DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO. SU/Sci./B.Voc./ Uty. Campus/5/2016

It is hereby inform to all concerned that, the recommendation of 17-02-2016 and 30-05-2016 of the Ad-hoc Board in Centre for Vocational Education and Training regarding the new curricula and minor changes in B.Voc. Courses. The Academic Council at its meeting held on 01 & 02 June, 2016 has accepted these recommendations **except recommendation No.03 of 17-02-2016 which is as under** :-

(iii) It was unanimously decided to recommend for separate and independent passing of students in internal and semester end examination (in prevailing Continuous Internal Assessment Pattern) to be qualified for promotion process.

The above recommendation has not accepted by the Academic Council, and decided that combine passing be continue for B.Voc. programme.

This is effective from the **Academic Year 2016-2017** and onwards as appended herewith.

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

University Campus,
Aurangabad-431 004.
REF.NO.SU/B.VOC./2016/
3216-22
A.C.M.A.I.No.6 & S.A.I.449[38]
Date:- 22-06-2016.

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Director,
Board of College and
University Development.

Copy forwarded with compliments to :-

1] The Director, Deen Dayal Upadhyay Kaushal Kendra, University Campus, Aurangabad

Copy to :-

1] The Controller of Examinations,
2] The Section Officer, [B.C.S. Unit],
3] The Programmer [Computer Unit-1] Examinations,
4] The Programmer [Computer Unit-2] Examinations,
5] The In-Charge, E-Suvidha Kendra, [Professional Unit], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr. Babasaheb Ambedkar Marathwada University,
6] The Record Keeper, Dr. Babasaheb Ambedkar Marathwada University.

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APPENDIX : A-E

Dr. Babasaheb Ambedkar Marathwada University

Aurangabad- 431004 (MS) India

Deen Dayal Upadhyay KAUSHAL Kendra

Bachelor of Vocation
(B. Voc.)

Course Structure

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

For

i. Industrial Automation
(Semester- III & V; skill components)
ii. Automobile
(Semester- III & V; skill components)

(Choice Based Credit System)

(Effective from June 2016 and onwards)

Curriculum for Bachelor of Vocation
(B. Voc.)

(Choice Based Credit System)

This Bachelor of Vocation programme is divided into six semester shaving 192credits.Each semester will have courses based on General Education Components and Skill Development Components, out of which five courses will be dedicated for theory (each theory course will have inbuilt practical / tutorial/ skill development components) and three courses will be devoted to Laboratory Work / Project / Industrial Training / In-plant Internship. This programe 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 following **Skill Development Components** viz 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 Commerce 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.

There is also provision for lateral entry to Third year (Semester V) of B. Voc Degree program (in both disciplines) against vacant seats in respective trade. Eligibility criteria, under lateral entry scheme, will be as per following –

Trade	Intake	Eligibility
Industrial Automation	Against Vacant seats in respective trade	Diploma (10+3/12+2 pattern) with Industrial Automation/ Electronics/ Electronics and Telecommunication/ Industrial Electronics/ Instrumentation/Electrical
Automobile		Diploma (10+3/12+2 pattern) with Automobile/ Automobile Technology/ Mechanical/ Production

Admission / Promotion Process:

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

The students will have to clear / qualify at least 50% of theory papers / courses from second semester and all papers / courses (inclusive of theory and practical) from first semester for getting promoted to second year. Similarly the students will have to clear / qualify at least 50% of theory papers / courses from fourth semester and all papers / courses (inclusive of theory and practical) from third semester for getting promoted to third 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 the Centre 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 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):

(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 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 the assessment will be done by the 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 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 the question papers and the assessment will be done by the concerned teacher.

Semester End Examination (SEE):

- The semester end theory examination for each theory course will be of 50 marks. 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 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:

(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 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.

(B) 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 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 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 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)	

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
		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	Automobile Drive Line	2
VOC 434	Automobile Systems	2
VOC 435	Laboratory Coursework based on Automobile Transmission	2
VOC 436	Laboratory Coursework based on Automobile Drive Line	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		12+18=3

Components (A/B/C)		0
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	Noise and Pollution Control	4
VOC 633	Laboratory Course –X (AU;Old)	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 details of code nomenclature is as per following –

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.

Appendix – (A)

Semester – III

Industrial Automation

(Skill Development Components)

Skill Development Components - Industrial Automation (A)		
Paper No	**Paper Title**	**Credits**
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

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)
Analog and Digital Circuit Design

List of Experiments: (Any 6 experiments are to be performed)

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)
Mechanical Power Transmission

List of Experiments: (Any 6 experiments are to be performed)

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

VOC- 317
Laboratory Coursework–XI (IA)
Fundamental of Hydraulics

List of Experiments: (Any 6 experiments are to be performed)

1. Study of DCVs
2. Study of single acting cylinder circuit
3. Study of double acting cylinder
4. Study of hydraulic motor circuit for forward and reverse rotation of motor
5. Study of pressure sequence valve operation
6. Study of solenoid driven DCVs
7. Study of flow-control valve
8. Study of any one application of accumulator

VOC- 318
Laboratory Coursework–XII (IA)
Embedded System Concepts

List of Experiments: (Any 6 experiments are to be performed)

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.

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

(02 credits – 50 marks)

Appendix – (B)

Semester – III

Automobile

(Skill Development Components)

Skill Development Components – Automobile (B)		
Paper No	**Paper Title**	**Credits**
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

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 Decarbonising.
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)

Appendix – (C)

Semester – IV

Industrial Automation

(Skill Development Components)

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

Appendix - C

(continued)

Semester – IV

Automobile

(Skill Development Components)

Skill Development Components - Automobile (B)		
VOC 431	Fundamentals of Mechanisms	2
VOC 432	Automobile Transmission	2
VOC 433	Automobile Drive Line	2
VOC 434	Automobile Systems	2
VOC 435	Laboratory Coursework based on Automobile Transmission	2
VOC 436	Laboratory Coursework based on Automobile Drive Line	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

Appendix – D

Semester – V

Industrial Automation

(Skill Development Components)

Skill Development Components - Industrial Automation (A)		
Paper No	**Paper Title**	**Credits**
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 Internship/ Field work	4

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: Introduction to PIC Microcontrollers *12 hrs*

Introduction to PIC microcontrollers and embedded processors: Difference between 8051 and PIC, History of microcontrollers, Microcontroller versus general-purpose microprocessor, criteria for choosing a microcontroller, Mechatronics and Microcontroller, Embedded system applications, Overview of the PIC18 family: PIC18 features, Simplified view of PIC, Members of PIC family, Comparison of 8051 and PIC Family;

Unit – II: Assembly Language Programming *12 hrs*

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,

Unit – III: Addressing modes and Instructions *12 hrs*

8051 Register banks and stack, 8051 data types and directives, Addressing modes with 8051: Immediate, Direct, Register indirect, Delays, Data movement instructions ; Arithmetic and Logic instructions ; Loop and jump instructions, Rotate instruction and data serialization, BCD and ASCII conversion, 8051 Timer Registers, PIC Interrupts, Programming on Keil: Procedure for running a program; Interfacing to the real world applications (stepper motor, DC motor, LCD, Led, Keypad, etc.)

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, nachine 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 segment 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

Appendix – E

Semester – V

Automobile

(Skill Development Components)

Paper No	Paper Title	Credits
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/ Project	4

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:

1. Students will acquire knowledge about various performance test on engine
2. 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 Course –IX (AU;Old)

(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 Heat balance Sheet
4. Perform Gradient test
5. Diagnose and troubleshooting of engine faults
6. Diagnose and troubleshooting of cooling system faults
7. Diagnose and troubleshooting of Lubrication system faults
8. Diagnose and troubleshooting of Ignition system faults
9. Diagnose and troubleshooting of Fuel supply system
10. Diagnose and troubleshooting of Electronics system faults
11. Demonstration of MPFI Engine
12. D monstration of CRDI Engine

VOC 534: Major Project (Phase- I) (03 Credits- 100 Marks)

VOC-535: In-Plant Internship / Field Work/ Project

(04 credits – 100 marks)