10. Troubleshooting of Electrical system: Dynamo is not produce voltage, Battery is not charge when engine is running, Alternator makes noise when running.

VOC 634 Major Project (Phase – II)

VOC 635 In-plant Internship/Field Work/ Project

Dr. Babasaheb Ambedkar Marathwada University

Aurangabad- 431004 (MS) India

Master of Vocation

(M. Voc.)

in

Industrial Automation
&
Automobile Technology

Course Structure and Curriculum

Choice Based Credit System

(Effective from June 2016 and onwards)

Deen Dayal Upadhyay KAUSHAL Kendra

Dr. Babasaheb Ambedkar Marathwada University

Aurangabad – 431004

Maharashtra, INDIA

INDEX

Sr. No.	Contents	Pg. No.
1.	Preamble …….	4
2.	Program Outcome……	5
4.	Eligibility…….	6
5.	Admission/ Promotion Process……	6
6.	Choice Based Credit System…….....	6
7.	Credit- to -Contact Hour mapping……...	7
8.	Attendance……	7
9.	Departmental Committee…….	7
10.	Results Grievances / Redressal Committee……..	7
11.	Evaluation Methods…….	7
12.	Earning Credits……	9
13.	Grading System……	9
14.	Grade Card……...	11
15.	Cumulative Grade Card…….....	11
16.	Course Structure……..	12
17.	Curriculum: Semester- I…….....	15
18.	Curriculum: Semester –II…….	37

Structure and Curriculum for Master of Vocation (M. Voc)
in
Industrial Automation
(Choice Based Credit System)

This M.Voc (Industrial Automation) program is divided in four semestershaving 102credits. The distribution or credits is as per following –

Sr. No.	Category of course(s)	Type of Course (Theory/ Practical/ Research Project)	Number of Course(s)	Total Credits	Semester-wise Credit Distribution
1	Compulsory Common Component (Constitution of India)	Theory	01	02	Sem I - 02
2	Core Component	Theory	07	14	Sem I - 08 Sem II - 06
3	Foundation Component (Elective)	Theory	01	02	Sem I – 02
4	Foundation Component (Research)	Theory	01	01	Sem I - 01
5	Foundation Component (Compulsory)	Theory	05	10	Sem I - 04 Sem II - 06
6	Generic Elective	Theory	05	10	Sem III – 08 Sem IV -02
7	Open Elective[#]	Theory	02	04	Sem III – 02 Sem IV - 02
8	Laboratory courses (Core)	Practical	07	10.5	Sem I - 06 Sem II - 4.5
9	Laboratory courses (Foundation)	Practical	05	7.5	Sem I - 03 Sem II - 4.5
10	Laboratory Courses (Generic Elective)	Practical	05	7.5	Sem III -06 Sem IV- 1.5
11	Research Component	Research/Industrial project			
	Part 1		Part 1	05	Sem II - 5.0
	Part 2		Part 2	09	Sem III- 9.0
	Part 3		Part 3	19.5	Sem IV - 19.5
			Total	**102 Credits**	

The above structure exercised component wise distribution as per following –

Constitution of India = 02 Credits

Core Component = 24. 5%

Foundation Component = 20.5%

Elective Component = 21.5 %

Research component = 33.5% (Excluding theory course entitled 'Research Methodology')

#Students can opt for open electives from courses offered by Automobile Division, Deen Dayal Upadhyay KASUSHAL Kendra

Preamble:

Dr. Babasaheb Ambedkar Marathwada University (BAMU) proposes to offer a twoyear Master programme invocation (M. Voc.).The curriculum design of this program is undertaken in the following framework (assumptions).

a) Although there has been remarkable progress in all sectors ofeducation 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 ofgraduates who pass-out every year and are forced to bare-trainedin order to become market table.

This programme is designed to produce a skilled manpower in Industrial Automationto 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 ofC ommerce and IndustryofIndia(ASSOCHAM), therewillbeadeficitof40millionworking 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 ofresources.

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 oftheir choice which are directly aligned to land a job in a chosen profession or a skilled trade.**

d) **This program is intended to offer students with life-long independent and reflective learning skills in their career.**

Program Outcomes:

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 acquires throughout the course. These Outcomes are generic and as per following-

i. Students with vocational training can find work in several state and central government organizations, non-profit group and academic institutions and in private sectors.

ii. This programme prepares students for specific types of occupations and frequently for direct entry into the skill based sectors.

iii. After completion of this programme students will have enough competences, to get benefit from skill sector opportunities.

iv. This programme would enable students to update their knowledge and professional skills for entering the work force executing income generating activities or occupying better positions;

v. After completion of the programme, students will be able to
   a) Apply knowledge of general education subjects and skill development subjects to the conceptualization of engineering models.
   b) Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
   c) Conduct investigations of complex problems including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
   d) Create, select and apply appropriate techniques, resources, and modern engineering tools, including prediction and modeling, to complex engineering activities, with an understanding of the limitations.

e) Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
f) Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
g) Demonstrate understanding of the social, health, safety, legal and cultural issues and the consequent responsibilities relevant to science and engineering practice.
h) Understand and commit to professional ethics and responsibilities and norms of science and engineering practice.
i) Understand the impact of science and engineering solutions in a societal context and demonstrate knowledge of and need for sustainable development.
j) Demonstrate a knowledge and understanding of management and business practices, such as risk and change management and understand their limitations.
k) Recognize the need and have the ability to engage in independent and life- long learning.

Eligibility:

Those who have completed B.Voc (Industrial Automation)/ B. Sc with Physics and Electronics / B. E/ B. Tech (Electronics/Electronics and Telecommunication/ Instrumentation/ Electrical/ Mechanical/Mechatronics/Industrial Automation) from any recognized Board/Institution are eligible for registration / admission.

AND

Students having B. Sc degree with Physics and Electronics will have to complete at least 4 credits in terms of two theory courses namely – (i) Fundamentals of Hydraulics and Pneumatics (ii) Process Control and Instrumentation during First year of M.VOC apart from courses being taught in course of regular academic session.

Admission / Promotion Process:

In response to the advertisement for registration, interested students will have to register themselves.Admissionwillbedoneonthebasisofperformanceofstudentsat Common Entrance Test(CET). The CET will be conducted in the month of June every year.

There is Full Carry on for M.Voc i.e. irrespective of individual performance in first year; a student will be promoted to Second Year. However, for obtaining M. Voc. Degree, a student will have to complete all semesters successfully within 4 years/08 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, theprofessionalsandsociety.Itgivesgreaterfreedomtostudentstodeterminetheirownpaceofstudy. The credit based system also facilitates the transfer of credits. Students will have to earn 102 credits for the award of two years Master of Vocation (M. 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 be strictly not allowed for appearing the semester examination of each course. Frequent absence from regular lecture/practical course may lead to disqualification from CIA process in respective subject.

Departmental Committee:

The Departmental Committee (DC) of the Centre will monitor smooth functioning of the program.

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 Head of the department, 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 50: 50 ratio of continuous internal assessment (CIA) and semester end examination (SEE). Separate and independent passing in CIA and SEE will be mandatory. In case of failure in CIA of a particular course, students will have to 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. However, in case of failure in SEE in particular course(s), exam will be conducted in immediate subsequent semester.

- 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):

There will be 25 marks for Continuous Internal Assessment. Distribution of25 marks will be as follows- 05 marks for tutorials, 05 marks for assignment, 05 marks for seminar presentation and 10 marks for weekly tests. Weekly tests of 10 marks each based on subjective short questions/ objective questions (as deemed fit by respective subject teacher) will be conducted every week during the semester as a part of continuous assessment. At the end of the semester, average of all weekly tests will be considered for calculation of final marks.

Semester End Examination (SEE):

- The semester end theory examination for each theory course will be of25 marks. The total marks shall be 50 for 2 credit theory course (25 marks semester end exam + 25 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 research 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:

    - The semester end examination of theory course will have two parts (05+20 = 25 Marks)
    - Part A will be consisting of05 questions having 1 marks each (multiple choice questions / fill in the blanks/ answer in sentence) as compulsory questions and it should cover entire course curriculum (05 Marks)
    - Part B will carry 8 questions (02 questions from each of 04 units and students will have to attempt any one). Therefore, students will have to attempt 04 questions out of 08 (20 Marks).
    - 20 to 30% weightage can be given to problems/ numerical wherein use of non-programmable scientific calculator may be allowed.
    - Number of sub questions (with allotment of marks) in a question may be decided by the examiner.

- Assessment of laboratory courses will also have 50 % internal and 50 % semester end assessment. Semester end practical examination will be of 25 marks and 25 marks will be

there for internal examination. The semester end practical examination will be conducted at the end of each semester along with the theory examination.

- Apart from regular semester wise detailed report and presentations (for evaluation purpose in that particular semester), students will have to submit detailed final dissertation. Draft of dissertation will only be approved for final documentation after a preliminary presentation and defense examination by departmental faculty committee. Once approved, the student will be allowed to prepare his final dissertation. The dissertation will be evaluated by one internal and one external examiner. Student will have to appear for final defense of his dissertation in an open- presentation followed by viva-voce in front of internal examiner, external examiner, departmental faculties and students.

- At the end of each semester the Departmental Committee will assign grades to the students. The result sheet will be prepared in duplicate.

- 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 final exit.

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 final exit.

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

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

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 final exit).

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 final exit.

Course Structure

M. Voc (Industrial Automation)

Semester	Paper Code	Paper Title	Contact Hrs/Week	Credits
Semester I	**CC100**	Constitution of India	2	2
	IAC110	Electronic Systems	2	2
	IAC111	Power Electronics	2	2
	IAC112	Transducer Technology	2	2
	IAC113	Electric Drives	2	2
	IAF120	Embedded Systems Design	2	2
	IAF121	Programmable Logic Controllers	2	2
	CF101	Research Methodology	1	1
	EF1XX	Elective Foundation (Any One) ▪ Operations Management (EF130) ▪ Materials management (EF 131)	2	2
	IALC 140	Electronic Systems lab	3	1.5
	IALC 141	Power Electronics lab	3	1.5
	IALC 142	Instrumentation lab - I	3	1.5
	IALC 143	Electric Drives lab	3	1.5
	IALF 150	Embedded Systems Lab	3	1.5
	IALF 151	PLC lab	3	1.5
	Assignments/Tutorials will remain integral part of all courses			
		Total Credits for Semester – I		**26**

Semester	Paper Code	Paper Title	Contact Hrs/Week	Credits
Semester II	**IAC 210**	Communication Protocols for Instrumentation	2	2
	IAC 211	Mechatronics	2	2
	IAC 212	Advanced Transducers	2	2
	IAF 220	Robotics	2	2
	IAF 221	Process Control	2	2
	IAF 222	Industrial Automation	2	2
	IALC 230	Industrial Networking lab	3	1.5
	IALC 231	Mechatronics lab	3	1.5
	IALC 232	Instrumentation lab -II	3	1.5
	IALF 240	Robotics lab	3	1.5
	IALF 241	Process Control lab	3	1.5
	IALF 242	Industrial Automation lab	3	1.5
	IAR 250	Research/ Industrial Project – Phase I (Review of Literature/ Industrial Orientation, Formulation of Topic, Experimental Plan)	10	5
	Assignments/Tutorials will remain integral part of all courses			
		Total Credits for Semester – II		**26**

Semester	Paper Code	Paper Title	Contact Hrs/Week	Credits

Semester III	**IAGE 31X**	Generic Elective – I	2	2
	IAGE 31X	Generic Elective – II	2	2
	IAGE 31X	Generic Elective – III	2	2
	IAGE 31X	Generic Elective – IV	2	2
	IAOE 32X	Open Elective -I	2	2
	IALE 33X	Lab Course based on Generic Elective – I	3	1.5
	IALE 33X	Lab Course based on Generic Elective – II	3	1.5
	IALE 33X	Lab Course based on Generic Elective – III	3	1.5
	IALE 33X	Lab Course based on Generic Elective – IV	3	1.5
	IAR 340	Research/ Industrial Project – Phase II (Experimental Work)	18	9
	Assignments/Tutorials will remain integral part of all courses			
			Total Credits for Semester – III	**25**

Semester	**Paper Code**	**Paper Title**	**Contact Hrs/Week**	**Credits**
Semester IV	**IAGE 41X**	Generic Elective - V	2	2
	IAOE 42X	Open Elective - II	2	2
	IALE 43X	Lab Course based on Generic Elective – V	3	1.5
	IAR 440	Research/ Industrial Project – Phase III (Experimental Work Continued, Organization and Interpretation of Result, Dissertation, Presentation)	39	19.5
	Assignments/Tutorials will remain integral part of all courses			
		Total Credits for Semester – IV		**25**

Electives for Semester – III

(Any four theory paper along with corresponding lab course have to be chosen from generic electives)
(Any one theory paper along with corresponding lab course have to be chosen from open electives)

	Paper Code	**Paper Title**		**Paper Code**	**Paper Title**
Generic	**IAGE 310**	Industrial Processes and Instrumentation	**Generic(Lab)**	**IALE 330**	Lab Course based on Industrial Process Control
	IAGE 311	SCADA System and Applications		**IALE 331**	Lab Course based on SCADA System and Applications
	IAGE 312	Applied Hydraulics and Pneumatics		**IALE 332**	Lab Course based on Applied Hydraulics and Pneumatics
	IAGE 313	Industrial Robotics		**IALE 333**	Lab Course based on Industrial Robotics
	IAGE 314	Advanced Sensor Technology		**IALE 334**	Lab Course based on Advanced Sensor Technology

	IAGE 315	Kinetics and Dynamics of Robotics		**IALE 335**	Lab Course based on Kinetics and Dynamics of Robotics
	IAGE 316	Mechatronics Systems Design		**IALE 336**	Lab Course based on Mechatronics Systems Design
	IAGE 317	Distributed Control System		**IALE 337**	Lab Course based on Distributed Control System
	IAGE 318	Advanced Electrical Drives		**IALE 338**	Lab Course based on Electrical Drives
	IAGE 319	Advanced Microcontrollers		**IALE 339**	Lab Course based on Advanced Microcontrollers
Open	**IAOE 321**	Applied Hydraulics and Pneumatics			
	IAOE 322	Robotics			

Electives for Semester – IV

(Any one theory paper along with corresponding lab course have to be chosen from generic electives)
(Any one theory paper along with corresponding lab course have to be chosen from open electives)

	Paper Code	**Paper Title**	**Generic(Lab)**	**Paper Code**	**Paper Title**
Generic	**IAGE 410**	Automated and Computer Integrated Manufacturing		**IALE 430**	Lab Course based on Automated and Computer Integrated Manufacturing
	IAGE 411	CNC Technology		**IALE 431**	Lab Course based on CNC Technology
	IAGE 412	Micro Mechatronic Systems		**IALE 432**	Lab Course based on Micro Mechatronic Systems
Open	**IAOE 420**	Automated Manufacturing			
	IAOE 421	Industrial Robotics			
	IAOE 422	Mechatronics Fundamentals			

SEMESTER – I

IAC - 110

Electronic Systems

(02 credits – 50 marks)

Learning Objectives:

The course should enable students:

1. To apply the generic concept of OP-AMPs for building systems to develop application oriented platforms
2. To gain knowledge that spans traditional to controlled oscillationsand monolithic frequency synthesizers
3. To gain operational knowledge of analog/digital timing and counting circuits
4. To gain knowledge of classic treatments on Phase locked loops and frequency to voltage conversion
5. To have insight on active filter operations

Learning Outcomes:

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

Identify necessary system requirements and apply classic concepts of analog and digital electronics to address complex application challenges

Course Contents:

Unit – I: Special Operational Amplifiers and Non-linear Function Circuits (06 Hrs)

High voltage/high current amplifiers, chopper and chopper stabilized amplifiers, instrumentation amplifierand isolation amplifier.

Nonlinear function circuits: limiter, log/anti-log, multiplier/divider, peak detector, comparator, true RMS/DC converter, square wave oscillators.

Unit – II: Oscillators, Timers, Counters (06 Hrs)

Sinusoidal and relaxation oscillators:phase shiftoscillator, Ringoscillator, Wien-bridgeoscillator, quadrature oscillator, crystal oscillator and clock circuits, voltage controlled oscillators – sine, square and triangle, frequency synthesizers.

Timing and counting circuits:digital counters, shift register, analog and digital timers, frequency counters,PLA and PLD applications.

Unit – III: Phase Locked Loops and F/V conversion (06 Hrs)

Phase locked loop, Loop response, Applications of PLL.

Frequency-to-voltage converters: diode pump integrator, frequency and RPM transducers; Phase andphase/frequency comparators – analog and digital.

Unit – IV: Active Filters (06 Hrs)

Active filter types, Filter approximations – Butterworth and chebyshev, filter realizations, frequency and impedance, scalings, filter transformations, sensitivity, switched capacitor circuit.

Unit - V:

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

Ref. Books:

1. Sende, B.S. – Introduction to System design using Integrated Circuits, New Age International (P), NewDelhi.
2. Fitchen, F.C. – Integrated Circuits and Systems,Van Nostrand, New York.

IAC - 111

Power Electronics

(02 credits – 50 marks)

Learning Objectives:

The course should enable students:

1. To gain knowledge of various Power Converter topologies and configurations
2. To gain knowledge of AC voltage control schemes

Learning Outcomes:

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

Apply the concepts of power conversion tools to address control related applications

Course Contents:

Unit – I: DC – DC Converters **(06 Hrs)**

Principle ofoperation of buck,boost, buck-boost, cuk, fly back, forward, push-pull, half bridge, full bridge converters, multi output boost converters, diode rectifier based boost converters

Unit – II: Inverters **(06 Hrs)**

Single and three phase inverters with R and RL loads, Voltage Control, Harmonic reduction, Square Wave generation, PWM inverters, modulation techniques, SPWM, Current Source Inverter

Unit – III: Resonant Pulse Converters **(06 Hrs)**

Series and parallel resonant inverters – zero current and zero voltage switching, Frequency Response Two quadrant zero voltage switching, Resonant DC link inverters, soft switching

Unit – IV: Cycloconverters and AC voltage Controllers **(06 Hrs)**

Single and Three phase cycloconverters with R and RL loads, Voltage control, harmonics and operation waveforms

Single and Three phase AC voltage controllers with R and RL loads, Voltage Control, harmonics, operation waveforms, PWM, Matrix converter

Unit - V:

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

Ref. Books:

1. Mohan, Undeland, Robbins-Power Electronics: Converters, Application and Design, John Wiley & Sons, 1989
2. A.I. Pressman –Switching mode power supply design-MGH, 1992
3. M. H. Rashid- Power Electronics, PHI, 2004
4. Michel, D. –DC-DC Switching Regulator Analysis – MGH 1987
5. Bimal K. Bose- Modern Power Electronics and AC Drives- PHI, 1995
6. Erickson, Makgimovic – Fundamentals of Power Electronics – Springer, 1998
7. P. T. Krein – Elements of Power Electronics – OUP, 1989

IAC - 112

Transducer Technology

(02 credits – 50 marks)

Learning Objectives:

The course should enable the students to:

1. Knowledge of the physical world depends on observation and measurement adds quantitative meaning to our knowledge.
2. Observation, monitoring, analysis and sympathy towards the instruments form the basis of measurement.

Learning Outcomes:

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

1. Distinguish between transducers, sensors and transmitters
2. Understand working of displacement, position, motion & temperature sensors
3. Work with different sensors
4. Learn principle behind strain gauge and pressure sensors

Course Contents:

Unit – I: Introduction to Transducers (06 Hrs)

Characteristics and choice of Transducer, Classification of Transducer: Primary & secondary, Passive & Active, Transducers & Inverse Transducers; Advantages of Electrical Transducers, Summery of factors influencing the choice of Transducers, Types of signals: Pneumatic signal, Hydraulic signal, Electric signal, Difference between sensors, transmitter and transducer.

Unit – II: Displacement, Position and Motion Sensor (06 Hrs)

Principles of variable resistance, variable inductance, variable reluctance, variable capacitance type sensors, Position and Motion sensor : Limit switches, proximity sensors, optical proximity sensor, ultrasonic proximity sensor

LVDT & RVDT: Construction, working principle, Advantages and Disadvantages

Hall Sensor: Working principle, Hall Effect gear tooth sensor

Accelerometer: Definition, General Construction, Working principle, types of accelerometer

Unit – III: Temperature Sensors (06 Hrs)

Mechanical and resistance type temperature sensors, Thermistors: Construction of Thermistors, resistance temperature characteristics of thermistors, voltage current and current time characteristics of thermistors, salient features of thermistors

Thermocouple: Construction of thermocouple, Measurement of thermocouple output, Compensation circuit, reference junction compensation, Optical pyrometer

Unit – IV: Strain Gauge and Pressure Sensor (06 Hrs)

Strain Gauge: Working principle, construction, piezo resistance co-efficient; Types of strain gauge: bonded, unbounded, semiconductor; Strain gauge measurement: Wheatstone bridge measurement

Pressure Sensor: Classification of pressure, Pressure measurement methods: inductive type, capacitance type, strain gauge type, reluctance type, piezoelectric pressure transducer

Unit - V:

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

Ref. Books:

1. A K Ghosh: Introduction to Instrumentation and Control, Prentice Hall of India, New Delhi 2004.
2. A K Sawhney: A course on electrical and electronic measurements and instrumentation, Dhanpat Raj & Co, 2005
3. D Patranabis: Principle of Industrial Instrumentation, Tata McGraw-Hill, New Delhi 2004
4. John P.Bentley: Principles of measurement systems, 3rd edition, Addison Wesley Longman, 2000.
5. David A Bell: Electronic Instrumentation and measurement, Prentice Hall of India
6. M.M.S.Anand: Electronic instruments and instrumentation Technology, Prentice-Hall of India,2004.
7. Alan S.Morris: Principles of measurement and instrumentation, 2nd edition, Prentice-Hall of India,2004.
8. Ernest O. Doebelin: Measurement systems, 4th edition, Tata-McGraw Hill, 1990.
9. H.S.Kalsi-Electronic Instrumentation,3rd edition,2011

IAC - 113

Electric Drives

(02 credits – 50 marks)

Learning Objectives:

The course should enable the students to:

1. Make student to understand starting and braking of Drives.
2. Speed-torque characteristics of Drives
3. Chopper, Inverter, Cycloconverter and PWM based Control

Learning Outcomes:

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

1. Students will be able to understand how to select drive for specific application.
2. Students will able to understand speed controlling of Motors.

Unit – I: Introduction to Electrical Drives (06 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, Starting and Braking of Electric Drives

Unit – II: Control ofElectrical Drives (06 Hrs)

Control of electric Drives: Modes of operation. Closed-loop control of drives. Current-limit control. Closed-loop torque, and speed control. Speed and current sensing. Phase-locked-loop control.

Unit – III: DC Drive (06 Hrs)

DC Drive: Single phase half wave and full wave converter Drive, Three phase half wave and full wave converter Drive , Chopper fed DC Drive: Motoring Control, Two –quadrant Chopper Drives

Unit – IV: AC Drive (06 Hrs)

AC Drive : Inverter fed drive,single phase and three phase cycloconverters Operations in different modes and configurations, Stator voltage control, stator frequency control, Stator Current control, PWM based control

Unit - V:

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

Ref. Books :

1. Bimal.K. Bose, “Power Electronics and Variable frequency drives”, Standard Publishers Distributors, New Delhi, 2000
2. Murphy J.M.D, Turnbull, F.G, “Thyristor control of AC motor, Pergamon press, Oxford, 1988.
3. M. H. Rashid, "Power Electronics -Circuits, Devices and Applications", P.H.I Private Ltd. New Delhi, Second Edition, 1994
4. N. Mohan et.al. "Power Electronics-Converters, Applications and Design", John Wiley & Sons (Asia) Private Ltd., Singapore, 1996
5. Bimal K Bose, “ Modern Power Electronics and AC Drives” PHI
6. R. Krishnan, “Electric motor drives: modeling, analysis and control, Pearson
7. Dubey G.K. “Power Semiconductor controlled drives”, Prentice Hall inc, A division of Simon and Schester England cliffs, New Jersey 1989.
8. Sheperal, Wand Hully, L.N. “Power Electronic and Motor control” Cambridge University Press Cambridge 1987
9. Dewan,S. Slemon B., Straughen,A. G.R., “Power Semiconductor drives”, John Wiley and Sons, NewYork 1984.
10. Dr. P.S. Bhimbra,”Power Electronics”, Khanna Publishers,2012

IAF – 120

Embedded Systems Design

(02 credits – 50 marks)

Learning Objectives:

The course should enable students:

1. To understand the architecture of 8051
2. To expand knowledge on Interfacing Digital Input and Output.
3. To develop expertise on Interfacing the Analog input and output.

Learning Outcomes:

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

Apply 8051 for developing real time platforms to address industrial application challenges

Unit - I: Introduction (05 Hrs)

Introduction, Microcontroller and embedded processors, Overview of 8051 family, 8051 Architecture, PSW registers, register bank and stacks, addressing modes, introduction to the use of assemblers and simulators.

Unit - II: Arithmetic, Logic Instructions and Assembly language program (08 Hrs)

Jump, loop and call instructions, Addressing modes, arithmetic instructions, logical instructions,Assembly language programs,introduction to timers and counters.

Unit - III: Real World Interfacing - I (06 Hrs)

Interfacing of - LCD, Keyboard, ADC (Parallel and Serial), DAC; Analog and Digital Sensor; Case Studies

Unit - IV: Real world interfacing– II (06 Hrs)

Interfacing of - External Memory, RTC, Stepper Motor, DC motor, Speed control of motors; Case studies

Unit - V:

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

Ref. Books:

1. Muhammad Ali Mazidi, J. G. Mazidi and Rolin D. McKinlay – The 8051 Microcontroller and Embedded Systems - Pearson, 2nd edition 2013
2. 8051 Architecture, Programming and Interfacing- K.J. Ayala; Penram International
3. John B. Peat Man- Design with Microcontroller, Pearson Edition Asia, 1998
4. Burns, Alan and Wellings, Andy, Real Time Systemand Programming Languages, 2nd edition 2013, Harlow: Addison- Wesley
5. Frank Wahid - Embedded Systems
6. Raj Kamal -Embedded Systems

IAF - 121

Programmable Logic Controllers

(02 credits – 50 marks)

Learning Objectives:

The course should enable students:

1. To gain generic operational knowledge of PLCs
2. To gain proficiency in ladder diagram development from real time system description

Learning Outcomes:

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

Apply PLCs for automation of real time processes

Unit – I: PLC fundamentals **(06 Hrs)**

Overview of PLC systems,input/output modules, power supplies, isolators, rack assembly, PLC programming units, Input and Output devices for PLC based systems; Relay ladder logic Circuits, Conceptualization of ladder diagram.

Unit – II: PLC Functions – I **(06 Hrs)**

General PLC programming procedures; Addressing, Relationship of Data File addresses to I/O modules; Language of ladder diagram, programming on-off inputs/ outputs; Auxiliary commands and functions: PLC Basic Functions: Register basics, timer functions, counter functions.

Unit - III: PLC Functions - II **(06 Hrs)**

Arithmetic functions, number comparison functions, Skip and MCR functions, data manipulation functions; PLC Advanced intermediate functions: Utilizing digital bits, sequencer functions, matrix functions.

Unit – IV: PLC Advanced Functions and Applications **(06 Hrs)**

PLC advanced functions: Alternate programming languages, analog PLC operation, networking of PLC, PLC -PID functions; PLC installation, troubleshooting and maintenance, design of interlocks and alarms using PLC. Creating ladder diagrams from real time system descriptions.

Unit - V:

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

Ref. Books:

1. J. W. Webb, R. A. Reis – Programmable Logic Controllers: Principles and Applications- PHI, New Delhi, 2013
2. W. Bolton – Programmable Logic Controllers – Elsevier, UK, 2006
3. J. R. Hackworth, F. D. Hackworth Jr- Programmable Logic Controllers: Programming Methods and Applications – Pearson, New Delhi, 2004
4. F. Petruzella – Programmable Logic Controllers – MGH, UK, 2014
5. G. D. Anderson – PLC programming using RSLogix 500: Ladder Logic Diagonistics and Trobleshooting (Vol 1-3)

CF 101

Research Methodology

(01 credits – 50 marks)

Learning Objectives:

The course should enable students:

1. to define research and describe the research process and research methods
2. to understand qualitative research and methods used to execute and validate qualitative research
3. to know how to apply the basic aspects of the research process in order to plan and execute a research project.
4. to provide insight into the processes that lead to the publishing of research.
5. to be able to present, review and publish scientific articles

Learning Outcomes:

Students will be able to -

1. do systematic literature survey, formulation of a research topic, study design, analysis and interpretation of data.
2. to design a research approach for a specific research issue of their choice.
3. select a suitable analytical method for a specific research approach.
4. demonstrate a good understanding of how to write a research report.
5. critically assess published quantitative research with regard to the statistical methods and approaches adopted

Course Contents:

Unit I : Research Fundamentals:

Introduction: Definition, objectives of the research, characteristics of the research, what makes people to do research, importance of research**,**

Unit II : Identification of Research Problem :

Defining the research problem: Identification of research problems, selection of research problem, facts one should know regarding selection of research problem, the process of research problem definition, some facts involved in defining research problem

Unit III : Formulation of Research Problem :

Formulation of the problems: steps involved in defining a problem, formulation of the problems, Formulation of hypothesis: Concept of hypothesis, hypothesis testing, Developing the research plan: implementation, interpreting and reporting the findings, Importance of hypothesis of in decision making.

Unit IV : Research Report and Proposal Writing :

Introduction, research proposal writing: costing, the research proposal, rationale for the study, research objectives, research methodology, target respondents, research Centres, sample size and sample composition, sampling procedures, research project execution, research units; An insight into research report and proposal, research project synopsis, research report writing : types of research reports, guidelines for writing reports; Steps in writing report, report presentation, typing the report, documentation and bibliography, formatting guidelines for writing a good research report / research paper.

References:

1. Research Methodology by Dr. S. L. Gupta, Hitesh Gupta; International Book House Pvt Ltd **(2013),** ISBN-10: 8191064278, ISBN-13: 978-8191064278
2. Basic Research Methods-Gerard Guthrie SAGE Publications, India, Pvt Ltd, New Delhi **(2010),** ISBN-10: 8132104579, ISBN-13: 978-8132104575
3. Research Methodology-methods and techniques By C. R. Kothari, New Age International Publishers **(2011)** ISBN 978-81-224-1522-3
4. Principles of Research Methodology- Phyllis G. Supino, Jeffrey S. Borer; Springer, Verlag New York **(2012),** ISBN-ebook: 1461433592, ISBN (Hardcover): 978-1461433590
5. Research Design Qualitative, Quantitative. and Mixed Methods Approaches- John W. Creswell; SAGE Publications Ltd, UK **(2011),** ISBN-9780857023452
6. Research Methodology -A Step-by-Step Guide for Beginners- Ranjit Kumar; Sage Publications Ltd **(2010)**, ISBN- 1849203016.
7. Scientific Writing and Communication- Angelika Hofmann; Oxford University Press, US **(2010),** ISBN-13-: 978-0 199947560, ISBN-10: 01 99947562
8. Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded- Joshua Schimel, Oxford University Press, **(2011)**, ISBN: 9780199760237
9. Handbook of Scientific Proposal Writing- A.Yavuz Oruc; CRC Press, Taylor & Francis group **(2011)**, ISBN: 9781439869185

EF 130
Operations Management

(02 credits – 50 marks)

Learning Objective

The course should enable students to:

1. Understand the role of operations management in organizations
2. Differentiate between strategic and tactical operations decisions
3. Describe the key operations management decisions faced by managers
4. Understand three of the most important operations management practices: Total Quality Management, Supply Chain Management, and Just-in-Time/Lean Operations

Learning Outcomes

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

1. Define 'operations' and 'operations management'
2. Identify the roles and responsibilities of operations managers in different organizational contexts
3. Apply the 'transformation model' to identify the inputs, transformation processes and outputs of an organization
4. Identify operational and administrative processes
5. Describe the boundaries of an operations system, and recognize its interfaces with other Functional areas within the organization and with its external environment

Course Contents:

Unit – I:Introduction to Operations Management (06 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.

Unit- II:Product Development Cycle (06 Hrs)

Product Decision and Analysis, Product Development, Process Selection, Process Design, Process

Analysis, Process-Product Matrix, Evolution of Production Systems, Batch Sizing-Models-Optimization

Unit- III: Layout and Management of Operation (06 Hrs)

Facility Location, Facility Layout, Capacity Planning, Capacity Decisions, Waiting Lines, Demand Management-models, Resource Planning-models, Total Quality Management, Supply ChainManagement and Just-in-Time/Lean Operations

Unit- IV: Planning and Management (06 Hrs)

Aggregate Planning, Basics of MRP / ERP**,** Basics of Scheduling**,** Basics of Project Management,Basics of Work Study, Job Design and Work Measurement**,** Basics of ISO 14000 / 9000, Basics ofValue Engineering & Analysis

Unit- V:
Presentation's, case studies, Assignments, Tutorials based on Module I to IV

Ref. Books:

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 – Kanishka Bedi – Oxford
8. Production & operation Management – R.C. Manocha
9. Production & operation Management – Muhlemann

EF-131

Materials Management

(02 credits – 50 marks)

Learning Objectives
The course should enable students to:

1. To widen the knowledge of materials management , its types and material Handling
2. Understand the role of purchasing, Negotiations etc
3. Understand the important practices – MRP, demand and supply of material, price costing, import procedure etc.

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

1. Define Materials and its Management
2. Identify Integrated Approach to Materials Management
3. Understand in International procurement-Imports

Course Contents:

Unit – I: Materials Management an overview (06 Hrs)

Introduction, Importance of Materials Management, Objectives of Materials Management, Costs involved in the Management of Materials, Integrated approach to Materials Management, organizing Materials Management, Organization based on Commodities, Organization based on Location, Organization based on function, Inter-departmental relationships, Centralized versus Decentralized materials management.

Unit- II: Materials Planning (06 Hrs)
Introduction and factors influencing materials planning, Techniques of materials planning, Bill-of-Materials, Materials Requirement Planning (MRP), Past Consumption Analysis Technique, Moving Average method, Exponential Smoothing.

Unit- III: Purchasing (06 Hrs)

Purchasing principles, policies, procedures and practices, Objectives, scope, responsibility and limitations, Sources of supply and Supplier selection, Vendor development-evaluation and rating,

Price forecasting, Price-cost analysis, Negotiations, Reciprocity, Legal aspects of purchasing, Purchase orders/ contracts, Method of buying- under certainty, under risk, and under uncertainty

Unit- IV: International procurement-Imports. (06 Hrs)

International commercial terms, Import procedures and documentation, Categories of importers, Identification of foreign sources, Payment terms including Letter of credit, Types of L/Cs, Custom tariff, Custom clearance, Bill of Lading and other documents.

Unit- V:

Presentation's, case studies, Assignments, Tutorials based on Module I to IV

Ref.Books:

1. Materials and Logistics Management By Prof. L.C. Jhamb (Everest Publishing House, Pune).
2. Purchasing and Materials Management By P.Gopalkrishnan (Tata McGraw Hill, New Delhi).
3. Materials Management –An integrated approach By P.Gopalkrishnan and M. Sundaresan (Prentice-Hall India, New Delhi).
4. Materials Management-Procedures, Text and Cases By A.K. Datta (Prentice-Hall India, NewDelhi).
5. Introduction to Materials Management By JR Tony Arnold and Stephan Chapman (Pearson Education, New Delhi) 2004 Fifth Edition.
6. Purchasing and Materials Management By N.K.Nair (Vikas Publishing House, New Delhi)

IALC - 140

Electronic Systems Lab

(1.5 credits – 50 marks)

List of Experiments: (Any 5 experiments are to be performed)

1. Study of Instrumentation amplifier
2. Study oflog/antilog amplifier
3. Study of window comparator
4. Study ofPhase shift/ Wien bridge oscillator
5. Study of typical monolithic frequency synthesizer
6. Study of voltage controlled oscillator
7. Study of fundamental digital counters
8. Study ofindustry standard event counter
9. Study of industry standard programmable timer (analog and digital)
10. Study of filters (any one pertinent to theory course)

IALC - 141

Power Electronics Lab

(1.5 credits – 50 marks)

List of Experiments: (Any 5 experiments are to be performed)

1. Study of Buck Converter
2. Study of Boost Converter
3. Study of Flyback Converter
4. Study of Forward Converter
5. Study ofsingle phase inverter with R load
6. Study ofsingle phase inverter with RL load
7. Study of PWM converter
8. Study of series inverter
9. Study of parallel inverter
10. Study of zero voltage switching
11. Study of single phase cycloconverter with R load
12. Study of single phase cycloconverter with RL load
13. Study of single phase AC voltage control scheme (any one pertinent to theory course)

IALC - 142

Instrumentation Lab

(1.5 credits – 50 marks)

List of Experiments: (Any 5 experiments are to be performed)

1. Study of Resistive Transducer
2. Study of Inductive Transducer
3. Study of Differential Output Transducer (LVDT)
4. Study of optical rotary encoder for speed measurement
5. Study of optical angle encoder for position measurement
6. Study of Capacitive Transducer
7. Study of RTD
8. Study of Photo Electric Transducer
9. Study of Pressure Cell
10. Study of Piezo Electric Transducer
11. Study of Optical fiber Transducer

IALC - 143

Electric Drives lab

(1.5 credits – 50 marks)

List of Experiments: (Any 5 experiments are to be performed)

1. To study single phase converter using RAMP Comparator
2. To study three phase converter using RAMP Comparator
3. To study operation of single phase cycloconverter AC Drive
4. To study operation of three phase cycloconverter AC Drive
5. To study single phase PWM based AC Drive
6. To study three phase PWM based AC Drive
7. To study thyristors based DC motor drive
8. Study of Industry grade VFD for motor control (ABB/Danfoss/Siemens)

IALF - 150

Embedded Systems Lab

(1.5 credits – 50 marks)

List of Experiments:

Every student should build at least 02 individual projects by implementing interface of 8051 with devices pertinent to theory course. Each project should invariably include at least two devices that should demonstrate clear operational correlation.

IALF - 151

PLC Lab

(1.5 credits – 50 marks)

List of Experiments:(Any 5 experiments are to be performed)

Allen Bradley platform to be employed

1. Develop ladder programming to implement (i)basic logic gates and (ii) sequencing operations employing timers (lamp output)
2. Develop ladder programming to implement counter operation (proximity sensor to be used as event indicator) for triggering an enunciator after a certain batch of count is over
3. Develop ladder programming to operate a conveyor based liquid vending station
4. To study operation of
5. Develop ladder programming to operate a density based traffic light arrangement
6. Develop ladder programming to operate an X-Y plotter
7. Develop ladder programming to address different sequence of operation in a real time batch process unit (should contain at least two liquid tanks as main storage, one mixing tank, stirrer, heater, liquid dispenser, conveyor based handling, liquid level indicators etc.).
8. Develop program for at least two real time industrial processes with ITS – PLC virtual platform

SEMESTER – II

IAC – 210

Communication Protocols for Instrumentation

(02 credits – 50 marks)

Learning Objectives

The course should enable students:

1. To widen the knowledge on Communication Protocols.
2. To learn about the Network Architectures.
3. To expand knowledge on Field Bus.
4. To enrich expertise on the commissioning of Industrial NetworksSystems

Learning Outcome

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

1. Explain the concept of communication model, OSI reference model, Recent Industry networks.
2. Classify the Network selection applicable for specific industrial needs.
3. Differentiate the Network Architecture and understand the concepts of Industrial protocols.
4. Design and install Field Bus oriented Industrial Communication Networks.

Course Contents:

Unit-I: Introduction and Communication Protocols (06 Hrs)

An Introduction to Networks in process automation: Information flow requirements, Hierarchical communication model, Data Communication basics, OSI reference model, Industry Network, Introduction to Communication Protocols: Communication basics, Network Classification, Device Networks, Control Networks.

Unit-II: Network Architectures (06 Hrs)

Proprietary and open networks: Network Architectures, Building blocks, Industry open protocols (RS-232C, RS- 422, and RS-485), Ethernet, Advantages and Limitations of Open networks, IEEE 1394

Unit-III: Field Bus **(06 Hrs)**

Field bus: Field bus Trends, Hardware selection, Field bus design, Installation, Documentation, Field bus advantages and limitations. HART: Introduction, Design, Installation, calibration, commissioning.

Unit-IV:Planning and Commissioning **(06 Hrs)**

Foundation Field bus & Profibus: Introduction, Design, Calibration, Commissioning, Application in Hazardous and Non-Hazardous area. Introduction to wireless Protocols: WPAN, Wi-Fi, Bluetooth, ZigBee, Z-wave.

Unit -V:

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

Ref. Books:

1. B.G. Liptak - Process Software and Digital Networks - CRC Press ISA-, 2002.
2. R. Bowden - HART Communications Protocol-Fisher-Rosemount, 2003.
3. A.S. Tanenbaum -Computer Networks - Pearson Education, 1996/PHI.
4. K. Kant – Computer based Process Control – New Age International, 1998

IAC - 211

Mechatronics

(02 credits – 50 marks)

Learning Objectives

The Course should enable studentsto

1. To equip students with knowledge of Mechatronics systems.
2. Learn various types of sensors and selection procedure
3. Learn about types of actuators used in mechatronics systems.
4. Mechatronics knowledge applied in practical situation.

Learning Outcomes

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

1. Develop an interdisciplinary understanding and integrated approach to engineering.
2. Select sensor for various applications.
3. Acquaint themselves with actuators used in mechatronics systems.
4. Understand real time applications and develop them.

Course Contents:

Unit – I: Introduction (06 Hrs)

Introduction to Mechatronics; Mechatronics Systems, Need for Mechatronics, Emerging area of Mechatronics, Classification of Mechatronics, Measurement Systems, Control Systems.

Unit– II: Sensors and Transducers (06 Hrs)

Performance Terminology in sensor technology; Potentiometers, LVDT, Capacitance sensors, Strain gauges, Eddy current sensor, Hall Effect sensor, Temperature sensors, Light sensors, Selection of sensors, Signal processing.

Unit– III: Actuators ***06 hrs***

Actuators: Mechanical, Electrical, Fluid Power, Piezoelectric, Magnetostrictive, Shape memory alloy, applications, selection of actuators.

Unit – IV: Design and Mechatronics Case Studies (06 Hrs)

Stages in mechatronics system design, Traditional and Mechatronics design concepts, Case studies of Mechatronics systems - Pick and place Robot, Conveyor based material handling system, PC based CNC drilling machine, Mechatronics Control in Automated Manufacturing

Unit -V:

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

Ref. Books:

1. Bolton.W – Mechatronics - Pearson education, second edition, fifth Indian Reprint, 2003
2. Smaili.A and Mrad.F - Mechatronics integrated technologies for intelligent machines - Oxford university press, 2008.
3. Devadas Shetty and Richard A.Kolk, - Mechatronics systems design - PWS Publishing Company, 2007.
4. Godfrey C. Onwubolu - Mechatronics Principles and Applications - Elsevier, 2006.
5. Nitaigour Premchand Mahalik -Mechatronics Principles, Concepts and Applications -Tata
6. McGraw-Hill Publishing Company Limited, 2003.
7. Michael B.Histand and Davis G. Alciatore - Introduction to Mechatronics and Measurement
8. Systems - McGraw Hill International edition, 1999.
9. Bradley D.A, Dawson.D, Buru N.C and Loader A.J – Mechatronics - Nelson Thornes Ltd, Eswar press, Indian print, 2004.

IAC - 212

Advanced Transducers

(02 credits – 50 marks)

Learning Objectives:

The course should enable students to:

1. The method of measurement is a comparison.
2. Learn flow and viscosity sensors
3. To gain knowledge of sensors in robotics

Learning Outcomes:

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

1. Measure, compare and find errors
2. Design Smart sensors and apply it in robotics

Course Contents:

Unit – I: Testing, Calibration and Error (06 Hrs)

Testing and calibration: Traceability. Measurement reliability. Calibration experiment and evaluation of results. Primary calibration. Secondary calibration. Direct calibration. Indirect calibration. Routine calibration. Calibration of a voltmeter, ammeter and an oscilloscope.Measurement Errors. Human Error. Systematic Error. Limiting and Random Errors.

Unit – II: Flow Sensors (06 Hrs)

Flow measurement: Introduction, definitions and Modules, classification of flow meters, Pitot tubes, orifice meters, venturi tubes, flow tubes, flow nozzles, positive displacement liquid meters and provers, positive displaceTesting and calibration ment gas flowmeters, variable area meters
Positive displacement type: Piston; oval gear, nutating disk and rotary vane types
Velocity meters: turbine, vortex shedding, electromagnetic and sonic design; head type flow meter, electromagnetic flow meter, rotameter, anemometer, ultrasonic flow meter

Unit – III: Viscosity Sensors (06 Hrs)

Measurement of viscosity: definition, units, Newtonian and Non-Newtonian behavior, Measurement of viscosity using laboratory viscometer, industrial viscometers,viscometer selection and application.
Measurement of density – definitions, units, liquid density measurement, gas densitometers – application and selection.

Unit – II: Smart Sensors and Sensors in Robotics (06 Hrs)

Smart Sensors: Methods of internal compensation, information coding, integrated sensor principles, present trends

Sensors in Robotics: Potentiometers, synchros and resolvers, optical encoder, tactile and proximity sensors, non-contact ranging sensors, ultrasonic transducers, opto-electronic sensors, geomagnetic sensors, gyroscopes; Different type of load cells and its application, Torque measurement.

Unit - V:

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

Ref. Books:

1. A K Ghosh: Introduction to Instrumentation and Control, Prentice Hall of India, New Delhi 2004.
2. A K Sawhney: A course on electrical and electronic measurements and instrumentation, Dhanpat Raj & Co, 2005
3. D Patranabis: Principle of Industrial Instrumentation, Tata McGraw-Hill, New Delhi 2004
4. John P.Bentley: Principles of measurement systems, 3rd edition, Addison Wesley Longman, 2000.
5. David A Bell: Electronic Instrumentation and measurement, Prentice Hall of India
6. M.M.S.Anand: Electronic instruments and instrumentation Technology, Prentice-Hall of India,2004.
7. Alan S.Morris: Principles of measurement and instrumentation, 2nd edition, Prentice-Hall of India,2004.
8. Ernest O. Doebelin: Measurement systems, 4th edition, Tata-McGraw Hill, 1990.
9. H.S.Kalsi-Electronic Instrumentation,3rd edition,2011

IAF - 220

Robotics

(02 credits – 50 marks)

Learning Objectives:
The course should enable students to:

1. Introduce the basic concepts, parts of robots and types of robots
2. Get introduced to basics to build robotic system.
3. Learn about the robotic kinematics and dynamics.
4. Learn about Robot Manipulators.
5. Write efficient programs on robot path planning

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

1. Understand Basic concepts, parts of Robots & types of Robots.
2. Understand basics to build robotic system.
3. Understand robot Kinematics and Dynamics.
4. Understand Robot Manipulators.
5. Execute and design a robot for any application.

Course Contents:

Unit – I: Introduction (06 Hrs)

Specifications of Robots, Classifications of robots, Laws of Robotics, Flexible automation versus Robotic technology, Applications of Robots

Unit – II: Robot Kinematics And Dynamics (06 Hrs)

Positions, Orientations and frames, Mappings: Changing descriptions from frame to frame, Operators: Translations, Rotations and Transformations, Transformation Arithmetic, D-H Representation, Forward and inverse Kinematics, Robot Arm dynamics

Unit - III: Manipulators (06 Hrs)

Construction of Manipulators, Manipulator Dynamic and Force Control, Electronic and Pneumatic manipulators, Classification of End effectors (Tools as end effectors), Drive system for grippers(Mechanical, adhesive, vacuum, magnetic, grippers), Hooks & scoops, Gripper force analysis and gripper design, Active and passive grippers.

Unit - IV: Path Planning &Programming (06 Hrs)

Trajectory planning and avoidance of obstacles, path planning, skew motion, joint integrated motion, straight line motion, Robot Programming

Unit -V:

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

Ref. Books:

1. S. R. Deb and S. Deb, 'Robotics Technology and Flexible Automation', Tata McGraw Hill Education Pvt. Ltd, 2010.
2. John J.Craig , "Introduction to Robotics", Pearson, 2009.
3. Mikell P. Groover et. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, New York, 2008.
4. Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Eastern Economy Edition, Prentice Hall of India P Ltd., 2006.
5. Fu K S, Gonzalez R C, Lee C.S.G, "Robotics : Control, Sensing, Vision and Intelligence", McGraw Hill, 1987

IAF - 221

Process Control

(02 credits – 50 marks)

Learning Objectives:
The course should enable students to:

1. Introduce fundamentals of Process Modelling, their design and operation.
2. Learn about Controller Characteristics.
3. Study of Control systems with Multiple loops.
4. Learn different Process loop tuning techniques.

Learning Outcomes:
After completion of the course, students are expected to have knowledge of:

1. Process Modelling Fundamentals.
2. Characteristics of Controller.
3. Control systems with Multiple loops.
4. Different Process loop and tuning techniques.

Course Contents:

Unit – I: Modelling of processes **(08 Hrs)**

Need for Process Control, Mathematical model of first order liquid and thermal processes, Processes with dead time, Processes with inverse response, Interacting and non-interacting systems, Continuous and batch processes, Servo and regulator operation

Unit– II:Controller Characteristics **(05 Hrs)**

Basic control action, Characteristics of ON-OFF, Proportional, Integral and Derivative Control Modes, Composite Control Modes, Electronic controllers to realize various control actions

Unit– III: Control Systems with Multiple Loops **(07 Hrs)**

Control system configurations; Cascade control, Feed forward control, Ratio Control, Selective Control system; Split Range Control, Adaptive and Inferential Control,

Unit – IV: Process Loop tuning (**06 Hrs)**

Evaluation criteria in control systems Quality, IAE, ISE, ITAE and ¼ decay ratio,; Process loop tuning- Open loop transient Response method, Ziegler – Nichols method, Cohencoon method, Damped oscillations method

Unit -V:

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

Ref. Books:

1. D. P. Eckman – Automatic Process Control – Wiley Eastern Ltd., New Delhi, 1993
2. G. Stephanopoulis – Chemical Process Control- PHI, New Delhi, 1990
3. B. G. Liptak – Process Control – Chilton Book Company, 1994
4. C. D. Johnson – Process Control Instrumentation Technology – 7^{th} edition, Pearson Education, New Delhi, 2002
5. J. G. Balchen, K. J. Mumme – Process Control Structures and Application – Van Nostrand Reinhold Co., New York, 1988

IAF - 222

Industrial Automation

(02 credits – 50 marks)

Learning Objectives:

The course should enable the students to:

1. Understand concepts of Industrial Automation.
2. Understand various Automation techniques used.
3. Understand Flexible Manufacturing Automation.
4. Understand Performance evaluation of System.

Learning Outcomes:

After completion of the course, students are expected to have knowledge of:

1. Explain the requirements of modern day industries.
2. Differentiate between High Volume Manufacturing Automation and Flexible Manufacturing Automation.
3. Know performance evaluation system.

Course Contents:

Unit – I: Introduction **(06 Hrs)**

Automated production system, Mechanization and automation, Types of automation, Automationstrategies, Economics of automation, Review of actuation devices used in automated systems

Unit – II: High Volume Manufacturing Automation **(06 Hrs)**

Classification and type of automatic transfer machines; Automation in part handling and feeding, Analysis of automated flow lines, design of single model, multimodel and mixed model productionlines.

Unit – III: Flexible Manufacturing Concepts **(04 Hrs)**

Introduction to Group Technology, Grouping methods, Cell Design, Flexible manufacturing system.

Unit – IV: Flexible Manufacturing Automation **(08 Hrs)**

Assembly Automation: Assembly systems, Automatic transfer, feeding and orienting devices,Flexible assembly systems, AS/RS, Performance evaluation and economics of assembly systems.

Unit -V:

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

Ref. Books:

1. M. P. Groover- Automation, Production System & Computer Integrated Manufacturing -PHI, New Delhi, 2001
2. Malov and Ivanov - Principles of Automation & Automated Production Process - Mir Publications, Moscow
3. Oates and Georgy - Automation in Production Engineering - Newness Publications
4. Buzacott& Shanty Kumar - Stochastic Models of Manufacturing Systems – PHI, New Delhi
5. W. Bolton – Mechatronics – Pearson Education, 1999
6. J. Boothroyd, P. Dewhurst, W. A. Knight – Product Design for Manufacture and assembly –CRC press, 2011

IALC - 230

Industrial Networking Lab

(1.5 credits – 50 marks)

List of Experiments: (Any 4 protocols are to be studied)

1. Study of 7 Layer OSI reference model
2. Study of Industry open protocol – RS 232
3. Study of IEEE 1394 protocol
4. Study of Bluetooth Technology
5. Study of Zigbee Technology
6. Study of Ethernet protocol
7. Study of Fieldbus Protocol
8. Study of profibus protocol

IALC - 231

Mechatronics Lab

(1.5 credits – 50 marks)

List of Experiments: (Any 5 experiments are to be performed)

1. Study of LVDT as displacement Sensor
2. Study of Strain Gauge as analog/digital balance
3. Study of Hall effect sensor as an event counter
4. Study of Stepper Motor
5. Study of BLDC
6. Study of Spring Mass system
7. Study of Hydraulic/Pneumatic Cylinders
8. Study of Hydraulic/Pneumatic Motors
9. Study of PC based CNC Drill Machine
10. Study of Automatic door closing and opening arrangement (PLC/PC/microcontroller based)
11. Study of user defined 2/3 floor elevator module (PLC/PC/microcontroller based)

IALC - 232

Instrumentation Lab-II

(1.5 credits – 50 marks)

List of Experiments: (Any 5 experiments are to be performed)

1. Study of Calibration of Bourdon Gauge using dead weight tester
2. Determination of discharge coefficient using Orifice Meter
3. Study of Calibration of Rota-meter
4. Study and calibration of Differential pressure transmitter
5. Study of water level measurement by Capacitive method/ Bubble purge method/ Contact method
6. Instrumentation tutor for Flow meter calibration.
7. Measurement of viscosity.
8. Measurement of temperature by using Thermocouple.
9. Study of water and air flow meter
10. Study of optical encoder
11. Study of Ultrasonic transducer.
12. Study of Differential flow measurement

IALF - 240

Robotics Lab

(1.5 credits – 50 marks)

List of Experiments: (Any 5 experiments are to be performed)

1. Study of components of robots with drive system and end effectors
2. Study of different types of robots based on configuration and application
3. Study of different type of links and joints used in robots
4. Programming exercises with moving Robotic arm platform for sorting/ batching/ stacking applications
5. Robot Programming exercises for line following and obstacle avoiding applications
6. Robot programming exercises for Pick and place operation on same plane
7. Robot programming exercises for Pick and place operation on orthogonal plane

IALF - 241

Process Control Lab

(1.5 credits – 50 marks)

List Of Experiments: (Any 5 experiments are to be performed)

1. Study of interacting and non-interacting system.
2. Response of different order processes with and without transportation lag
3. Response of P+I+D Controller
4. Study of Closed loop response of flow control loop
5. Study of Closed loop response of level control loop
6. Study of Closed loop response of temperature control loop
7. Study of Closed loop response of pressure control loop
8. Tuning of PID Controller
9. Response of Cascade Control System

IALF - 242

Industrial Automation Lab

(1.5 credits – 50 marks)

List Of Experiments:(Any 3 experiments are to be performed with expt. 7 as compulsory)

1. Study of Conveyor based material handling
2. Study of pick and place operation
3. Study of gravity based feed station
4. Study of linear transfer mechanism
5. Study of Rotary Indexing Platform
6. Study of AS/RS System
7. Study of a Modular FMS System

IAR – 250

Research/Industrial Project (Phase-I)

(5 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 –

(i) build up a concrete fundamental of the concept on which they are going to work,

(ii) carry out thorough literature survey to find out scope of work in the particular field,

(iii) thereby, finalizing the topic of further study/investigation

(iv) and finally, draft a systematic experimental plan to achieve projected goal

(v) deliver regular presentations

(vi) 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

Course Structure

M. Voc. (Automobile Technology)

Semester	Paper Code	Paper Title	Contact Hrs / Week	Credits
Semester I	**CC 100**	Constitution of India	2	2
	ATF 121	Automotive Engines	2	2
	ATF122	Automotive Transmission Systems	2	2
	ATF 123	Fuels and Combustion	2	2
	ATC 124	Automobile Control Systems	2	2
	ATC 125	Automobile Engine Components Design	2	2
	ATC 126	Automobile Air Conditioning	2	2
	CF 101	Research Methodology	1	1
	EF 1XX	Elective Foundation (Any One) ▪ Operations Management (EF 130) ▪ Materials management (EF 131)	2	2
	ATLF 127	Laboratory Coursework based on Automobile Engines and Engine Design (Auto-CAD)	6	3
	ATLF 128	Laboratory Coursework based on Automotive Transmission Systems	3	1.5
	ATLF 129	Laboratory Coursework based on Fuels and Combustion	3	1.5
	ATLC 130	Laboratory Coursework based on Automobile Control Systems	3	1.5
	ATLC 131	Laboratory Coursework based on Automobile Air Conditioning	3	1.5
	Assignments/Tutorials will remain integral part of all courses			
		Total Credits for Semester – I		**26**

Semester	Paper Code	Paper Title	Contact Hrs/Week	Credits
Semester II	**ATF 221**	Transmission System Design	2	2
	ATF 222	Automobile Systems Design	2	2
	ATF 223	Hydraulic and Pneumatic Systems	2	2
	ATF 224	Noise and Vibration	2	2
	ATC 225	Automobile Body Engineering	2	2
	ATC 226	Vehicle Dynamics	2	2
	ATLF 227	Laboratory Coursework based on Hydraulic and Pneumatic Systems	3	1.5
	ATLF 228	Laboratory Coursework based on Noise and Vibration	3	1.5
	ATLC 229	Laboratory Coursework based on Solid Modeling	6	3

	ATLC 230	Laboratory Coursework based on Automobile Body Engineering	3	1.5
	ATLC 231	Laboratory Coursework based on Automotive Electrical system diagnosis	3	1.5
	ATR 232	Research/ Industrial Project – Phase I (Review of Literature/ Industrial Orientation, Formulation of Topic, Experimental Plan)	10	5
	Assignments/Tutorials will remain integral part of all courses			
			Total Credits for Semester – II	**26**

Semester	**Paper Code**	**Paper Title**	**Contact Hrs/Week**	**Credits**
Semester III	**ATC 321**	Vehicle Testing	2	2
	ATC 322	Transport Management	2	2
	ATGE 32X	Generic Elective – I	2	2
	ATGE 32X$_1$	Generic Elective – II	2	2
	ATOE 32X$_2$	Open Elective -I	2	2
	ATLC 332	Laboratory Coursework based on Vehicle Testing	3	1.5
	ATLC 333	Laboratory Coursework based on Wheel Balancing and Wheel Alignment	3	1.5
	ATLE 33X$_L$	Laboratory Coursework based on Generic Elective - I	3	1.5
	ATLE 33X$_{1L}$	Laboratory Coursework based on Generic Elective - II	3	1.5
	ATR 340	Research/ Industrial Project – Phase II (Experimental Work)	18	9
	Assignments/Tutorials will remain integral part of all courses			
			Total Credits for Semester – III	**25**

Semester	**Paper Code**	**Paper Title**	**Contact Hrs/Week**	**Credits**
Semester IV	**ATGE 42X**	Generic Elective - III	2	2
	ATGE 42X$_1$	Open Elective - II	2	2
	ATLE 42X$_2$	Laboratory Coursework based on Generic Elective - III	3	1.5
	ATR 430	Research/ Industrial Project – Phase III (Experimental Work Continued, Organization and Interpretation of Result, Dissertation, Presentation)	39	19.5
	Assignments/Tutorials will remain integral part of all courses			
			Total Credits for Semester – IV	**25**

Electives for Semester – III

(Any four theory paper along with corresponding lab course have to be chosen from generic electives)
(Any one theory paper along with corresponding lab course have to be chosen from open electives)

	Paper Code	Paper Title		Paper Code	Paper Title
Generic Elective-I	**ATGE 323**	Automotive Maintenance & Management	**Generic Elective-I (Lab)**	**ATLE 334**	Laboratory Coursework based on Automotive Maintenance & Management
	ATGE 324	Finite Element Methods		**ATLE 335**	Laboratory Coursework based on Finite Element Methods
	ATGE 325	Vehicle Aerodynamics and Design		**ATLE 336**	Laboratory Coursework based on Vehicle Aerodynamics and Design
Generic	**ATGE 326**	Autotronics	**Generic Elective-II (Lab)**	**ATLE 337**	Laboratory Coursework based on Autotronics
	ATGE 327	Automotive Metallurgy		**ATLE 338**	Laboratory Coursework based on Automotive Metallurgy
	ATGE 328	Special Purpose Vehicles		**ATLE 339**	Laboratory Coursework based on Special Purpose Vehicles
Open	**ATOE 329**	Robotics			
	ATOE 330	CNC Technology			
	ATOE 331	Automated and Computer Integrated Manufacturing			

Electives for Semester – IV

(Any one theory paper along with corresponding lab course have to be chosen from generic electives)
(Any one theory paper along with corresponding lab course have to be chosen from open electives)

	Paper Code	Paper Title		Paper Code	Paper Title
Generic Elective-III	**ATGE 421**	Automotive Emission and Controls	**Generic Elective-III (Lab)**	**ATLE 427**	Laboratory Coursework based on Automotive Emission and Controls
	ATGE 422	Hybrid Vehicles		**ATLE 428**	Laboratory Coursework based on Hybrid Vehicles
	ATGE 423	Automotive Safety		**ATLE 429**	Laboratory Coursework based on Automotive Safety
Open Elective-	**ATOE 424**	Applied Hydraulics and Pneumatics			
	ATOE 425	Industrial Robotics			
	ATOE 426	Advanced Electrical Drives			

SEMESTER – I

ATF 121

Automotive Engines

(02 credits – 50 marks)

Learning Objectives:

1. To penetrate deep into engine classification, construction and operation of I.C. engines with latest technologies.
2. Understand the performance parameters and testing methodologies.

Learning Outcomes:

1. Differentiate the fuel dynamics for SI and CI engines and define the key terms like Supercharging, Turbocharging.
2. To get acquainted with the latest technologies.

Course Content:

Module-I: Introduction to Engines (05 Hrs)

Introduction, Carnot cycle, Classification, I.C. Engines, Otto cycle, Diesel cycle, Flywheel, performance parameters, Brake Power, Indicated Power, Zeroth law of thermodynamics, First law of thermodynamics, Second law of thermodynamics, Fuel-Air cycles, numerical on performance parameters.

Module- II: Petrol Engines (07 Hrs)

Engine Construction and Operation: Constructional details of 4-stroke petrol engine. Working principle, actual indicator diagram, Firing order and its significance, Two Stroke Engines: Terminologies and definitions, Theoretical scavenging methods. Effect of operating variables: Compression Ratio, Fuel- Air Ratio, Ignition system, Combustion in petrol engine, morse test, motoring test, willans line method

Module- III: Diesel Engines (07 Hrs)

Engine construction and operation. Two stroke and four stroke diesel engines. Fuel-air and actual cycle analysis. Diesel fuel, Ignition quality, fuel injection systems, supercharging, turbo charging, Diesel Engine Testing and Performance: Automotive and stationary diesel engine testing, Performance characteristics. Variables affecting engine performance. Methods to improve engine performance. Heat balance.

Module- IV Advanced Engines (05 Hrs)

Need of advancement in engine, Common Rail Direct Injection Engine, Multi point fuel injection engine, Gasoline Direct Injection engine, Lean burn engines, Homogeneous charge compression ignition engine, variable compression ratio engine, Wankel Engine.

Module -V Tutorials, case studies and presentation based on Module I to IV (06 Hrs)

References:

10. Internal Combustion Engines, Ganesan.V, Tata McGraw Hill Publishing Co., New York, 4th Edition (2012), *ISBN*-0-07-049457-6.
11. High Speed Combustion Engines, Heldt.P.M, Oxford Publishing Co., New York, (1990).
12. Automotive Engines, William H. Crouse (Author), Donald Anglin (Author), Donald L. Anglin, McGraw-Hill Education (ISE Editions); (1994), ISBN-10: 0071138846, ISBN-13: 978-0071138840.
13. Automotive Engines, Ellinger.H.E, Prentice Hall Publishers (1992).
14. Diesel Engine Operation and Maintenance, Maleev.V.M, McGraw Hill (1974)
15. Dicksee.C.B, Diesel Engines, Blackie & Son Ltd., London (1964)

ATF 122

Automotive Transmission Systems

(02 credits – 50 marks)

Learning Objective:

1. To impart knowledge about the critical importance of the transmission system in an automobile
2. To create awareness about the evolution, components involved and different types of transmission system widely used in automobiles.

Learning Outcomes:

1. Differentiate various types of gearbox, its working, Analyse gear ratios for various types of gear boxes for real time applications
2. Be familiar with epicyclic gear trains, its types, operations, merits & demerits.

Course Content:

Module-I: Clutch (05 Hrs)

Need for Transmission system, Tractive Effort and Resistances to Motion of a vehicle, Requirements of transmission system, Classification of Transmission systems, Multi axle drives, Clutch principle and constructional details, types of clutches, Modes of operating a clutch – mechanical, hydraulic and Electric, Automatic Clutch, Over-running clutch, numerical on power transmission of clutch.

Module – II: Gearbox (07 Hrs)

Determination of gear ratios for vehicles, Performance characteristics in different speeds, Different types of gear boxes – sliding, constant and synchromesh type, Need for double declutching and working of synchronizing unit, Power and economy modes in gearbox. Transfer box. Transaxles. Overdrives. Gear shifting mechanisms, Torque convertor, Automatic transmission with intelligent electronic control system.

Module – III: Propeller Shaft and Differential Drive (05 Hrs)

Introduction, propeller shaft, types of propeller shafts, Universal joint, Slip joint, Two yokes and Spider Universal joint, Final drive, Differential, Arrangements of differential, Backlash, Rear axle, Rear axle drives: Hotchkiss drive, Torque tube drive, Rear axle shaft supporting: Semi-floating axle, Full- Floating axle, Three quarter floating axle, Rear axle casing, Lubrication of rear axle.

Module – IV: Wheel and Tyres (07 Hrs)

Types of wheels, Desirable tyre properties, types of tyre, Carcass type, tyre materials, tyre designation, Consideration in tread design, Wheel and tyre trouble shooting, tyre designations, tyre manufacture, factors affecting tyre life, tyre wear indicators.

Module – V: Tutorials, Case studies and presentation based on Module I to IV (06 Hrs)

References:

1. *Motor Vehicle* by Garrett, T. K. *Newton*, K. and *Steeds*, W., Butterworth London,, 13th Edition, (2005), *ISBN*- 10: 1560918985 *ISBN*- 13: 9781560918981 .
2. Judge.A.W., " Modern Transmission systems ", Chapman and Hall Ltd (1969), ISBN-13: 9780412094507.
3. Crouse. W.H., Anglin., D.L., "Automotive Transmission and Power Trains construction Tata McGraw -Hill Publishing Co.
4. Design Practices, passenger Car Automotive Transmissions- SAE Hand book.
5. Kirpal Singh, "Automobile Engineering Vol-1", Standard Publications (2007), ISBN-10 8180140997 ISBN-13 9788180140990

ATF 123

Fuels and Combustion

(02 credits – 50 marks)

Learning Objectives:

The course should enable students:

7. To gain knowledge about the characteristics of Conventional and Alternate fuels
8. Understand the performance characteristics of SI and CI engines.
9. Understand, describe and differentiate between TBI and MPFI systems

Learning Outcomes:

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

1. Understand stages of combustion in SI and CI engines
2. Compare the performance characteristics of SI and CI engines.
3. Carried out performance tests under different varying conditions

Course Content:

Module –I: Conventional Fuels (05 Hrs)

Introduction, Types of Fuels – Solid, Gaseous and Liquid fuels, Chemical structure of petroleum, Petroleum refining process, Important qualities of SI and CI engine fuels, Rating of SI and CI engine fuels

Module –II: Alternate fuels (05 Hrs)

Introduction, Possible alternatives to solid fuels and liquid fuels, Surface-Ignition Alcohol CI engines, Spark assisted Diesel engines, Vegetable oils, Biodiesels, Gaseous fuels, Hydrogen engines, Duel fuel operation, Other possible fuels

Module –III: Combustion in SI Engines (07 Hrs)

Introduction, Homogeneous mixture, Heterogeneous mixture, Stages of Combustion in SI Engines, Flame Front Propagation, Factors influencing flame speed, Rate of pressure rise, Abnormal combustion, Phenomenon of knock/detonation in SI engines, Effects of engine variables on knock, Combustion chambers for SI engines.

Module –IV: Combustion in CI Engines (07 Hrs)

Introduction, Stages of Combustion in CI Engines, Factors affecting the delay period, diesel knock, Phenomenon of knock in CI engines, Effects of engine variables on knock, Combustion chambers for CI engines.

Module –V: Assignments / seminars / case studies on Module -I to Module - IV (06 Hrs)

References:

1. Combustion Engineering – Gary L. Borman, Kenneth W. Ragland, McGraw Hill, 1998 ISBN 10: 0070065675 / ISBN 13: 9780070065673
2. Principles of Combustion – Kenneth K. Kuo, John Wiley & Sons, 2nd edition, (2005), ISBN-13: 978-0471046899, ISBN-10: 0471046892
3. Fundamentals and Technology of Combustion, Mahallawy-Habik, *Elsevier* Science (2002). *ISBN* 10: 0080441068 *ISBN* 13: 9780080441061.
4. Fuels & Combustion – S. P. Sharma & Chander Mohan, Tata McGraw Hill, (1987) ISBN: 0070966273 9780070966277
5. Fuels & Combustion – Samir Sarkar, Universities Press, 3rd edition (2010), ISBN 1439825416, 9781439825419
6. A Course in Internal Combustion engine, Mathur-Sharma, Dhanpat Rai Publication (2010), ISBN-10: 8189928465, ISBN-13: 978-8189928469
7. Internal Combustion Engines, Ganesan.V, Tata McGraw Hill Publishing Co., New York, 4th Edition (2012), *ISBN*-0-07-049457-6.
8. Internal Combustion Engines, K.K. Ramalingam, SCITECH, 2nd edition (2011), *ISBN* 10: 8183711022 / *ISBN* 13: 9788183711029

ATC 124

Automobile Control Systems

(02 credits – 50 marks)

Learning Objectives:

The course should enable students:

1. Understand construction, working and functions o f Automobile Systems.
2. Understand construction, working and functions of Automobile control systems such as steering, braking and suspension.
3. Compare the developments in control systems and safety equipment.

Learning Outcomes:

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

1. Identify necessary system requirements of control systems,
2. Compare the developments in control systems and safety equipment

Course Content:

Module –I: Components Selection (04 Hrs)

Tyre selection, air resistance, rolling resistance, requirement of engine power, transmission system layout

Module –II: Steering systems: (07 Hrs)

Front axle types, constructional details, front wheel geometry, Condition for True rolling, skidding, steering linkages for conventional & independent suspensions, turning radius, wheel wobble and shimmy, power and power assisted steering

Module –III: Braking system: (06 Hrs)

Types of brakes, brake-actuating mechanisms, factors affecting brake performance, power & power assisted brakes, Brake system design, Recent developments in transmission & braking system

Module –IV: Suspension systems (07 Hrs)

Rigid and independent Suspension, Types of Independent suspension system-McPherson strut, wishbone type, Semi-elliptical Leaf spring, coil spring , torsion bar arrangement, Construction and working of Air Suspension System, Construction and working of- Shock absorbers - Telescopic and Gas filled, Anti roll bar or stabilizer bar.

Module –V: Assignments / seminars / case studies on Module -I to Module - IV (05 Hrs)

References:

1. The Automotive Chassis – Engineering Principle – Jornsen *Reimpell*, Helmut Stoll, Jurgen Betzler, (2001), 2nd Edition *ISBN*-9780080527734
2. Automotive Chassis – Design & Calculation – P. Lukin, G. Gasparyarts, V. Rodionov, MIR Publishing, Moskow (2005)
3. Automotive Chassis – P. M. Heldt, Chilton Co. NK, 2012, ISBN-13:9781258374150, ISBN-13: 9781258386382
4. Mechanics for Road Vehicles – W. Steed, Illiffe Books Ltd., London (1960), ASIN: B0000CKKGV
5. Automotive Mechanics, Crouse, Anglin, Tata McGraw - Hill Career Education ISBN 10: 0028009436 ISBN 13: 9780028009438
6. Machine Design, P.Kannaiah, Scitech, (2010) ISBN 10: 8183711510 / ISBN 13: 9788183711517
7. Auto design, R. B Gupta, Satya Prakashan, ISBN: 8176840106 ISBN-13: 9788176840101

ATC 125

Automobile Engine Components Design

(02 credits – 50 marks)

Learning Objective:

1. To make the students understand the design concept and principles of various engine components.
2. These concepts and principles are familiarized for design of components.

Learning Outcomes:

1. Design the connecting rod, piston and its parts based on the engine specifications and also based on the engine application with balancing weight of crankshaft.

Course Content:

Module-I: Introduction to Design (05 Hrs)

Stress, types of stresses, Engineering materials and their physical properties applied to design, selection of materials , Factor of safety, Theory of failures, Static load, dynamic load, failure modes, endurance limit, notch sensitivity, principles of design optimization.

Module-II: Design of Cylinder and Piston (07 Hrs)

Choice of material for cylinder and piston, load on cylinder, stress in cylinder, piston friction, piston slap, load on piston, stresses in piston, design of cylinder, piston, piston pin, piston rings, piston failures, lubrication of piston assembly, types of tolerances and fits, design considerations for interference fits, surface finish, and surface roughness.

Module – III: Design of Connecting rod, Crankshaft (07 Hrs)

Material for connecting rod, determining minimum length of connecting rod, small end and big end design, shank design, design of big end cap bolts, connecting rod failures, balancing of I.C. Engines, significance of firing order, material for crankshaft, design of crankshaft under bending and twisting, balancing weight calculations.

Module –IV: Design of Valves and Flywheel (05 Hrs)

Design aspects of intake and exhaust manifolds, inlet and Exhaust valves, valve springs, tappets, valve train, Materials and design of flywheel, Design of Solid flywheel, Rimmed Flywheel, stresses in flywheel, Coefficient of fluctuation of speed, Coefficient of fluctuation of energy.

Module –V: Tutorials, Case studies and presentation based on Module I to IV (06 Hrs)

References:

1. Design of Automotive Engines", A.Kolchin and V.Demidov, MIR Publishers, Moscow (1984).
2. Design Techniques for Engine Manifolds, D.E. Winterborne and R.J.Pearson, SAE Int. Publisher, 1999.
3. The Internal Combustion Engine in Theory and Practice, C.F. Taylor, The M.I.T. Press, Cambridge, MA, 1985
4. Internal combustion engines fundamentals, J.B. Heywood McGraw-Hill, N.Y., 1988.
5. Diesel-Engine Management, H. Bauer, K.H. Dietsche, J. Crepin, F. Dinkler, Bosch-SAE Publishers, 1999.
6. Design of Machine Elements, V.B.Bhandari, Tata McGraw Hill publication, 3rd Edition, (2010), ISBN-10: 0070681791 ISBN-13: 9780070681798
7. Machine Design, P.Kannaiah, Scitech, (2010) ISBN 10: 8183711510 / ISBN 13: 9788183711517

ATC 126

Automobile Air Conditioning

(02 credits – 50 marks)

Learning Objectives:

The course should enable students:

1. Identify various HVAC systems and sub systems.
2. Explain working & construction of HVAC Systems and sub systems.

Learning Outcomes:

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

1. Carry out repair and maintenance of HVAC Systems and sub systems.
2. Carry out retrofitting and alteration of HVAC Systems.
3. Know environmental aspects related to HVAC Systems.

Course Content:

Module –I: Introduction to Automobile Air Conditioning (05 Hrs)

Environmental and safety aspects in Heating, Ventilation and Air Conditioning (HVAC) systems, Human comfort control, Heat transfer fundamentals, Requirements of HVAC system for light motor vehicle, Heavy goods vehicle, Heavy passenger vehicle, Controlled and uncontrolled ventilation, Case and Duct System**,** Downstream, upstream, split and hybrid, Rear heating and cooling system

Module –II: Air Conditioning System (07 Hrs)

General layout of Automotive Air conditioning system, vapour compression cycle**,** Construction and working of refrigeration sub systems, evaporator, condenser, accumulator, Receiver, driers and accumulator. Reciprocating, scroll and rotary vane compressors, Refrigerant- Properties**,** types, Packaging and storage, color code and purity test, Metering devices, Thermostatic Expansion valve and fixed orifice tube, Functions of thermostatic expansion valve.

Module –III: System Control Devices (06 Hrs)

System controls - typical vacuum system and electronic temperature control system, vacuum operated devices i.e. vacuum reserve tank, vacuum restrictor, vacuum motor, check valve and check relays.

Switches - high- Side temperature switch, low-side temperature switch, high pressure switch, low- pressure switch, pressure regulator, ambient switch and superheat switch.

Sensors- sun load sensor, outside temperature sensor and in car temperature sensors.

Controls- Concept of Aspirator, blower clutch control, heater control, and time delay relay for heater control. Block diagram of climate control system and Electronic climate control system.

Module –IV: Repairs and Maintenance of Air Conditioning System (06 Hrs)

Maintenance Of A.C. Systems - Visual and acoustic check, side glass, leak test, Temperature test, procedure of charging and discharging. Moisture removal procedure, Service equipments and tools- Vacuum pump, Manifold and gauge i.e. Low side and high side, gauge calibration recovery unit and recycling unit, Halide (Freon) and Fluorescent leak detector, nitrogen leak tester. Symptoms, Faults, causes and remedies, Hoses and connectors - construction of system hoses, charging hose with shut off valve and connectors, Comfort heating system - Function, Construction and working, Maintenance general faults and their remedies

Module –V: Assignments / seminars / case studies on Module -I to Module - IV (06 Hrs)

References:

1. Automobile Air Conditioning, Boyce H. Dwiggins, Thomson Learning, 8th Edition, (2001) ISBN-13: 978-0-7668-0788-4, ISBN: 0-7668-0788-6
2. Automotive Heating and Air Conditioning, John H Haynes and Mike Stubblefield, Haynes Publishing Group, 2nd edition (January 1994), ISBN-10: 1563920719, ISBN-13: 978-1563920714
3. Automotive Mechanics, Crouse, Anglin, Tata McGraw - Hill Career Education ISBN 10: 0028009436 ISBN 13: 9780028009438
4. A text book of Refrigeration and Air Conditioning, R. S. Khurmi and J. K. Gupta, S. Chand, (2006), *ISBN* 10: 8121927811 - *ISBN* 13: 9788121927819
5. Refrigeration and Air Conditioning, P. N. Ananthanarayanan, Tata McGraw Hill, (2015), ISBN 10: 1259062708 / ISBN 13: 9781259062704
6. Principles of Refrigeration, Roy Dossat, Pearson Education, 4th Edition, *ISBN* 10: 8177588818 / *ISBN* 13: 9788177588811
7. Refrigeration and Air Conditioning, Domkunwar and Arora, Dhanpat Rai & Co.(p) Ltd-Delhi, 6th Edition, ISBN-10: 0000229660, ISBN-13: 9780000229663

CF 101

Research Methodology

(01 credits – 50 marks)

Learning Objectives:

The course should enable students:

6. To define research and describe the research process and research methods
7. To understand qualitative research and methods used to execute and validate qualitative research
8. To know how to apply the basic aspects of the research process in order to plan and execute a research project.
9. To provide insight into the processes that lead to the publishing of research.
10. To be able to present, review and publish scientific articles

Learning Outcomes:

Students will be able to -

6. Do systematic literature survey, formulation of a research topic, study design, analysis and interpretation of data.
7. To design a research approach for a specific research issue of their choice.
8. Select a suitable analytical method for a specific research approach.
9. Demonstrate a good understanding of how to write a research report.
10. critically assess published quantitative research with regard to the statistical methods and approaches adopted

Course Contents:

Module I: Research Fundamentals (03 Hrs)

Introduction: Definition, objectives of the research, characteristics of the research, what makes people to do research, importance of research**,**

Module II: Identification of Research Problem (04 Hrs)

Defining the research problem: Identification of research problems, selection of research problem, facts one should know regarding selection of research problem, the process of research problem definition, some facts involved in defining research problem

Module III: Formulation of Research Problem (05 Hrs)

Formulation of the problems: steps involved in defining a problem, formulation of the problems, Formulation of hypothesis: Concept of hypothesis, hypothesis testing, Developing the research plan: implementation, interpreting and reporting the findings, Importance of hypothesis of in decision making.

Module IV: Research Report and Proposal Writing (04 Hrs)

Introduction, research proposal writing: costing, the research proposal, rationale for the study, research objectives, research methodology, target respondents, research Centres, sample size and sample composition, sampling procedures, research project execution, research units; An insight into research report and proposal, research project synopsis, research report writing : types of research reports, guidelines for writing reports; Steps in writing report, report presentation, typing the report, documentation and bibliography, formatting guidelines for writing a good research report / research paper.

References:

10. Research Methodology by Dr. S. L. Gupta, Hitesh Gupta; International Book House Pvt Ltd (2013), ISBN-10: 8191064278, ISBN-13: 978-8191064278
11. Basic Research Methods-Gerard Guthrie SAGE Publications, India, Pvt Ltd, New Delhi (2010), ISBN-10: 8132104579, ISBN-13: 978-8132104575
12. Research Methodology-methods and techniques By C. R. Kothari, New Age International Publishers (2011) ISBN 978-81-224-1522-3
13. Principles of Research Methodology- Phyllis G. Supino, Jeffrey S. Borer; Springer, Verlag New York (2012), ISBN-ebook: 1461433592, ISBN (Hardcover): 978-1461433590
14. Research Design Qualitative, Quantitative. and Mixed Methods Approaches- John W. Creswell; SAGE Publications Ltd, UK (2011), ISBN-9780857023452
15. Research Methodology -A Step-by-Step Guide for Beginners- Ranjit Kumar; Sage Publications Ltd (2010), ISBN- 1849203016.
16. Scientific Writing and Communication- Angelika Hofmann; Oxford University Press, US (2010), ISBN-13-: 978-0 199947560, ISBN-10: 01 99947562
17. Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded- Joshua Schimel, Oxford University Press, (2011), ISBN: 9780199760237
18. Handbook of Scientific Proposal Writing- A.Yavuz Oruc; CRC Press, Taylor & Francis group (2011), ISBN: 9781439869185

EF 130

Operations Management

(02 credits – 50 marks)

Learning Objective

The course should enable students to:

5. Understand the role of operations management in organizations
6. Differentiate between strategic and tactical operations decisions
7. Describe the key operations management decisions faced by managers
8. Understand three of the most important operations management practices: Total Quality Management, Supply Chain Management, and Just-in-Time/Lean Operations

Learning Outcomes

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

6. Define 'operations' and 'operations management'
7. Identify the roles and responsibilities of operations managers in different organizational contexts
8. Apply the 'transformation model' to identify the inputs, transformation processes and outputs of an organization
9. Identify operational and administrative processes
10. Describe the boundaries of an operations system, and recognize its interfaces with other Functional areas within the organization and with its external environment

Course Contents:

Module – I: Introduction to Operations Management (06 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 Development Cycle (06 Hrs)

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

Module - III: Layout and Management of Operation (06 Hrs)

Facility Location, Facility Layout, Capacity Planning, Capacity Decisions, Waiting Lines, Demand Management-models, Resource Planning-models, Total Quality Management, Supply Chain Management and Just-in-Time/Lean Operations

Module - IV: Planning and Management (06 Hrs)

Aggregate Planning, Basics of MRP / ERP**,** Basics of Scheduling**,** Basics of Project Management, Basics of Work Study, Job Design and Work Measurement**,** Basics of ISO 14000 / 9000, Basics of Value Engineering & Analysis

Module - V:

Presentation's, case studies, Assignments, Tutorials based on Module I to IV (**06 Hrs)**

References:

1. S. N. Chary, Production & Operations Management McGraw Hill ISBN:9781259005107
2. S. Anil Kumar, N.Suresh Operations Management, New age International Publishers, ISBN : 978-81-224-2587-1
3. E. S. BUFFA, Modern Production Management, 8th Edition, ISBN 9780471819059
4. Norman Gaither, Production and Operations Management, ISBN 10: 0538891084 ISBN 13: 9780538891080
5. S. N. Chary ,Theory and problem in Production and operations Management, ISBN:9780074620526

EF 131

Materials Management

(02 credits – 50 marks)

Learning Objectives

The course should enable students to:

4. To widen the knowledge of materials management , its types and material Handling
5. Understand the role of purchasing, Negotiations etc
6. Understand the important practices – MRP, demand and supply of material, price costing, import procedure etc.

Learning Outcome

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

4. Define Materials and its Management
5. Identify Integrated Approach to Materials Management
6. Understand in International procurement-Imports

Course Contents:

Module – I: Materials Management an overview (06 Hrs)

Introduction, Importance of Materials Management, Objectives of Materials Management, Costs involved in the Management of Materials, Integrated approach to Materials Management, organizing Materials Management, Organization based on Commodities, Organization based on Location, Organization based on function, Inter-departmental relationships, Centralized versus Decentralized materials management.

Module - II: Materials Planning (06 Hrs)

Introduction and factors influencing materials planning, Techniques of materials planning, Bill-of-Materials, Materials Requirement Planning (MRP), Past Consumption Analysis Technique, Moving Average method, Exponential Smoothing

Module - III: Purchasing (06 Hrs)

Purchasing principles, policies, procedures and practices, Objectives, scope, responsibility and limitations, Sources of supply and Supplier selection, Vendor development-evaluation and rating, Price forecasting, Price-cost analysis, Negotiations, Reciprocity, Legal aspects of purchasing, Purchase orders/ contracts, Method of buying- under certainty, under risk, and under uncertainty

Module: International procurement-Imports (06 Hrs)

International commercial terms, Import procedures and documentation, Categories of importers, Identification of foreign sources, Payment terms including Letter of credit, Types of L/Cs, Custom tariff, Custom clearance, Bill of Lading and other documents.

Module - V: Presentation's, case studies, Assignments based on Module I to IV ***06 hrs***

References:

1. Prof. L.C. Jhamb , Materials and Logistics Management,Everest, Publishing House, Pune,
2. P.Gopalkrishnan ,Purchasing and Materials Management , ,Tata McGraw Hill, New Delhi, ISBN-13: 978-0074516508
3. P.Gopalkrishnan and M. Sundaresan ,Materials Management –An integrated approach, Prentice-Hall India, New Delhi, ISBN : 8120300270.
4. A.K. Datta,Materials Management-Procedures, Text and Cases ,Prentice-Hall India, New Delhi, ISBN: 978-81-203-1251-7
5. JR Tony Arnold and Stephan Chapman ,Introduction to Materials Management , Pearson Education, New Delhi,2004 Fifth Edition, ISBN: 0131 128744

ATLF 127 - Laboratory Coursework based on Automobiles Engines and Engine Design (Auto-CAD)

(03 credits – 100 marks)

List of Practical's: (Any 08 Practical can be performed)

1. Setting up of drawing environment by setting drawing limits, drawing units, naming the drawing naming layers, setting line types for different layers using various type of lines in Engineering drawing, saving the file with .dwg Extension using Auto CAD software.
2. To Draw Orthographic projection drawings (Front, Top and side) of machine part in AutoCAD.
3. Make an Isometric dimensioned drawing of a connecting Rod using Isometric grid and snap.
4. Draw different types of bolts and nuts with internal and external threading in Acme and square threading standards. Save the bolts and nuts as blocks suitable for insertion.
5. Draw a 3D model of a machine component using 3D primitives and using commands like Union. Subtraction, Revolve, Slice, Rotate 3D etc.
6. Draw a spiral by extruding a circle
7. Trial on Multi point fuel injection engine.
8. Trial on Common Rail direct injection engine
9. Trial on willians line method to calculate frictional power
10. Trial on Motoring Test.
11. Trial on Retardation test.
12. Fuel injector cleaning and perform various tests on injector.

ATLF 128 - Laboratory Coursework based on Automotive Transmission Systems

(1.5 credits – 50 marks)

List of Practical's: (Any 05 Practical can be performed)

1. Assembly and Disassembly of Multi plate clutch from transmission unit.
2. Assembly and Disassembly of Sliding Mesh gear box.
3. Assembly and Disassembly of Synchromesh Gear box.
4. Assembly and Disassembly of Differential Gear box
5. Calculation of gear ratios of respective assemblies.
6. Demonstration of Automatic Transmission system
7. Demonstration of Torque Convertor.

ATLF 129 - Laboratory Coursework based on Fuels and Combustion

(1.5 credits – 50 marks)

List of Practical's: (Any Five)

1. Identify Combustion chamber of multi cylinder S.I. and C. I. Engine and single cylinder 2/4 stroke engine.
2. Observe and draw layout of LPG or CNG Fuel supply system.
3. Perform exhaust gas analysis of an engine exhaust using 4-gas analyzer. Diagnose engine condition from exhaust gas analysis.
4. Prepare Heat Balance Sheet And Plot Performance Characteristics Curve of An Engine After Trial.
5. Conduct Morse Test on Multi-cylinder Engine & Calculate Frictional Power & Mechanical Efficiency.
6. Conduct performance test on single cylinder diesel engine test rig by varying various engine parameters to study effects of engine variables on performance of CI engine.
7. Conduct performance test petrol engine test rig by varying various engine parameters to study effects of engine variables on performance of SI engine.

ATLC 130 - Laboratory Coursework based on Automobile Control Systems

(1.5 credits – 50 marks)

List of Practical's: (Any Five)

1. Observe the steering linkages, draw its layout. Dismantle the steering gear box, identify its type, sketch its components and assemble it.
2. Observe and sketch different types of Front Axles. Dismantle the various Front Axles to study its construction.
3. Observe and draw the layout of hydraulic braking system. Dismantle master cylinder, wheel cylinder and remove brake drum, identify and sketch the components and assemble it.
4. Observe and draw the layout of hydraulically operated air/vacuum assisted braking system
5. Observe and sketch the construction of Mc-pherson and wishbone type suspension with labels. Dismantle semi elliptical leaf spring, sketch its components with labels and understand it's working.
6. Dismantle telescopic shock absorber, identify components and draw sketches of components with labels and understand it's working.
7. Observe air suspension system, air brakes, power steering system and draw layout.

ATLC 131 - Laboratory Coursework based on Automobile Air Conditioning

(1.5 credits – 50 marks)

List of Practical's: (Any Five)

1. Observe and draw layout of Automobile Air Conditioning System and sub systems. Observe and Sketch of all types of Duct system.
2. Observe and write the procedure of evacuation and charging of refrigerant from A.C. system.
3. Test on vapor compression test rig.
4. Observe and write the procedure of leakage test of A.C. system
5. Diagnoses of control systems faults and write causes and remedies.
6. Diagnosis of various running faults in car HVAC and write causes and remedies.
7. Perform trial on A.C. test rig and report the performance.

SEMESTER – II

ATF 221

Transmission System Design

(02 credits – 50 marks)

Learning Objective:

1. To Provide the Knowledge to Understand the Fundamental Principles involved in Design Of transmission system components such as gearbox, Propeller Shaft and spring.

Learning Outcomes:

1. After the successful completion of this course student will able to learn the design principles involved in transmission design also they are in position to design shaft, gearbox and clutch by using given specifications

Course Content:

Module-I: Design of Shaft (6 Hrs)

Pure torsion, bending moment, Compound stresses and strain, Twisting moment, Shafts, design of shaft, Material selection for shaft, Stresses in shaft, shafts in series, shaft in parallel, composite shaft

Module-II: Design of Gearbox (8 Hrs)

Gears, terminologies of gears, Material selection for gear, Spur gear, Helical gear, Bevel gear, worm and worm wheel, gear tooth failures, Simple gear train, Compound gear train, Epicyclic gear train, Lubrication of gearbox, Stages in gearbox. Performance of vehicle, total resistance to motion, traction and tractive effort, calculation of gear ratio, design of three speed gear box, design of four speed gear boxes.

Module-III: Design of Clutch (6 Hrs)

Design of single plate clutch, multi plate clutch, design of centrifugal clutch, cone clutch, energy dissipated, torque capacity of clutch, design of clutch components, uniform pressure theory, uniform wear theory

Module –IV: Design of Spring (4 Hrs)

Coil Spring, leaf spring, Load on springs, Stresses in spring, Design of Leaf Spring, Spring Index, Stiffness of spring, Springs in series, springs in parallel, Materials for springs, Shot peening of springs.

Module – V: Tutorials, Case studies and presentation based on Module I to IV (06 Hrs)

References:

1. Steeds. W -"Mechanics of Road Vehicles"- Illiffe Publisher 1960., London, ASIN: B0000CKKGV
2. Giri.N.K- "Automobile Mechanics"- Khanna Publisher, New Delhi- 2008, ISBN-10: 8174092161
3. Dean Averns - "Automobile Chassis Design"- Illiffe Publisher, London, ISBN-13: 978-1444600049.
4. V.B.Bhandari, "Design of Machine Elements", Tata McGraw Hill publication, 2010, ISBN: 0070681791
5. Keith J Nisbett and Richard G Budynas, "Mechanical Engineering Design" ,Mcgraw Hill Series, 2013, ISBN 13: 9780073529288

ATF 222

Automobile Systems Design

(02 credits – 50 marks)

Learning Objectives:

The course should enable students:

1. Understand the basic of various automobile systems
2. Explain construction & working of automobile systems.

Learning Outcomes:

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

1. Know requirements and design procedures of automobile systems.
2. Design automobile systems as per specifications.
3. Know recent developments in automobile systems.

Course Content:

Module –I: Components Selection (4 Hrs)

Tyre selection, air resistance, rolling resistance, requirement of engine power, transmission system layout, four wheel drive, transfer case

Module –II: Transmission systems (8 Hrs)

Clutch, types of clutch, clutch design, Gear box, types of gear boxes, gear box design, overdrive gears, Fluid flywheel & torque converter, Epicyclic gear box, semi-automatic & automatic transmission, Propeller shaft, design of propeller shaft, slip joint, universal joint, Final drive, differential, Dead & live axle, axle design, Constant velocity joints

Module –III: Braking system: (6 Hrs)

Types of brakes, brake-actuating mechanisms, factors affecting brake performance, power & power assisted brakes, Brake system design, Recent developments in transmission & braking system

Module –IV: Steering systems: (6 Hrs)

Front axle types, constructional details, front wheel geometry, Condition for True rolling, skidding, steering linkages for conventional & independent suspensions, turning radius, wheel wobble and shimmy, power and power assisted steering,

Module – V: Tutorials, Case studies and presentation based on Module I to IV (06 Hrs)

References

1. Reimpell J., "The Automotive Chassis – Engineering Principle" – 2nd Edition, ISBN 9781493302864
2. P. Lukin, G. Gasparyarts, V. Rodionov, "Automotive Chassis – Design & Calculation", MIR Publishing, Moscow, ISBN, 1-55623-603-4
3. P. M. Heldt, "Automotive Chassis" ,Chilton Co. NK, ISBN-13: 9781114312395
4. W. Steed, "Mechanics of Road Vehicles" , Illiffe Books Ltd., London ASIN: B0000CKKGV
5. Keith J Nisbett and Richard G Budynas, "Mechanical Engineering Design" ,Mcgraw Hill Series, 2013, ISBN 13: 9780073529288
6. R. B Gupta, "Auto design", Satya Prakashan, ISBN-13: 9788176840101
7. V.B.Bhandari, "Design of Machine Elements", Tata McGraw Hill publication, 2010, ISBN: 0070681791

ATF 223

Hydraulic and Pneumatic Systems

(02 credits – 50 marks)

Learning Objectives:

The course should enable students:

1. Understand the basic properties of fluid, important principles of hydraulics with their applications and hydraulic devices used in practice.
2. Explain construction & working of Elements of Hydraulic and Pneumatic system.

Learning Outcomes:

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

1. Verifying the conditions of fittings, oil, pipes, seals & packing of hydraulic systems in automobile vehicles.
2. Carry out troubleshooting and maintenance of Hydraulic & Pneumatic Systems.
3. Construct the Hydraulic and Pneumatic circuits for various applications.

Course Content:

Module –I: Introduction to fluid power (06 Hrs)

Classification, application in various fluids of engineering, various hydraulic and pneumatic ISO/JIC Symbols, transmission of power at static and dynamic states, Types of hydraulic fluids and their properties, effect of temperature on fluids.

Module –II: Hydraulic system elements (07 Hrs)

Control of fluid power elements- Pressure control, direction control, flow control valves, pilot operated, relief, pressure reducing, quick exhaust, sequence valves, flow control valves and their types, meter-in and meter-out circuit and flow through circuit. Types of direction control valves, Actuators – linear and rotary, hydraulic motors, types of hydraulic cylinders and their mountings. Hydraulic servo-system for rotary and linear motion

Module –III: Pneumatic Systems: (07 Hrs)

Application of pneumatics, physical principles, basic requirement of pneumatic system, Comparison with hydraulic systems, Elements of Pneumatics, Air compressors, Pneumatic control valves, Pneumatic actuators - types and the mountings, Air motors – types, Pneumatic circuits – Basic pneumatic circuit, impulse operation, speed control, pneumatic motor circuit, sequencing of motion, time delay circuits and their applications. Pneumatic servo-system for linear and rotary motion

Module –IV: Automotive Applications, Maintenance and troubleshooting: **(06 Hrs)**

Hydraulic tipping mechanism, power steering, fork lift hydraulic gear, hydro-pneumatic suspension Maintenance and trouble shooting of hydraulic & pneumatic circuits, Introduction to fluidics-study of simple logic gates, turbulence, amplifiers, pneumatic sensors and applications.

Module –V: Assignments / seminars / case studies on Module -I to Module – IV (06 Hrs)

References:

1. Industrial Hydraulic & pneumatics – J.J. Pippenger - McGraw Hill, ISBN-13: 978-0070501409
2. Fluid with applications – A. Esposito- PHI Publishers, ISBN: 9781292023878
3. Industrial Hydraulic Manual by Vicker Sperry, ISBN 10: 0963416200
4. Practical guide to Fluid Power by H.S. Stewart
5. ISO 1219 Fluid systems and components
6. Hydraulic and Pneumatic Controls, K. Shanmuga Sundaram, S. Chand Publication, ISBN : 81-219-2635-1
7. Introduction to Hydraulics and Pneumatics, S. Ilango and V. Soundararajan, PHI Learning Private Limited, New Delhi, ISBN: 9788120330795
8. Hydraulic and Fluid Mechanics, Dr. P N Modi Dr. SM Seth, Standard Book House, Delhi, ISBN No, 978-81-89401-26-9
9. Hydraulic & pneumatics- Andrew Parr-Jaico Publishing House, ISBN-9780080966748

ATF 224

Noise and Vibration

(02 credits – 50 marks)

Learning Objectives:

The course should enable students:

1. Understand the characteristics and Sources of noise and vibrations in a vehicle.
2. Understand the environmental noise management system.

Learning Outcomes:

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

1. Explain vehicle noise and vibration level measurement techniques.
2. Identify causes and remedies for vibrations.
3. Carry out troubleshooting and maintenance to control noise and vibration in a vehicle.

Course Content:

Module –I: Noise: (04 Hrs)

Noise characteristics, Sources of noise, noise level measurement techniques, vehicular noise level, engine noise, transmission noise, brake squeal, structural noise, noise in auxiliaries, wind noises etc.

Module –II: Vehicle Vibration Measurement and Modelling (06 Hrs)

Introduction, Hand Sensing, Basic Vibration Measurement, Vibration Response Investigation And Vibration Testing, Environments Testing,

Module –III: Vehicle Noise measurement and analysis: (08 Hrs)

Introduction, Sound fundamental, vehicle noise, measuring microphone, measuring amplifier, calibrations, background noise, recording sound

Module –IV: Vehicle noise and vibration diagnostics (06 Hrs)

Introduction, wheel and tyre vibration, run out, match mounting, wheel run out, balancing, wheel balancing method, on vehicle balcing, driveline vibration

Module –V: Assignments / seminars / case studies on Module -I to Module – IV (06 Hrs)

References:

1. Mechanical Vibration – S. S. Rao, New Age International (P) Ltd., New Delhi, ISBN: 9780201065510
2. Engineering Mechanics Static & Dynamics – I. H. Shames, ISBN-10 8177581236
3. Mechanical Vibration Analysis, P. Srinivasan, Tata McGraw Hill Pub. New Delhi, ISBN: 9780074519332
4. Non-linear Mechanical Vibration – P. Srinivasan, Tata McGraw Hill Pub. New Delhi, ISBN: 978-0-470-23439-6
5. Fundamental of Mechanical Vibration – S. Graham Kelly, Tata McGraw Hill Pub., ISBN-10: 1577666917
6. Mechanical Vibration – Grover G. K., Nem Chand & Brothers, Roorkee, ISBN-13:9788185240565
7. Engineering Vibration – Daniel J. Inman, Prentice Hall, NJ, 4th Edition, ISBN: 9780132871693
8. Theory of Vibrations – W. T. Thomson, CBS Publishers, New Delhi, ISBN 13: 9780136510680
9. Noise, Pollution & Control – S. P. Singal, Narosa Publishing House, New Delhi, ISBN: 9788173193637

ATC 225

Automobile Body Engineering

(02 credits – 50 marks)

Learning Objectives:

The course should enable students:

1. Identify various forces and moments associated with aerodynamics.
2. Explain construction of various car bodies and importance of aesthetic, ergonomics and safety in the designing of vehicle body.

Learning Outcomes:

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

1. To understand the physics of fluid flow over vehicle body and its optimization techniques.
2. Describe repair methods of body and repainting.
3. Identify painting defects and describe their causes and remedies.

Course Content:

Module –I: Vehicle body engineering: (06 Hrs)

Vehicle body design, purpose of body design, car body details, classification of motor vehicle body, types of car bodies, visibility, visibility regulation, safety, crashworthiness, terminology, typical engine configuration.

Module –II: Vehicle Aerodynamics: (04 Hrs)

Introduction, objective, importance, drag, types of drag, aerodynamic forcesand moments, general aerodynamics principle, aerodynamic devices, aerodynamic design tips, wind tunnel, classification of wind tunnel.

Module –III: Bus body: (06 Hrs)

Classification of vehicle, types of construction, chasis, body work, general design issue, bus body types, single decker bus body, split level model.

Module –IV Frame and Body repair (07 Hrs)

Frame repairs (for cracks, loose rivets, and skewness in frames) and alignments, Body repairs- Procedure to remove dent, denting tools and equipments, Adjustment of doors and locks, Repainting procedure, patch work, Painting defects

Module –V: Assignments / seminars / case studies on Module -I to Module – IV (6 Hrs)

References

6. Vehicle Body Engineering – Pawloski J., Business Books Ltd**.,** ISBN 10: 0220689164
7. The Automotive Chassis: Engineering Principles – Reimpell J., ISBN: 9781493302864
8. Vehicle Body Layout and Analysis – John Fenton, Mechanical Engg. Publications Ltd. London, ISBN: 9780852984451
9. Body Construction and Design – Giles J. G., Illife Books, Butterworth and Co., ISBN: 1-4051-5592-2.

ATC 226

Vehicle Dynamics

(02 credits – 50 marks)

Learning Objectives:

The course should enable students:

1. Understand the vehicle coordinate system
2. Understand vehicle performance characteristics of road vehicle for steady state operation and transient operation.

Learning Outcomes:

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

1. Ability to know acceleration and braking characteristics, effect on vehicle due to various forces.
2. Ability to know what is ride and handling in vehicle design

Course Content:

Module –I: Introduction of Vehicle Dynamics (04 Hrs)

Vehicle coordinate system, earth fixed coordinate system, longitudinal, lateral and vertical vehicle dynamics, vehicle springing system - requirements, sprung mass and unsprung mass, performance characteristics of road vehicles,

Module –II: Steady State and Transient Operation (08 Hrs)

Various external forces acting on vehicle, Nature of the forces and factors affecting the forces, Tractive effort and Power available from the engine, equation of motion, maximum tractive effort, weight distribution, stability of vehicle on slope, road performance curves, acceleration, gradibility and drawbar pull, Inertia effect, Equivalent mass, Equivalent moment of inertia, Equivalent ungeared system, Time to produce synchronizing during gear change, Effect of engine flywheel on acceleration, Dynamics of vehicles on Banked tracks, Gyroscopic Effects, Net driving power.

Module –III: Acceleration and Braking Characteristics: (06 Hrs)

Acceleration - Power limited acceleration: Engines, Power Train, And Automatic Transmission. Traction Limited Acceleration: Transverse Weight Shift, Traction Limit, Numerical Treatment.

Braking – Constant Deceleration, Braking Force, Brake Factor, Braking Efficiency And Stopping Distance, Reaction Time And Stopping Time, Braking Applied To Rear Wheels,

Front Wheels And All Four Wheels, On Straight And Curved Path, Mass Transfer And Its Effect.

Module –IV: Handling Mode and Ride Mode: (06 Hrs)

Mathematical model of handling, Fundamental condition for true Rolling Steady State Handling: Slip angle, cornering power, Neutral steer, under steer and over steer, Steady state response, Yaw velocity, Lateral Acceleration, Curvature response and Directional stability. Transient Handling: Basic principles, differential equations of motions. Vehicle Test for handling performance: Steady state testing, constant speed test, constant steer angle test, Constant radius test. Ride performance criteria: Mathematical modeling of vehicle ride, Excitation sources Vehicle Response Properties: Effects of damping the vibration, vibration absorbers, oscillation centers, active and semi active suspension, orthogonlity of mode shapes, modal analysis.

Module –V: Assignments / seminars / case studies on Module -I to Module – IV (6 Hrs)

References:

1. Theory of Ground Vehicles - J. Y. Woung - John Willey & Sons, NY, ISBN: 9780471354611
2. Steering, Suspension & Tyres – J. G. Giles, Illefe Books Ltd., London, ISBN-10: 0-592-00620-4
3. Mechanics of Road Vehicles – W. Steed, Illefe Books Ltd. London, ASIN: B0000CKKGV
4. Automotive Chassis – P. M. Heldt, Chilton Co. NK, ISBN-13: 9781114312395
5. Mechanical Vibrations, S. S. Rao Pearson Education, ISBN: 9780201065510
6. Vibration and Noise for Engineers, Kewal Pujara and R.S. Pujara, Dhanpat Rai and Sons, Delhi, *ISBN* : 0-7680-0403-9 – 1999.
7. Fundamentals of Vehicle Dynamics, Gillespie Thomas D, SAE USA ,1992, ISBN: 9781560911999
8. Tyre and Vehicle Dynamics, Hans B, Pacejka SAE Publication – 2002, ISBN-9780080970165

ATLF 227 - Laboratory Coursework based on Hydraulic and Pneumatic Systems

(1.5 credits – 50 marks)

List of Practicals: (Any Five)

1. Understand and Verify Bernoulli's theorem by using Bernoulli's Apparatus.
2. Calculate the coefficient of discharge (Cd) of Venturimeter by using setup of convergent - divergent section.
3. Determine overall efficiency of Centrifugal Pump & plot its operating characteristics by using Centrifugal pump test rig.
4. Dismantling and assembly of reciprocating pump to identify components, functions of each component and prepare trouble shooting chart.
5. Understand operation of Hydraulic trainer having simple circuit actuation with single acting cylinder.
6. Understand functions of various components in pneumatic trainer with simple circuit actuation of double acting cylinder.
7. Construct and operate speed control Hydraulic circuit for speed control of Double Acting Cylinder by Meter in, Meter out, By pass methods.
8. Understand faults, probable causes and remedial action that can be taken to trouble shoot problems in hydraulic circuits
9. Perform mini project on practical application of hydraulic and pneumatics

ATLF 228 - Laboratory Coursework based on Noise and Vibration

(1.5 credits – 50 marks)

List of Practicals: (Any Five)

1. Pass- by noise test.
2. Vibration measurement in passenger compartment
3. Use of vibration measurement instruments like vibrometer, velocity pick-ups, frequency measurement instrument.
4. Noise control at source – along the path – isolation, damping, balancing, resonators, absorption, barriers and enclosures
5. Methods for control of engine noise, transmission noise.
6. Methods for control of intake and exhaust noise
7. Methods for control of aerodynamic noise, tyre noise, brake noise

ATLC 229 - Laboratory Coursework based on Solid Modeling

(3 credits – 100 marks)

List of Practical's: (Any 08 Practical can be performed)

1. Introduction to solid modeling their commands
2. CAD drawing of Piston
3. CAD drawing of Piston pin and piston rings
4. CAD drawing of Connecting rod
5. CAD drawing of Inlet and Exhaust valves
6. CAD drawing Crankshaft
7. CAD drawing of Camshaft
8. CAD drawing of Gear.
9. CAD drawing of Spring
10. CAD drawing of pin.
11. Engine complete assembly with cylinder block, cylinder head, crankcase, valve ports, water jackets, front and rear end details.

Software Used: PRO-E/ Solidworks /CATIA

ATLC 230 - Laboratory Coursework based on Automobile Body Engineering

(1.5 credits – 50 marks)

List of Practicals: (Any Five)

1. Study of effect of different shapes, styles and exterior objects on drag force.
2. Calculation of aerodynamic forces and pitching, rolling, yawing moments.
3. Measurement of drag, lift force of a scaled model in wind tunnel.
4. Use of denting tools and denting process.
5. Vehicle surface preparation and masking
6. Painting techniques- use of paint booth.
7. Painting defects- Probable causes and remedies for Spray pattern

ATLC 231 - Laboratory Coursework based on Automotive Electrical System Diagnosis

(1.5 credits – 50 marks)

List of Practical: (Any Five)

1. Use of oscilloscope to test vehicle components like sensors and actuators.
2. Use of engine analyzer for faultfinding modern vehicle engine system.
3. Diagnosis of battery faults and battery testing.
4. Diagnosis of starting system and charging system.
5. Diagnosis of lighting system faults.
6. Diagnosis of body electrical system faults.
7. Diagnosis of instruments system faults.
8. Diagnosis of auxiliary system faults

ATR 232 - Research / Industrial Project (Phase-I)

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

(5 credits – 100 marks)

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–

i. Build up a concrete fundamental of the concept on which they are going to work,
ii. Carry out thorough literature survey to find out scope of work in the particular field
iii. Thereby, finalizing the topic of further study/investigation and finally, draft a systematic experimental plan to achieve projected goal
iv. Deliver regular presentations
v. 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/her.