2018

[OBE DESIGN- DEEN DAYAL UPADHYA KAUSALYA VIKAS KENDRA DEPARTMENT]

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PREFACE

Outcome Based Education (OBE) is the educational approach which focuses on student centric education in the context of development of personal, social, professional and knowledge (KSA) requirements in one's career and life. It is the decade ago curriculum development methodology. The educational triangle of *LEARNING-ASSESSMENT-TEACHING* is the unique nature of the OBE approach. The curriculum practices such as Competency Based Curriculum, Taylor's Model of Curriculum Development, Spadys' Curriculum principles, Blooms taxonomy and further use of assessment methodologies like, Norm-reference testing and Criterion reference testing, etc is being practiced since decades. It is also interesting to know that, globally, different countries and universities adopts the curriculum development models/approaches such as, CDIO (Conceive-Design-Implement-Operate), Evidenced Based Education, Systems' Approach, etc as the scientific and systematic approaches in curriculum design.

The authorities of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (M.S.) in-lieu of accreditation standards of National Assessment and Accreditation Council, decided to opt for Outcomes Based Education (OBE). As the part of the decision, different meetings, workshops and presentations were held at the campus of university.

This document is the outcome of different meetings and workshops held at university level and department level. The detailed document is designed and the existing curriculum of the department is transformed in to the framework of OBE. This is the first step towards the implementation of OBE in the department. The document will serve all stakeholders in the effective implementation of the curriculum. The OBE is continuous process for quality enhancement and it will go a long way in order to enhance the competencies and employability of the graduates/Post-graduates of the university department.

Head of Department

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OUTCOME BASED EDUCATION

Faculty of Science & Technology

Department of Deen Dayal Uppadhya Kaushalya Vikas Kendra

1. Mission:

Mission Statement

- The holistic development of the students of under-graduate and Post-graduate students in Vocational Education.
- To impart key relevant skills that enables them to be employable at public as well as private sectors.
- To catalyze a continued value added learning culture that is comprehensive and focuses on assuring the best possible outcomes for every student at an affordable cost.
- To continue with our proactive response to the changing development needs, employment opportunities, realities of the region and aim at increasing our contribution towards skill training needs for competent human resource development.
- To promote effective partnership with industries, academia to identify lacunae areas in training, thereby truly responding to the changing needs of skill based education.
- To continue with expansion of the Institute's range of time responsive training provisions to cater for all potential clients and stakeholders.
- To ensure successful achievement of qualifications for students, their progression to the higher level of study, and a positive destination for every alumni.

2. Vision:

Vision Statement

- The DDUKK aims to strengthen the economic backbone of the region by preparing a steady source of self-reliant Human Resource with the belief in Education 'by which one can stand on his/her own feet' through the motto that 'a drop of practice is better than an ocean of theories'.
- The DDUKK wishes to stand as an open forum for student and teacher fraternity as well as industry personnel and enthusiasts to take this revolution forward.
- To be a leading institution for training, assessment and certifying skill levels in relevant fields.

The mission and vision of the organization help in preparation of strategic plan.

3. Title of the Program (s):

a. **Master of Vocation Automobile**
b. **Master of Vocation Industrial Automation**
c. **Bachelor of Vocation Automobile**
d. **Bachelor of Vocation Industrial Automation**

4. Program Educational Objectives:

The program educational objectives (PEO) are the statement that describes the career and professional achievement after the program of studies (graduation/ post-graduation). The PEO s are driven form question no. (ii) of the Mission statement (What is the purpose of organization). The PEOs can be minimum three and maximum five.

PEO1: To have competencies to apply theories and principles of technology domain in solving the field problems.

PEO2: To provide the professional services to industry, business and institutes.

PEO3: To establish own enterprise in the domain of specialization.

PEO4: To opt for higher education and to be a life-long learner.

PEO5: To provide, value based and ethical leadership in the professional and social life.

5. Program Outcomes:

The program outcomes (PO) are the statement of competencies/ abilities. POs are the statement that describes the knowledge and the abilities the graduate/ post-graduate will have by the end of program studies.

Bachelor of Vocation

a. Basic knowledge:
    a. An ability to apply knowledge of basic mathematics, science and engineering to solve the engineering problems.
b. Discipline knowledge:
    a. An Ability to apply discipline-specific knowledge to solve core and/or Applied engineering problems.

c. Experiments and practice:
    a. An ability to plan and perform experiments and practices and to use The results to solve engineering problems.
d. Engineering Tools:
    a. Apply appropriate technologies and tools with an understanding of the limitations.
e. The engineer and society:
    a. Demonstrate knowledge to assess societal, health, safety, legal and Cultural issues and the consequent responsibilities relevant to engineering practice.
f. Environment and sustainability:
    a. Understand the impact of the engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.
g. Ethics:
    a. Apply ethical principles and commit to professional ethics and Responsibilities and norms of the engineering practice.
h. Individual and team work:
    a. Function effectively as an individual, and as a member or leader in diverse/multidisciplinary teams.
i. Communication:
    a. An ability to communicate effectively.
j. Life-long learning:
    a. Recognize the need for, and have the preparation and ability to engage in independent and life -long learning in the context of technological changes.

Master of Vocation

PO1	**Domain specific Vocation knowledge** : Attainment of the ability to acquire and ap knowledge of basic engineering sciences and specialization so as to make analysis of comp problems.
PO2	**Problem Analysis ability**: Attainment of the ability to acquire knowledge which will ena them to analyze problems while working in respective vocation and allied industries as w as consultancies.
PO3	**Acquiring skills to Design/develop solutions to problems**: Acquiring skills in selecti operations and to attain ability to design and develop solutions for the vocational relev problems.
PO4	**Capacity to investigate complex problems** : Attainment of the ability to identify n research areas in vocation and to use research-based knowledge and research meth including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions, also to make efforts to come up with strik innovations in the field.

PO5	**Modern tool usage**: Attainment of the ability to create, select and apply appropri techniques, resources, and modern engineering and IT tools so as to solve vocation rela problems.
PO6	**The professional connectivity with society**: Apply reasoning informed by the context knowledge to assess societal, health, safety, legal and cultural issues and the consequ responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability awareness**: Understand the impact of the professio solutions in societal and environmental contexts, and demonstrate the knowledge of, a need for sustainable development.
PO8	**Practicing Ethics and Values**: Apply ethical principles and commit to professional ethics a responsibilities and norms of the practice.
PO9	**Ability to work as an Individual and in team:** Function effectively as an individual, and a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Acquiring Communication Skills**: Communicate effectively on complex engineering activit with the engineering community and with society at large, such as, being able comprehend and write effective reports and design documentation, make effect presentations, and give and receive clear instructions.
PO11	**Well verse with task of Project management and finance aspects**: Demonstrate knowle and understanding of the engineering and management principles and apply these to on own work, as a member and leader in a team, to manage projects and in multidisciplin environments.
PO12	**Life-long learning attitude**: Recognize the need for, and have the preparation and ability engage in independent and life-long learning in the broadest context of technological chan
PSO1	**Professional skills** : Acquiring skills to utilize the knowledge of vocation in innovat dynamic and challenging environment for design and development of new products.
PSO2	**Successful career and entrepreneurship**: Transformation of the students into technocr who will design and develop systems and subsystems for vocational allied Technologies a entrepreneurs.

6. Course- Program outcome Matrix:

The Program Outcomes are developed through the curriculum (curricular/co-curricular-extra-curricular activities). The program outcomes are attained through the course implementation. As an educator, one must know, ***"to which POs his/her course in contributing?"***. So that one can design the learning experiences, select teaching method and design the tool for assessment. Hence, establishing the Corse-PO matrix is essential step in the OBE. The course-program outcomes matrix indicates the co-relation between the courses and program outcomes. The CO-PO matrix is the map of list of courses contributing to the development of respective POs.

The **CO-PO MATRIX** is provided in the below table.

Bachelor of Vocation (Automobile)

Paper Name		a	b	c	d	e	f	g	h	i	j	K PSO1	L PSO2
Linguistic Proficiency-I (English & Marathi)	3									*			
Computer Fundamentals-I (Theory)	2	*	*	*	*								
Auto Service Technician (Theory)	3	*	*	*	*	*							
Auto Service Technician (Practical)	2	*	*	*	*	*							
Occupational Practice Essentials (Theory)	2	*	*	*	*	*							
Automobile Technology	2	*	*	*	*	*							
Automotive Tools and Equipment	2	*	*	*	*	*							
Workshop Technology	1	*	*	*	*	*							
Engineering Drawing	2	*	*	*	*	*							
Lab. Course-I (AU) (Automobile Technology)	2	*	*	*	*	*		*	*				
Lab. Course-II (AU) (Automotive Tools and Equipment	3	*	*	*	*			*	*				
Lab. Cource-III (AU) (Workshop Technology	2	*	*	*	*			*	*				
Lab. Course-IV (AU)(Engineering Drawing	2	*	*	*	*			*	*				
Communicative English and Hindi	2	*	*	*	*					*			
Computer Hardware System : Theory	3	*	*	*	*								
Computer Hardware System : Lab. Course	3	*	*	*	*			*	*				

Environment Management	1	*	*	*	*								
Engine Systems	1	*	*	*	*								
Engineering Material	3	*	*	*	*								
Manufacturing Processes	2	*	*	*	*								
Engineering Drawing - II	2	*	*	*	*								
Laboratory Coursework - (Engine Systems)	2	*	*	*	*			*	*				
Laboratory Coursework- (Two Wheeler Servicing)	3	*	*	*	*	*		*	*				
Laboratory Coursework- (Workshop Practice)	2	*	*	*	*	*		*	*				
Laboratory Course work - (Engineering Drawing-II	2	*	*	*	*	*		*	*				
In- plant Training / Field Work / Mini Project	3	*	*	*	*	*		*	*				
Linguistic Proficiency - III	2	*	*	*	*	*				*			
Business Software Tools - I	2	*	*	*	*	*							
Statistical Tools (Probability and Statistics)	2	*	*	*	*								
Machine Drawing	2	*	*	*	*								
Thermodynamics	1	*	*	*	*								
Automotive Petrol Engine	1	*	*	*	*								
Automotive Diesel Engine	2	*	*	*	*								
Laboratory Course work based on Machine Drawing	1	*	*	*	*			*	*				
Laboratory Course work based on Automotive Petrol Engines	3	*	*	*	*			*	*				
Laboratory Course Work based on	3	*	*	*	*			*	*				

Automotive Diesel Engines													
Laboratory Course Work based on Two-wheeler overhauling	3	*	*	*	*			*	*				
In Plant Internship / Field work / Mini - Project - III	3						*	*	*	*	*	*	*
Industrial Ethics and Safety Management (IA&AU)/Ethical, Legal and Regulatory	1						*	*	*	*	*	*	*
Business Software Tools - II	2	*	*	*	*	*	*						
Fundamentals of Business and Accounting	2	*	*	*	*	*	*						
Fundamentals of Mechanisms	1	*	*	*	*	*	*						
Automobile Transmission	2	*	*	*	*	*	*						
Auto Electrical Systems	2	*	*	*	*	*	*						
Automobile Systems	1	*	*	*	*	*	*						
Laboratory Coursework based on Automobile Transmission	3	*	*	*	*	*	*						
Laboratory Coursework based on Auto Electrical Systems	3	*	*	*	*	*	*		*	*			
Laboratory Coursework based on Automobile Systems	2	*	*	*	*	*	*		*	*			
Laboratory Coursework based on Auto - CAD	2	*	*	*	*	*	*		*	*			
In-plant Internship / Field Work / Mini - Project - IV	2			*	*	*	*	*	*	*	*		
Personality Development and Stress Management	2					*	*	*					

Operations Management	1	*	*	*	*	*	*						
Business Communication	1				*	*	*	*					
Vehicle testing	1	*	*	*	*	*	*			*	*		
Engine Diagnostic & trouble shooting	1	*	*	*	*	*				*	*	*	*
Metrology	3	*	*	*	*	*							
Hydraulic and Pneumatic	3	*	*	*	*	*							
Fuel Testing and Standards	2	*	*	*	*	*		*	*				
Heat, Ventilation, and Air conditioning (HVAC)	3	*	*	*	*	*		*	*				
Laboratory Coursework - Engine Diagnostics and Troubleshooting	2	*	*	*	*	*		*	*				
Laboratory Coursework – Hydraulic and Pneumatic	3	*	*	*	*	*		*	*				
Laboratory Coursework - Engine and Fuel Testing Laboratory	1	*	*	*	*	*		*	*				
Major Project – Phase I	2					*	*	*	*	*		*	*
In-plant Training/Field work/Mini Project – V (AU)	1					*	*	*	*	*		*	*
Foreign Language	2									*			
Entrepreneurship Development	3									*		*	*
Production Management	2	*	*	*	*	*	*						
Autotronics	2	*	*	*	*	*	*					*	*
Farm Equipment and Machinery	1	*	*	*	*	*	*					*	*
Transport Management and safety Regulation	2	*	*	*	*	*	*						
Design of Automotive Components	3	*	*	*	*	*	*						

Lab. Course based on wheel Balancing and wheel Alignment	3	*	*	*	*	*	*		*	*			
Lab. Course based on Solid Modeling	3	*	*	*	*	*	*		*	*			
Major Project - Phase -II	2						*	*	*	*	*		
In-Plant Training Field work Mini Project	3						*	*	*	*	*		

Bachelor of Vocation (Industrial Automation)

Paper Code	**Paper Name**		a	b	c	d	e	f	g	h	i	j	K PSO 1	L PSO 2
VOC 101	Functional English & Marathi	2									*			
VOC 102	Basic Computing	3	*	*	*	*								

VOC 103	UPS Repairing-Theory	3	*	*	*	*	*							
VOC 104	UPS repairing	2	*	*	*	*	*							
VOC 105	Occupational Practice Essentials	2	*	*	*	*	*							
VOC 111	Analog and Digital Electronics	1	*	*	*	*	*							
VOC 112	Electrical Systems	0	*	*	*	*	*							
VOC 113	Industrial Electronics	2	*	*	*	*	*							
VOC 114	Industrial Instrumentation	2	*	*	*	*	*							
VOC 115	Laboratory Coursework – I (IA)(Analog and Digital Electronics)2	2	*	*	*	*	*		*	*				
VOC 116	Laboratory C3oursework – II (IA) (Electrical Systems)	2	*	*	*	*			*	*				
VOC 117	Laboratory Coursework – III (IA) (Industrial Electronics)	3	*	*	*	*			*	*				
VOC 118	Laboratory Coursework – IV (IA) (Industrial Instrumentation)	1	*	*	*	*			*	*				
VOC 201	Communicative English and Hindi	2	*	*	*	*					*			
VOC 202	Basic Computer Hardware System : Theory	1	*	*	*	*								
VOC 203	Basic Computer Hardware System : Lab- Course	1	*	*	*	*			*	*				
VOC 204	Environment Management	1	*	*	*	*								
VOC 211	Interfacing and Signal Conditioning	0	*	*	*	*								
VOC 212	Control Systems Fundamentals	0	*	*	*	*								
VOC 213	Fundamentals of Drives	0	*	*	*	*								
VOC 214	PLC Fundamentals	0	*	*	*	*								
VOC 215	Laboratory Coursework– V (IA)(Interfacing and Signal Conditioning)	0	*	*	*	*			*	*				

VOC 216	Laboratory Coursework – VI(IA) (Control Systems Fundamentals)	0	*	*	*	*	*		*	*				
VOC 217	Laboratory Coursework – VII (IA) (Fundamentals of Drives)	0	*	*	*	*	*		*	*				
VOC 218	Laboratory Coursework – VIII (IA) (PLC Fundamentals)	0	*	*	*	*	*		*	*				
VOC-239	In-plant Training – I (IA)	0	*	*	*	*	*		*	*				
VOC-301	Linguistic Proficiency-III	2	*	*	*	*	*				*			
VOC-302	Business Software Tools – I	3	*	*	*	*	*							
VOC-303	Statistical Tools (Probability and Statistics)	1	*	*	*	*								
VOC 311	Analog and Digital Circuit Design	2	*	*	*	*								
VOC 312	Mechanical Power Transmission	1	*	*	*	*								
VOC 313	Fundamentals of Hydraulics	1	*	*	*	*								
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 401	Industrial Ethics and Safety Management(for Industrial Automation and Automobile) / Ethical, Legal and Regulatory Aspects of Tourism(for Travel & Tourism)	1						*	*	*	*	*	*	*

VOC 402	Business Software Tools-II	2						*	*	*	*	*	*	*
VOC 403	Fundamentals of Business and Accounting	2	*	*	*	*	*	*						
VOC 411	PLC based Automation	1	*	*	*	*	*	*						
VOC 412	Process Control	2	*	*	*	*	*	*						
VOC 413	Fundamentals of Pneumatics	2	*	*	*	*	*	*						
VOC 414	Embedded System Applications	1	*	*	*	*	*	*						
VOC 415	Laboratory Coursework–XIII (IA)(PLC based Automation)	2	*	*	*	*	*	*						
VOC 416	Laboratory Coursework–XIV(IA) (Process Control)	2	*	*	*	*	*	*						
VOC 417	Laboratory Coursework – XV (IA) (Fundamentals of Pneumatics)	2	*	*	*	*	*	*		*	*			
VOC 418	Laboratory Coursework – XVI(IA)(Embedded System App.)	1	*	*	*	*	*	*		*	*			
VOC 419	In-plant Training/Field work/Mini Project – II (IA)	2	*	*	*	*	*	*		*	*			
VOC 501	Personality Development and Stress Management	2			*	*	*	*	*	*	*	*		
VOC 502	Operations Management	1	*	*	*	*	*	*						
VOC 503	Business Communication	1	*	*	*	*	*	*						
VOC 504	Production Engineering	1	*	*	*	*	*	*						
VOC 511	Workshop Technology	2	*	*	*	*	*	*						
VOC 512	Introduction to Robotics	2	*	*	*	*	*						*	*

VOC 513	Networking Essentials	2	*	*	*	*	*							
VOC 514	Advance Microcontrollers	2	*	*	*	*	*							
VOC 515	Laboratory Coursework – XVII (IA)(Pertaining to VOC 511 and VOC 512)	3	*	*	*	*	*		*	*				
VOC 516	Laboratory Coursework – XVIII(IA)(Pertaining to VOC 513 and VOC 514)	2	*	*	*	*	*		*	*				
VOC-517	Major Project – Phase I	1	*	*	*	*	*		*	*				
VOC 601	Foreign Language(German/Chinese/Japanese/Russian)	3	*	*	*	*	*		*	*				
VOC 602	Entrepreneurship Development	1									*			
VOC 603	Production Management	1									*		*	*
VOC 611	Flexible Manufacturing System	1	*	*	*	*	*	*						
VOC 612	Industrial Robotics	3	*	*	*	*	*	*					*	*
VOC 613	Introduction to SCADA	2	*	*	*	*	*	*					*	*
VOC 614	Introduction to IOT	0	*	*	*	*	*	*						
VOC 615	Laboratory Coursework – XVII (IA)(Pertaining to VOC 611 and VOC 612)	2	*	*	*	*	*	*						
VOC 616	Lab. Coursework – XVIII (IA)(Pertaining to VOC 613 and VOC 614)	1	*	*	*	*	*	*		*	*			
VOC 617	Major Project – Phase II	1	*	*	*	*	*	*		*	*	*	*	*
VOC 618	In-plant Training/Field work/Mini Project – IV (IA)	3						*	*	*	*	*	*	*

Master of Vocation (Automobile)

Paper Code	Paper Title		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CC 100	Constitution of India	3	*	*	*	*	*										
ATF 121	Automotive Engines	1	*	*	*	*	*										
ATF122	Automotive Transmission Systems	1	*	*	*	*	*										
ATF 123	Fuels and Combustion	0	*	*	*	*	*										
ATC 124	Automobile Control Systems	0	*	*	*	*	*										
ATC 125	Automobile Engine Components Design	1	*	*	*	*	*										
ATC 126	Automobile Air Conditioning	2	*	*	*	*	*										
CF 101	Research Methodology	3	*	*	*	*	*						*	*	*	*	*
EF 1XX	Elective Foundation (Any One) ▪ Operations	2	*	*	*	*	*								*	*	*

	Management (EF 130) ▪ Materials management (EF 131)																
ATLF 127	Laboratory Coursework based on Automobile Engines and Engine Design (Auto-CAD)	3	*	*	*	*											
ATLF 128	Laboratory Coursework based on Automotive Transmission Systems	2	*	*	*	*											
ATLF 129	Laboratory Coursework based on Fuels and Combustion	2	*	*	*	*											
ATLC 130	Laboratory Coursework based on Automobile Control Systems	0	*	*	*	*									*	*	*
ATLC 131	Laboratory Coursework based on Automobile Air Conditioning	0	*	*	*	*									*	*	*
ATF 221	Transmission System Design	1	*	*	*	*	*										
ATF 222	Automobile Systems Design	3	*	*	*	*	*								*	*	*
ATF 223	Hydraulic and Pneumatic Systems	1	*	*	*	*	*								*	*	*
ATF 224	Noise and Vibration	1	*	*	*	*	*								*	*	*
ATC 225	Automobile Body Engineering	2	*	*	*	*	*								*	*	*
ATC 226	Vehicle Dynamics	2	*	*	*	*	*								*	*	*
ATLF 227	Laboratory Coursework based on Hydraulic and Pneumatic Systems	1	*	*	*	*	*								*	*	*
ATLF 228	Laboratory Coursework based on Noise and Vibration	1	*	*	*	*	*								*	*	*

ATLC 229	Laboratory Coursework based on Solid Modeling	0	*	*	*	*	*								*	*	*
ATLC 230	Laboratory Coursework based on Automobile Body Engineering	3	*	*	*	*	*								*	*	*
ATLC 231	Laboratory Coursework based on Automotive Electrical system diagnosis	3	*	*	*	*	*								*	*	*
ATR 232	Research/ Industrial Project – Phase I (Review of Literature/ Industrial Orientation, Formulation of Topic, Experimental Plan)	2	*	*	*	*	*						*	*	*	*	*
ATC 321	Generic Elective – I	2	*	*	*	*	*						*	*	*	*	*
ATC 322	Generic Elective – II	3	*	*	*	*	*						*	*	*	*	*
ATGE 32X	Generic Elective – I	1	*	*	*	*	*						*	*	*	*	*
ATGE $32X_1$	Generic Elective – II	1	*	*	*	*	*						*	*	*	*	*
ATOE $32X_2$	Open Elective –I	1	*	*	*	*	*						*	*	*	*	*
ATLC 332	Laboratory Coursework based on Generic Elective I	3	*	*	*	*	*								*	*	*
ATLC 333	Laboratory Coursework based on Generic Elective – II	2	*	*	*	*	*								*	*	*
ATLE $33X_L$	Laboratory Coursework based on Generic Elective – I	1	*	*	*	*	*								*	*	*
ATLE $33X_{1L}$	Laboratory Coursework based on Generic Elective – II	1	*	*	*	*	*								*	*	*
ATR 340	Research/ Industrial Project – Phase I	3			*	*	*	*	*	*	*	*	*	*	*	*	*
ATGE	Generic Elective – III	2	*	*	*	*	*							*	*	*	*

42X																	
ATGE 42X$_1$	Open Elective – II	3	*	*	*	*	*							*	*	*	*
ATLE 42X$_2$	Laboratory Coursework based on Generic Elective - III	0	*	*	*	*	*										
ATR 430	Research/ Industrial Project – Phase III (Experimental Work Continued, Organization and Interpretation of Result, Dissertation, Presentation)	3			*	*	*	*	*	*	*	*	*	*	*	*	*

Master of Vocation (Industrial Automation)

Paper Code	Paper Title		a	b	c	d	e	f	g	h	i	j	k	l	m	n
CC100	Constitution of India	2	*	*	*	*	*									
IAC110	Electronic Systems	3	*	*	*	*	*									
IAC111	Power Electronics	0	*	*	*	*	*									
IAC112	Transducer Technology	2	*	*	*	*	*									
IAC113	Electric Drives	3	*	*	*	*	*									
IAF120	Embedded Systems Design	2	*	*	*	*	*									
IAF121	Programmable Logic Controllers	0	*	*	*	*	*									
CF101	Research Methodology	2	*	*	*	*	*						*	*	*	*
EF1XX	Elective Foundation (Any One) ▪ Operations Management (EF130) ▪ Materials management (EF 131)	0	*	*	*	*	*								*	*
IALC140	Electronic Systems lab	0	*	*	*	*										
IALC141	Power Electronics lab	2	*	*	*	*										
IALC	Instrumentation lab – I	0	*	*	*	*										

142																
IALC 143	Electric Drives lab	2	*	*	*	*									*	*
IALF 150	Embedded Systems Lab	0	*	*	*	*									*	*
151	PLC lab	2	*	*	*	*									*	*
IAC 210	Communication Protocols for Instrumentation	3	*	*	*	*	*									
IAC 211	Mechatronics	3	*	*	*	*	*								*	*
IAC 212	Advanced Transducers	2	*	*	*	*	*								*	*
IAF 220	Robotics	3	*	*	*	*	*								*	*
IAF 221	Process Control	2	*	*	*	*	*								*	*
IAF 222	Industrial Automation	2	*	*	*	*	*								*	*
IALC 230	Industrial Networking lab	2	*	*	*	*	*								*	*
IALC 231	Mechatronics lab	3	*	*	*	*	*								*	*
IALC 232	Instrumentation lab –II	3	*	*	*	*	*								*	*
IALF 240	Robotics lab	2	*	*	*	*	*								*	*
IALF 241	Process Control lab	3	*	*	*	*	*								*	*
IALF 242	Industrial Automation lab	2	*	*	*	*	*						*	*	*	*
IAR 250	Research/ Industrial Project – Phase I (Review of Literature/ Industrial Orientation, Formulation of Topic, Experimental Plan)	2			*	*	*	*	*	*	*	*	*	*	*	*
IAGE 31X	Generic Elective – I	3	*	*	*	*	*						*	*	*	*
IAGE 31X	Generic Elective – II	2	*	*	*	*	*						*	*	*	*
IAGE 31X	Generic Elective – III	1	*	*	*	*	*						*	*	*	*
IAGE 31X	Generic Elective – IV	1	*	*	*	*	*						*	*	*	*
IAOE 32X	Open Elective –I	1	*	*	*	*	*						*	*	*	*
IALE 33X	Lab Course based on Generic Elective – I	2	*	*	*	*	*								*	*
IALE 33X	Lab Course based on Generic Elective – II	3	*	*	*	*	*								*	*
IALE	Lab Course based on	2	*	*	*	*	*								*	*

33X	Generic Elective – III															
IALE 33X	Lab Course based on Generic Elective – IV	1	*	*	*	*	*								*	*
IAR 340	Research/ Industrial Project – Phase II (Experimental Work)	2			*	*	*	*	*	*	*	*	*	*	*	*
IAGE 41X	Generic Elective – V	2	*	*	*	*	*							*	*	*
IAOE 42X	Open Elective – II	1	*	*	*	*	*							*	*	*
IALE 43X	Lab Course based on Generic Elective – V	3	*	*	*	*	*									
IAR 440	Research/ Industrial Project – Phase III (Experimental Work Continued, Organization and Interpretation of Result, Dissertation, Presentation)	2			*	*	*	*	*	*	*	*	*	*	*	*

7. Course Outcomes (for all courses):

The course outcomes are the statement that describes the knowledge & abilities developed in the student by the end of course (subject) teaching. The focus is on development of abilities rather than mere content. There can be 5 to 7 course outcomes of any course. These are to be written in the specific terms and not in general. The list of Course Outcomes is the part of ***Annexure-C*** attached herewith.

8. Set Target levels for Attainment of Course Outcomes:

The course outcome attainment is assessed in order to track the graduates' performance w.r.t target level of performance. The CO-PO attainment is the tool used for continuous improvement in the graduates' abilities through appropriate learning & teaching strategies. In order to assess students' performance with respect to abilities (at the end of course teaching/by the end of program) the course outcome attainment are measured/calculated. In order to calculate the program outcome attainment, the course outcome attainment is calculated. Prior to that, the course-program outcome mapping is done.

9. Set Target level for Attainment of Program Outcomes:

The program outcome attainment is assessed in order to track the graduates' performance w.r.t target level of performance. The CO-PO attainment is the tool used for continuous improvement in the graduates' abilities through

appropriate learning & teaching strategies. In order to assess students' performance with respect to abilities (at the end of course teaching/by the end of program) the course outcome attainment and program outcome attainment is measured/calculated. The program outcome attainment is governed by curricular, co-curricular and extra-curricular activities including the stakeholders' participation. The direct method and indirect method is adopted to calculate the PO attainment. The direct method implies the attainment by course outcomes contributing to respective program outcomes. And indirect method is the satisfaction/feed-back survey of stakeholders. In order to calculate the program outcome attainment, the course outcome attainment is calculated. Prior to that, the course-program outcome mapping is done.

The set target level is the set benchmark to ensure the continuous improvements in the learners/ graduates' performance.

10. Course Attainment Levels:

a. CO attainment is defined/set at three levels;
b. The CO attainment is based on end term examination assessment and internal assessment;
c. The Co attainment is defined at three levels in ascending order-
    i. e.g. For end term and internal examination;
    ii. Level-1: 40% students scored more than class average
    iii. Level-2: 50% students score more than class average;
    iv. Level-3: 60% students score more than class average.
d. The target level is set (e.g. Level-2). It indicates that, the current target is level-2; 50% students score more than class average. The CO attainment is measured and the results are obtained. Based on the results of attainment, the corrective measures/remedial action are taken.
e. CO Attainment= 80% (Attainment level in end term examination) + 20% (Attainment level in internal examination).
f. <u>The example for calculation CO attainment is explained in Point No. 12 for one representative course from B. Voc. Automobile.</u>

11.Program attainment Level:

a. PO attainment is defined at five levels in ascending order;
b. The PO attainment is based on the average attainment level of corresponding courses (Direct Method) and feed-back survey (Indirect method);
c. The PO attainment levels are defined / set as stated below;
    i. Level-1: Greater than 0.5 and less than 1.0 (0.5>1)- Poor
    ii. Level-2: 1.0>1.5-Average
    iii. Level-3: 1.5>2.0-Good
    iv. Level-4: 2.0>2.5-Very Good
    v. Level-5: 2.5>3.0 -Excellent

d. The PO attainment target level is set/defined (say, Level-4). It implies that, the department is aiming at minimum level-4 (very good) in the performance of abilities by the graduates. Based upon the results of attainment, the remedial measures are taken;
e. PO Attainment= 80% (Average attainment level by direct method) + 20% (Average attainment level by indirect method).
f. <u>The example for calculation PO attainment is explained in in Point No. 13 for one representative PO of B. Voc. Automobile.</u>

12. The Results of CO Attainment:

<u>The summary of Results of CO-PO attainment is provided in Annexure-B.</u>

<u>FOR EXAMPLE:</u>

<u>COURSE CODE/TITLE: VOC-303 Statistics</u>

e.g. For end term and internal examination;

i. Level-1: 40% students scored more than class average
ii. Level-2: 50% students score more than class average; iv.
iii. Level-3: 60% students score more than class average

Average Total Marks in Examination: 48 = i.e. 48.00

% Students score more than 48 is 15/29 i.e. 51.72% i.e. Levl-2

A(CO)VOC-303= 100% (2)

=2.00

Hence, the attainment level is Level-2 and the set target level is Level-2 and therefore the CO is fully attained.

<u>Table No. 1.0: CO Attainment Level</u>

B. VOC. AUTOMOBILE

Paper Name	CO Attainment Value	Target Attainment Level	Fully Attained/ Not Attained	Remedial Measures
Linguistic Proficiency-I	3	2	Fully Attained	

(English & Marathi)				
Computer Fundamentals-I (Theory)	2	2	Fully Attained	
Auto Service Technician (Theory)	3	2	Fully Attained	
Auto Service Technician (Practical)	2	2	Fully Attained	
Occupational Practice Essentials (Theory)	2	2	Fully Attained	
Automobile Technology	2	2	Fully Attained	
Automotive Tools and Equipment	2	2	Fully Attained	
Workshop Technology	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Engineering Drawing	2	2	Fully Attained	
Lab. Course-I (AU) (Automobile Technology)	2	2	Fully Attained	
Lab. Course-II (AU) (Automotive Tools and Equipment	3	2	Fully Attained	
Lab. Cource-III (AU) (Workshop Technology	2	2	Fully Attained	
Lab. Course-IV (AU)(Engineering Drawing	2	2	Fully Attained	
Communicative English and Hindi	2	2	Fully Attained	
Computer Hardware System : Theory	3	2	Fully Attained	
Computer Hardware System : Lab. Course	3	2	Fully Attained	
Environment Management	1	2	**Not Attained**	Assignment, practice, exercise, coaching.

Engine Systems	1	2	**Not Attained**	Assignment, practice, exercise, coaching.
Engineering Material	3	2	Fully Attained	
Manufacturing Processes	2	2	Fully Attained	
Engineering Drawing - II	2	2	Fully Attained	
Laboratory Coursework - (Engine Systems)	2	2	Fully Attained	
Laboratory Coursework- (Two Wheeler Servicing)	3	2	Fully Attained	
Laboratory Coursework- (Workshop Practice)	2	2	Fully Attained	
Laboratory Course work - (Engineering Drawing-II	2	2	Fully Attained	
In- plant Training / Field Work / Mini Project	3	2	Fully Attained	
Linguistic Proficiency - III	2	2	Fully Attained	
Business Software Tools - I	2	2	Fully Attained	
Statistical Tools (Probability and Statistics)	2	2	Fully Attained	
Machine Drawing	2	2	Fully Attained	
Thermodynamics	1	2	**Not Attained**	Assignment, practice, exercise, coaching.
Automotive Petrol Engine	1	2	**Not Attained**	Assignment, practice, exercise, coaching.
Automotive Diesel Engine	2	2	Fully Attained	
Laboratory Course work based on Machine Drawing	1	2	Fully Attained	
Laboratory Course work based on Automotive Petrol	3	2	Fully Attained	

Engines				
Laboratory Course Work based on Automotive Diesel Engines	3	2	Fully Attained	
Laboratory Course Work based on Two-wheeler overhauling	3	2	Fully Attained	
In Plant Internship / Field work / Mini - Project - III	3	2	Fully Attained	
Industrial Ethics and Safety Management (IA&AU)/Ethical, Legal and Regulatory	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Business Software Tools - II	2	2	Fully Attained	
Fundamentals of Business and Accounting	2	2	Fully Attained	
Fundamentals of Mechanisms	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Automobile Transmission	2	2	Fully Attained	
Auto Electrical Systems	2	2	Fully Attained	
Automobile Systems	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Laboratory Coursework based on Automobile Transmission	3	2	Fully Attained	
Laboratory Coursework based on Auto Electrical Systems	3	2	Fully Attained	
Laboratory Coursework based on Automobile	2	2	Fully Attained	

Systems				
Laboratory Coursework based on Auto - CAD	2	2	Fully Attained	
In-plant Internship / Field Work / Mini - Project - IV	2	2	Fully Attained	
Personality Development and Stress Management	2	2	Fully Attained	
Operations Management	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Business Communication	1	2	**Not Attained**	
Vehicle testing	1	2	**Not Attained**	
Engine Diagnostic & trouble shooting	1	2	**Not Attained**	
Metrology	3	2	Fully Attained	
Hydraulic and Pneumatic	3	2	Fully Attained	
Fuel Testing and Standards	2	2	Fully Attained	
Heat, Ventilation, and Air conditioning (HVAC)	3	2	Fully Attained	
Laboratory Coursework - Engine Diagnostics and Troubleshooting	2	2	Fully Attained	
Laboratory Coursework – Hydraulic and Pneumatic	3	2	Fully Attained	
Laboratory Coursework - Engine and Fuel Testing Laboratory	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Major Project – Phase I	2	2	Fully Attained	
In-plant Training/Field work/Mini Project – V (AU)	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.

Foreign Language	2	2	Fully Attained	
Entrepreneurship Development	3	2	Fully Attained	
Production Management	2	2	Fully Attained	
Autotronics	2	2	Fully Attained	
Farm Equipment and Machinery	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Transport Management and safety Regulation	2	2	Fully Attained	
Design of Automotive Components	3	2	Fully Attained	
Lab. Course based on wheel Balancing and wheel Alignment	3	2	Fully Attained	
Lab. Course based on Solid Modeling	3	2	Fully Attained	
Major Project - Phase -II	2	2	Fully Attained	
In-Plant Training Field work Mini Project	3	2	Fully Attained	

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Paper Name	CO Attainment Value	Target Attainment Level	Fully Attained/ Not Attained	Remedial Measures
Functional English & Marathi	2	2	Fully Attained	
Basic Computing	3	2	Fully Attained	
UPS Repairing-Theory	3	2	Fully Attained	
UPS repairing	2	2	Fully Attained	
Occupational Practice Essentials	2	2	Fully Attained	
Analog and Digital Electronics	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Electrical Systems	0	2	**Not Attained**	
Industrial Electronics	2	2	Fully Attained	
Industrial Instrumentation	2	2	Fully Attained	
Laboratory Coursework – I (IA)(Analog and Digital Electronics)2	2	2	Fully Attained	
Laboratory C3oursework – II (IA) (Electrical Systems)	2	2	Fully Attained	
Laboratory Coursework – III (IA) (Industrial Electronics)	3	2	Fully Attained	
Laboratory Coursework – IV (IA) (Industrial Instrumentation)	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Communicative English and Hindi	2	2	Fully Attained	
Basic Computer Hardware System : Theory	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Basic Computer Hardware System : Lab- Course	1	2	**Not Attained**	
Environment	1	2	**Not Attained**	

Management				
Interfacing and Signal Conditioning	0	2	**Not Attained**	
Control Systems Fundamentals	0	2	**Not Attained**	
Fundamentals of Drives	0	2	**Not Attained**	
PLC Fundamentals	0	2	**Not Attained**	
Laboratory Coursework–V (IA)(Interfacing and Signal Conditioning)	0	2	**Not Attained**	
Laboratory Coursework – VI(IA) (Control Systems Fundamentals)	0	2	**Not Attained**	
Laboratory Coursework – VII (IA) (Fundamentals of Drives)	0	2	**Not Attained**	
Laboratory Coursework – VIII (IA) (PLC Fundamentals)	0	2	**Not Attained**	
In-plant Training – I (IA)	0	2	**Not Attained**	
Linguistic Proficiency-III	2	2	Fully Attained	
Business Software Tools –I	3	2	Fully Attained	
Statistical Tools (Probability and Statistics)	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Analog and Digital Circuit Design	2	2	Fully Attained	
Mechanical Power Transmission	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Fundamentals of Hydraulics	1	2	**Not Attained**	
Embedded System Concepts	2	2	Fully Attained	
Laboratory	2	2	Fully Attained	

Coursework–IX (IA)(Analog and Digital Circuit Design)				
Laboratory Coursework–X(IA) (Mechanical Power Transmission)	2	2	Fully Attained	
Laboratory Coursework – XI (IA) (Fundamentals of Hydraulics)	2	2	Fully Attained	
Laboratory Coursework – XII (IA)(Embedded Systems Concepts)	2	2	Fully Attained	
Industrial Ethics and Safety Management(for Industrial Automation and Automobile) / Ethical, Legal and Regulatory Aspects of Tourism(for Travel & Tourism)	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Business Software Tools-II	2	2	Fully Attained	
Fundamentals of Business and Accounting	2	2	Fully Attained	
PLC based Automation	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Process Control	2	2	Fully Attained	
Fundamentals of Pneumatics	2	2	Fully Attained	
Embedded System Applications	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Laboratory Coursework–XIII	2	2	Fully Attained	

(IA)(PLC based Automation)				
Laboratory Coursework–XIV(IA) (Process Control)	2	2	Fully Attained	
Laboratory Coursework – XV (IA) (Fundamentals of Pneumatics)	2	2	Fully Attained	
Laboratory Coursework – XVI(IA)(Embedded System App.)	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
In-plant Training/Field work/Mini Project – II (IA)	2	2	Fully Attained	
Personality Development and Stress Management	2	2	Fully Attained	
Operations Management	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Business Communication	1	2	**Not Attained**	
Production Engineering	1	2	**Not Attained**	
Workshop Technology	2	2	Fully Attained	
Introduction to Robotics	2	2	Fully Attained	
Networking Essentials	2	2	Fully Attained	
Advance Microcontrollers	2	2	Fully Attained	
Laboratory Coursework – XVII (IA)(Pertaining to VOC 511 and VOC 512)	3	2	Fully Attained	
Laboratory Coursework – XVIII(IA)(Pertaining to VOC 513 and VOC 514)	2	2	Fully Attained	
Major Project – Phase I	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment,

				practice, exercise, coaching.
Foreign Language(German/Chinese/Japanese/Russian)	3	2	Fully Attained	
Entrepreneurship Development	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Production Management	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Flexible Manufacturing System	1	2	**Not Attained**	
Industrial Robotics	3	2	Fully Attained	
Introduction to SCADA	2	2	Fully Attained	
Introduction to IOT	0	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Laboratory Coursework – XVII (IA)(Pertaining to VOC 611 and VOC 612)	2	2	Fully Attained	
Lab. Coursework – XVIII (IA)(Pertaining to VOC 613 and VOC 614)	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Major Project – Phase II	1	2	**Not Attained**	
In-plant Training/Field work/Mini Project – IV (IA)	3	2	Fully Attained	

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Paper Title	CO Attainment Value	Target Attainment Level	Fully Attained/ Not Attained	Remedial Measures
Constitution of India	3	2	**Fully Attained**	*
Automotive Engines	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Automotive Transmission Systems	1	2	**Not Attained**	
Fuels and Combustion	0	2	**Not Attained**	
Automobile Control Systems	0	2	**Not Attained**	
Automobile Engine	1	2	**Not**	

Components Design			**Attained**	
Automobile Air Conditioning	2	2	**Fully Attained**	*
Research Methodology	3	2	**Fully Attained**	*
Elective Foundation (Any One) Operations Management (EF 130)/Materials management (EF 131)	2	2	**Fully Attained**	*
Laboratory Coursework based on Automobile Engines and Engine Design (Auto-CAD)	3	2	**Fully Attained**	*
Laboratory Coursework based on Automotive Transmission Systems	2	2	**Fully Attained**	*
Laboratory Coursework based on Fuels and Combustion	2	2	**Fully Attained**	*
Laboratory Coursework based on Automobile Control Systems	0	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Laboratory Coursework based on Automobile Air Conditioning	0	2	**Not Attained**	
Transmission System Design	1	2	**Not Attained**	
Automobile Systems Design	3	2	**Fully Attained**	*
Hydraulic and Pneumatic Systems	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Noise and Vibration	1	2	**Not Attained**	
Automobile Body Engineering	2	2	**Fully Attained**	*

Vehicle Dynamics	2	2	**Fully Attained**	*
Laboratory Coursework based on Hydraulic and Pneumatic Systems	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Laboratory Coursework based on Noise and Vibration	1	2	**Not Attained**	
Laboratory Coursework based on Solid Modeling	0	2	**Not Attained**	
Laboratory Coursework based on Automobile Body Engineering	3	2	**Fully Attained**	*
Laboratory Coursework based on Automotive Electrical system diagnosis	3	2	**Fully Attained**	*
Research/ Industrial Project – Phase I (Review of Literature/ Industrial Orientation, Formulation of Topic, Experimental Plan)	2	2	**Fully Attained**	*
Generic Elective – I	2	2	**Fully Attained**	*
Generic Elective – II	3	2	**Fully Attained**	*
Generic Elective – I	1	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Generic Elective – II	1	2	**Not Attained**	
Open Elective –I	1	2	**Not Attained**	
Laboratory Coursework based on Generic Elective I	3	2	**Fully Attained**	*
Laboratory Coursework based on Generic Elective – II	2	2	**Fully Attained**	*
Laboratory Coursework based on	1	2	**Not Attained**	Assignment, practice, exercise,

Generic Elective – I				coaching. Assignment, practice, exercise, coaching.
Laboratory Coursework based on Generic Elective – II	1	2	**Not Attained**	
Research/ Industrial Project – Phase I	3	2	**Fully Attained**	*
Generic Elective – III	2	2	**Fully Attained**	*
Open Elective – II	3	2	**Fully Attained**	*
Laboratory Coursework based on Generic Elective - III	0	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Research/ Industrial Project – Phase III (Experimental Work Continued, Organization and Interpretation of Result, Dissertation, Presentation)	3		**Fully Attained**	*

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Paper Title	CO Attainment Value	Target Attainment Level	Fully attained/ Not Attained	Remedial Measures
Constitution of India	2	2	**Fully attained**	
Electronic Systems	3	2	**Fully attained**	
Power Electronics	0	2	**Not Attained**	Assignment, practice, exercise, coaching. Assignment, practice, exercise, coaching.
Transducer Technology	2	2	**Fully attained**	
Electric Drives	3	2	**Fully attained**	
Embedded Systems Design	2	2	**Fully attained**	
Programmable Logic Controllers	0	2	**Not Attained**	Assignment, practice, exercise, coaching.

Research Methodology	2	2	**Fully attained**	
Elective Foundation (Any One) ▪ Operations Management (EF130) ▪ Materials management (EF 131)	0	2	**Not Attained**	Assignment, practice, exercise, coaching.
Electronic Systems lab	0	2		
Power Electronics lab	2	2	**Fully attained**	
Instrumentation lab – I	0	2	**Not Attained**	
Electric Drives lab	2	2	**Fully attained**	
Embedded Systems Lab	0	2	**Not Attained**	
PLC lab	2	2	**Fully attained**	
Communication Protocols for Instrumentation	3	2	**Fully attained**	
Mechatronics	3	2	**Fully attained**	
Advanced Transducers	2	2	**Fully attained**	
Robotics	3	2	**Fully attained**	
Process Control	2	2	**Fully attained**	
Industrial Automation	2	2	**Fully attained**	
Industrial Networking lab	2	2	**Fully attained**	
Mechatronics lab	3	2	**Fully attained**	
Instrumentation lab –II	3	2	**Fully attained**	
Robotics lab	2	2	**Fully attained**	
Process Control lab	3	2	**Fully attained**	
Industrial Automation lab	2	2	**Fully attained**	
Research/ Industrial	2	2	**Fully**	

Project – Phase I (Review of Literature/ Industrial Orientation, Formulation of Topic, Experimental Plan)			**attained**	
Generic Elective – I	3	2	**Fully attained**	
Generic Elective – II	2	2	**Fully attained**	
Generic Elective – III	1	2	**Fully attained**	
Generic Elective – IV	1	2	**Not Attained**	Assignment, practice, exercise, coaching.
Open Elective –I	1	2		
Lab Course based on Generic Elective – I	2	2	**Fully attained**	
Lab Course based on Generic Elective – II	3	2	**Fully attained**	
Lab Course based on Generic Elective – III	2	2	**Fully attained**	
Lab Course based on Generic Elective – IV	1	2	**Not Attained**	Assignment, practice, exercise, coaching.
Research/ Industrial Project – Phase II (Experimental Work)	2	2	**Fully attained**	
Generic Elective – V	2	2	**Fully attained**	
Open Elective – II	1	2	**Not Attained**	Assignment, practice, exercise, coaching.
Lab Course based on Generic Elective – V	3	2	**Fully attained**	
Research/ Industrial Project – Phase III (Experimental Work Continued, Organization and Interpretation of Result, Dissertation, Presentation)	2	2	**Fully attained**	

13.The Results of PO Attainment:

The summary of Results of CO-PO attainment is provided in Annexure-B.

FOR EXAMPLE:

PO NO.: f

(Note: Refer point No. 11 above which describes the attainment level and set target attainment level)

PO Attainment= 80% (Average attainment level by direct method) + 20% (Average attainment level by indirect method).

A (PO) f= 80% (3+3+1+2+2+1+2+2+1+3+3+2+2+2+1+1+2+1+2+2+1+2+3+3)/24 +20% (2.58)

= 80% (2.00) + 20 %(2.00)

= 2.00

=2.00 i.e. Levl-4. The Target level is Level-4.

Hence PO is attained.

Table No. 2.0 PO Attainment Level

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PO/PSO number	PO Attainment Value	Target Attainment level	Fully attained/ Not Attained	Remedial Measures
a	2	4	Fully attained	NOT APPLICABLE
b	2	4	Fully attained	
c	2	4	Fully attained	
d	2	4	Fully attained	
e	2	4	Fully attained	
f	2	4	Fully attained	
g	2	4	Fully attained	

h	2	4	Fully attained	
i	2	4	Fully attained	
j	2	4	Fully attained	
k	2	4	Fully attained	
l	2	4	Fully attained	

B. VOC. INDUSTRIAL AUTOMATION

PO/PSO number	PO Attainment Value	Target Attainment level	Fully attained/ Not Attained	Remedial Measures
a	2	4	Fully attained	
b	2	4	Fully attained	
c	2	4	Fully attained	
d	2	4	Fully attained	
e	2	4	Fully attained	
f	2	4	Fully attained	
g	2	4	Fully attained	
h	2	4	Fully attained	
i	2	4	Fully attained	
j	2	4	Fully attained	
k	2	4	Fully attained	
l	2	4	Fully attained	

MASTER OF VOCATION – AUTOMOBILE

PO/PSO number	PO Attainment Value	Target Attainment level	Fully attained/ Not Attained	Remedial Measures
a	2	4	Fully attained	Not Applicable
b	2	4	Fully attained	
c	2	4	Fully attained	
d	2	4	Fully attained	
e	2	4	Fully attained	
f	2	4	Fully attained	
g	3	4	Fully attained	
h	3	4	Fully attained	
i	3	4	Fully attained	
j	3	4	Fully attained	
k	3	4	Fully attained	
l	2	4	Fully attained	
m	2	4	Fully attained	
n	2	4	Fully attained	
o	2	4	Fully attained	
p	2	2	Fully attained	

MASTER OF VOCATION INDUSTRIAL AUTOMATION

PO Attainment Value	Target Attainment level	PO Attainment Value	Fully attained/ Not Attained	Remedial Measures
a	2	4	Fully attained	
b	2	4	Fully attained	
c	2	4	Fully attained	
d	2	4	Fully attained	
e	2	4	Fully attained	
f	2	4	Fully attained	
g	2	4	Fully attained	
h	2	4	Fully attained	
i	2	4	Fully attained	
j	2	4	Fully attained	
k	2	4	Fully attained	
l	2	4	Fully attained	
m	2	4	Fully attained	
n	2	4	Fully attained	
o	2	4	Fully attained	
p	2	4	Fully attained	

14. Planned Actions for Course Attainment:

The course(s) having CO attainment level less than Level-2 (As per the table stated in Point No. 12) Shall be address by planning and organizing remedial measures such as assignments, tutorials, exercises and remedial coaching.

15.Planned Actions for Program Outcome Attainment:

The PO having PO attainment level less than Level-4 (as per the table stated in Point No. 13) Shall be addressed by planning and organizing remedial measures for the courses corresponding to respective PO (s) such as assignments, tutorials, exercises and remedial coaching.

ANNEXURE-B

THE SUMMARY OF RESULTS OF CO-PO ATTAINMENT

B.VOC. AUTOMOBILE

Paper Name	**CO**	a	b	c	d	e	f	g	h	i	j	K
												PSO1
Linguistic Proficiency-I (English & Marathi)	3									3		
Computer Fundamentals-I (Theory)	2	2	2	2	2							
Auto Service Technician (Theory)	3	3	3	3	3	3						
Auto Service Technician (Practical)	2	2	2	2	2	2						
Occupational Practice Essentials (Theory)	2	2	2	2	2	2						

Automobile Technology	2	2	2	2	2	2						
Automotive Tools and Equipment	2	2	2	2	2	2						
Workshop Technology	1	1	1	1	1	1						
Engineering Drawing	2	1	1	1	1	1						
Lab. Course-I (AU) (Automobile Technology)	2	2	2	2	2	2		2	2			
Lab. Course-II (AU) (Automotive Tools and Equipment	3	3	3	3	3			3	3			
Lab. Cource-III (AU) (Workshop Technology	2	2	2	2	2			2	2			

Lab. Course-IV (AU)(Engineering Drawing	2	2	2	2	2			2	2			
Communicative English and Hindi	2	2	2	2	2					2		
Computer Hardware System : Theory	3	3	3	3	3							
Computer Hardware System : Lab. Course	3	3	3	3	3			3	3			
Environment Management	1	1	1	1	1							
Engine Systems	1	1	1	1	1							
Engineering Material	3	3	3	3	3							
Manufacturing Processes	2	2	2	2	2							
Engineering Drawing - II	2	2	2	2	2							

Laboratory Coursework - (Engine Systems)	2	2	2	2	2			2	2			
Laboratory Coursework - (Two Wheeler Servicing)	3	3	3	3	3	3		3	3			
Laboratory Coursework - (Workshop Practice)	2	2	2	2	2	2		2	2			
Laboratory Course work - (Engineering Drawing-II	2	2	2	2	2	2		2	2			
In- plant Training / Field Work / Mini Project	3				3	3	3	3	3	3	3	3
Linguistic Proficiency - III	2	2	2	2	2	2				2		

Business Software Tools - I	2	2	2	2	2	2						
Statistical Tools (Probability and Statistics)	2	2	2	2	2							
Machine Drawing	2	2	2	2	2							
Thermodynamics	1	1	1	1	1							
Automotive Petrol Engine	1	1	1	1	1							
Automotive Diesel Engine	2	2	2	2	2							
Laboratory Course work based on Machine Drawing	1	1	1	1	1			1	1			

Laboratory Course work based on Automotive Petrol Engines	3	3	3	3	3			3	3			
Laboratory Course Work based on Automotive Diesel Engines	3	3	3	3	3			3	3			
Laboratory Course Work based on Two-wheeler overhauling	3	3	3	3	3			3	3			
In Plant Internship / Field work / Mini - Project - III	3						3	3	3	3	3	3

Industrial Ethics and Safety Management (IA&AU)/Ethical, Legal and Regulatory	1						1	1	1	1	1	1
Business Software Tools - II	2		2	2	2	2	2					
Fundamentals of Business and Accounting	2	2	2	2	2	2	2					
Fundamentals of Mechanisms	1	1	1	1	1	1	1					
Automobile Transmission	2	2	2	2	2	2	2					
Auto Electrical Systems	2	2	2	2	2	2	2					
Automobile Systems	1	1	1	1	1	1	1					

Laboratory Coursework based on Automobile Transmission	3	3	3	3	3	3	3					
Laboratory Coursework based on Auto Electrical Systems	3	3	3	3	3	3	3		3	3		
Laboratory Coursework based on Automobile Systems	2	2	2	2	2	2	2		2	2		
Laboratory Coursework based on Auto - CAD	2	2	2	2	2	2	2		2	2		
In-plant Internship / Field Work / Mini - Project - IV	2					2	2	2	2	2	2	2

Personality Development and Stress Management	2					2	2	2				
Operations Management	1	1	1	1	1	1	1					
Business Communication	1				1	1	1	1				
Production Engg.	1	1	1	1	1	1	1			1	1	
Vehicle testing	1	1	1	1	1	1				1	1	1
Engine dignostics	3	3	3	3	3	3						
Metrology	3	3	3	3	3	3						
Hydraulics & Pneumatics	2	2	2	2	2	2		2	2			
Lab 1	3	3	3	3	3	3		3	3			
Lab2	2	2	2	2	2	2		2	2			
Major Project	3				3	3		3	3	3	3	3
Foreign Language	1	1	1	1	1	1		1	1			
Entrepreneurship Development	2					2	2	2	2	2		2

Production Management	1					1	1	1	1	1		1
Autotronics	2	2	2	2						2		2
Farm Equipment and Machinery	3									3	3	3
Transport Management and safety Regulation	2	2	2	2	2	2	2					
Design of Automotive Components	2	2	2	2	2	2	2					2
Lab. Course based on wheel Balancing and wheel Alignment	1	1	1	1	1	1	1					1
Lab. Course based on Solid Modeling	2	2	2	2	2	2	2					
Major Project - Phase -II	3				3	3	3	3	3	3	3	3

In-Plant Training Field work Mini Project	3				3	3	3	3	3	3	3	3
		2	2	2	2	2	2	2	2	2	2	2

B. VOC. INDUSTRIAL AUTOMATION

Paper Name		a	b	c	d	e	f	g	h	i	j	K	L
												PSO1	PSO2
Functional English & Marathi	2									2			
Basic Computing	3	3	3	3	3								
UPS Repairing-Theory	3	3	3	3	3	3							

UPS repairing	2	2	2	2	2	2							
Occupational Practice Essentials	2	2	2	2	2	2							
Analog and Digital Electronics	1	1	1	1	1	1							
Electrical Systems	0	0	0	0	0	0							
Industrial Electronics	2	2	2	2	2	2							
Industrial Instrumentation	2	2	2	2	2	2							
Laboratory Coursework – I (IA)(Analog and Digital Electronics)2	2	2	2	2	2	2		2	2				
Laboratory C3oursework – II (IA) (Electrical Systems)	2	2	2	2	2			2	2				

Laboratory Coursework – III (IA) (Industrial Electronics)	3	3	3	3	3			3	3				
Laboratory Coursework – IV (IA) (Industrial Instrumentation)	1	1	1	1	1			1	1				
Communicative English and Hindi	2	2	2	2	2					2			
Basic Computer Hardware System : Theory	1	1	1	1	1								
Basic Computer Hardware System : Lab- Course	1	1	1	1	1			1	1				
Environment Management	1	1	1	1	1								

Interfacing and Signal Conditioning	0	0	0	0	0								
Control Systems Fundamentals	0	0	0	0	0								
Fundamentals of Drives	0	0	0	0	0								
PLC Fundamentals	0	0	0	0	0								
Laboratory Coursework–V (IA)(Interfacing and Signal Conditioning)	0	0	0	0	0			0	0				
Laboratory Coursework – VI(IA) (Control Systems Fundamentals)	0	0	0	0	0	0		0	0				
Laboratory Coursework – VII (IA) (Fundamentals of Drives)	0	0	0	0	0	0		0	0				

Laboratory Coursework – VIII (IA) (PLC Fundamentals)	0	0	0	0	0	0		0	0				
In-plant Training – I (IA)	0	0	0	0	0	0		0	0				
Linguistic Proficiency-III	2	2	2	2	2	2				2			
Business Software Tools –I	3	3	3	3	3	3							
Statistical Tools (Probability and Statistics)	1	1	1	1	1								
Analog and Digital Circuit Design	2	2	2	2	2								
Mechanical Power Transmission	1	1	1	1	1								
Fundamentals of Hydraulics	1	1	1	1	1								

Embedded System Concepts	2	2	2	2	2								
Laboratory Coursework–IX (IA)(Analog and Digital Circuit Design)	2	2	2	2	2			2	2				
Laboratory Coursework–X(IA) (Mechanical Power Transmission)	2	2	2	2	2			2	2				
Laboratory Coursework – XI (IA) (Fundamentals of Hydraulics)	2	2	2	2	2			2	2				

Laboratory Coursework – XII (IA)(Embedded Systems Concepts)	2	2	2	2	2			2	2				
		2	2	2	2	2	2	2	2	2	2	2	2

Industrial Ethics and Safety Management(for Industrial Automation and Automobile) / Ethical, Legal and Regulatory Aspects of Tourism(for Travel & Tourism)	1						*	*	*	*	*	*	*
Business Software Tools-II	2						2	2	2	2	2	2	2
Fundamentals of Business and Accounting	2	2	2	2	2	2	2						
PLC based Automation	1	1	1	1	1	1	1						
Process Control	2	2	2	2	2	2	2						

Fundamentals of Pneumatics	2	2	2	2	2	2	2						
Embedded System Applications	1	1	1	1	1	1	1						
Laboratory Coursework–XIII (IA)(PLC based Automation)	2	2	2	2	2	2	2						
Laboratory Coursework–XIV(IA) (Process Control)	2	2	2	2	2	2	2						
Laboratory Coursework – XV (IA) (Fundamentals of Pneumatics)	2	2	2	2	2	2	2		2	2			

Laboratory Coursework – XVI(IA)(Embedded System App.)	1	1	1	1	1	1	1			1			
In-plant Training/Field work/Mini Project – II (IA)	2	2	2	2	2	2	2		2	2			
Personality Development and Stress Management	2			2	2	2	2	2	2	2	2		
Operations Management	1	1	1	1	1	1	1						
Business Communication	1	1	1	1	1	1	1						
Production Engineering	1	1	1	1	1	1	1						
Workshop Technology	2	2	2	2	2	2	2						
Introduction to Robotics	2	2	2	2	2	2						2	2

Networking Essentials	2	2	2	2	2	2							
Advance Microcontrollers	2	2	2	2	2	2							
Laboratory Coursework – XVII (IA)(Pertaining to VOC 511 and VOC 512)	3	3	3	3	3	3		3	3				
Laboratory Coursework – XVIII(IA)(Pertaining to VOC 513 and VOC 514)	2	2	2	2	2	2		2	2				
Major Project – Phase I	1	1	1	1	1	1		1	1				
Foreign Language(German/Chinese/Japanese/Russian)	3	3	3	3	3	3		3	3				

Entrepreneurship Development	1									1			
Production Management	1									1		1	1
Flexible Manufacturing System	1	1	1	1	1	1	1						
Industrial Robotics	3	3	3	3	3	3	3					3	3
Introduction to SCADA	2	2	2	2	2	2	2					2	2
Introduction to IOT	0	0	0	0	0	0	0						
Laboratory Coursework – XVII (IA)(Pertaining to VOC 611 and VOC 612)	2	2	2	2	2	2	2						

Lab. Coursework – XVIII (IA)(Pertaining to VOC 613 and VOC 614)	1	1	1	1	1	1	1		1	1			
Major Project – Phase II	1	1	1	1	1	1	1		1	1	1	1	1
In-plant Training/Field work/Mini Project – IV (IA)	3						3	3	3	3	3	3	3
		2	2	2	2	2	2	2	2	2	2	2	2

M.VOC. AUTOMOBILE

Paper Code	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CC 100	3	3	3	3	3	3									
ATF 121	1	1	1	1	1	1									
ATF122	1	1	1	1	1	1									
ATF 123	0	0	0	0	0	0									
ATC 124	0	0	0	0	0	0									
ATC 125	1	1	1	1	1	1									
ATC	2	2	2	2	2	2									

126																
CF 101	3	3	3	3	3	3						3	3	3	3	
EF 1XX	2	2	2	2	2	2								2	2	
ATLF 127	3	3	3	3	3											
ATLF 128	2	2	2	2	2											
ATLF 129	2	2	2	2	2											
ATLC 130	0	0	0	0	0									0	0	
ATLC 131	0	0	0	0	0									0	0	
ATF 221	1	1	1	1	1	1										
ATF 222	3	3	3	3	3	3								3	3	
ATF 223	1	1	1	1	1	1								1	1	
ATF 224	1	1	1	1	1	1								1	1	
ATC 225	2	1	1	1	1	1								1	1	
ATC 226	2	2	2	2	2	2								2	2	
ATLF 227	1	1	1	1	1	1								1	1	
ATLF 228	1	1	1	1	1	1								1	1	
ATLC 229	0	0	0	0	0									0	0	
ATLC 230	3	3	3	3	3	3								3	3	
ATLC 231	3	3	3	3	3	3								3	3	
ATR 232	2	2	2	2	2	2						2	2	2	2	
ATC 321	2		2	2	2	2						2	2	2	2	
ATC 322	3	3	3	3	3	3						3	3	3	3	
ATGE 32X	1	1	1	1	1	1						1	1	1	1	
ATGE $32X_1$	1	1	1	1	1	1						1	1	1	1	
ATOE $32X_2$	1	1	1	1	1	1						1	1	1	1	

ATLC 332	3	3	3	3	3	3								3	3	
ATLC 333	2	2	2	2	2	2								2	2	
ATLE 33X$_L$	1	1	1	1	1	1								1	1	
ATLE 33X$_{1L}$	1	1	1	1	1	1								1	1	
ATR 340	3			3	3	3	3	3	3	3	3	3	3	3	3	
ATGE 42X$_1$	2	2	2	2	2	2							2	2	2	
ATLE 42X$_2$	3	3	3	3	3	3							3	3	3	
ATR 430	0	0	0	0	0	0										
ATLF 12	3			3	3		3	3	3	3	3	3	3	3	3	
	2	2	2	2	2	2	3	3	3	3	3	2	2	2	2	

M.VOC. INDUSTRIAL AUTOMATION

Paper Title		**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**	**p**
Constitution of India	2	2	2	2	2	2											
Electronic Systems	3	3	3	3	3	3											
Power Electronics	0	0	0	0	0	0											
Transducer Technology	2	2	2	2	2	2											

Electric Drives	3	3	3	3	3	3											
Embedded Systems Design	2	2	2	2	2	2											
Programmable Logic Controllers	0	0	0	0	0	0											
Research Methodology	2	2	2	2	2	2						2	2	2	2	2	2
Elective Foundation (Any One) ▪ Operations Management (EF130) ▪ Materials management (EF 131)	0	0	0	0	0	0								0	0	0	0
Electronic Systems lab	0	0	0	0	0												
Power Electronics lab	2	2	2	2	2												
Instrumentation lab – I	0	0	0	0	0												

Electric Drives lab	2	2	2	2	2									2	2	2	2
Embedded Systems Lab	0	0	0	0	0									0	0	0	0
PLC lab	2	2	2	2	2									2	2	2	2
Communication Protocols for Instrumentation	3	3	3	3	3	3											
Mechatronics	3	3	3	3	3	3								3	3	3	3
Advanced Transducers	2	2	2	2	2	2								2	2	2	2
Robotics	3	3	3	3	3	3								3	3	3	3
Process Control	2	2	2	2	2	2								2	2	2	2
Industrial Automation	2	2	2	2	2	2								2	2	2	2
Industrial Networking lab	2	2	2	2	2	2								2	2	2	2
Mechatronics lab	3	3	3	3	3	3								3	3	3	3
Instrumentation lab –II	3	3	3	3	3	3								3	3	3	3
Robotics lab	2	2	2	2	2	2								2	2	2	2
Process Control lab	3	3	3	3	3	3								3	3	3	3

Industrial Automation lab	2	2	2	2	2	2						2	2	2	2	2	2
Research/ Industrial Project – Phase I (Review of Literature/ Industrial Orientation, Formulation of Topic, Experimental Plan)	2			2	2	2	2	2	2	2	2	2	2	2	2	2	2
Generic Elective – I	3	3	3	3	3	3						3	3	3	3	3	3
Generic Elective – II	2	2	2	2	2	2						2	2	2	2	2	2
Generic Elective – III	1	1	1	1	1	1						1	1	1	1	1	1
Generic Elective – IV	1	1	1	1	1	1						1	1	1	1	1	1
Open Elective – I	1	1	1	1	1	1						1	1	1	1	1	1
Lab Course based on Generic Elective – I	2	2	2	2	2	2								2	2	2	2

Lab Course based on Generic Elective – II	3	3	3	3	3	3								3	3	3	3
Lab Course based on Generic Elective – III	2	2	2	2	2	2								2	2	2	2
Lab Course based on Generic Elective – IV	1	1	1	1	1	1								1	1	1	1
Research/ Industrial Project – Phase II (Experimental Work)	2			2	2	2	2	2	2	2	2	2	2	2	2	2	2
Generic Elective – V	2	2	2	2	2	2							2	2	2	2	2
Open Elective – II	1	1	1	1	1	1							1	1	1	1	1
Lab Course based on Generic Elective – V	3	3	3	3	3	3											
Research/ Industrial Project – Phase III	2			2	2	2	2	2	2	2	2	2	2	2	2	2	2
		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

ANNEXURE-B

COURSE OUTCOMES

Course Structure (B.Voc. Automobile)

Paper No	Paper Title	Credits
Semester – I		
General Education Components (A)		
VOC 101	Linguistic Proficiency-I (English Marathi) with Language lab training	4
VOC 102	Computer Fundamentals-I (Information Technology) : Theory	2
VOC 103	Auto Service Technician (Theory)	2
VOC 104	Auto Service Technician (Practical)	
VOC 105	Occupational Practice Essentials	4
Skill Development Components (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
Total Credits = General Education Components + Skill Development Components		12+16 =28
Semester – II		
General Education Components (A)		
VOC 201	Linguistic Proficiency- II (English and Hindi) with Language Lab	4
VOC 202	Computer Fundamentals- II (Basic Computer Hardware system)	2
VOC 203	Computer Fundamentals- II (Laboratory Course)	2
VOC 204	Environment Management	4
Skill Development Components (B)		

VOC 231	Engine System	2
VOC 232	Engineering Material	2
VOC 233	Manufacturing Processes	2
VOC 234	Engineering Drawing - II	2
VOC 235	Laboratory Coursework based on Engine System	2
VOC 236	Laboratory Coursework based on Two wheeler servicing	2
VOC 237	Laboratory Coursework based on Workshop practices	2
VOC 238	Laboratory Coursework based on Engineering Drawing - II	2
VOC 239	In-plant Training – II (AU)	4
Total Credits = General Educational Components + Skill Development Components		12+20 =32
Semester – III		
General Education Components (A)		
VOC 301	Linguistic Proficiency-III	4
VOC 302	Business Software Tools –I	4
VOC 303	Statistical Tools (Probability and Statistics)	4
Skill Development Components (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
Total Credits = General Education Components + Skill Development Components		12+16 =28

Semester – IV		
General Education Components (A)		
VOC 401	Industrial Ethics and Safety Management	4
VOC 402	Business Software Tools-II	4
VOC 403	Fundamentals of Business and Accounting	4
Skill Development Components (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	Laboratory Coursework based on In-plant Internship/Field Work/ Mini-Project-IV	4
Total Credits = General Education Components + Skill Development Components		12+20= 32
Semester – V		
General Education Components (A)		
VOC 501	Personality Development and Stress Management	4
VOC 502	Operations Management	4
VOC 503	Business Communication	2
VOC 504	Production Engineering	2
Skill Development Components (B)		
VOC 531	Vehicle Testing	2
VOC 532	Engine Diagnostics and Troubleshooting	2
VOC 533	Metrology	2
VOC 534	Hydraulic and Pneumatic	2
VOC 531 A	Fuel Testing and Standards	2
VOC 532 A	Heat, Ventilation, and Air conditioning (HVAC)	2
VOC 535	Laboratory Coursework - Engine Diagnostics and Troubleshooting	3
	Laboratory Coursework – Hydraulic and Pneumatic	3
VOC 536	Laboratory Coursework - Engine and Fuel Testing Laboratory	3
VOC 535 A	Major Project – Phase I	2
VOC 537	In-plant Training/Field work/Mini Project – V (AU)	2
VOC 538		
Total Credits = General Education Components + Skill Development Components		12+18= 30
Semester - VI		
General Education Components (A)		

VOC 601	Foreign Language(German/Chinese/Japanese/Russian)	4
VOC 602	Entrepreneurship Development	4
VOC 603	Production Management	4
Skill Development Components (B)		
VOC 631	Autotronics	2
VOC 632	Farm Equipment and Machinery	2
VOC 633	Transport Management and safety regulation	2
VOC 634	Automotive Component Design	2
VOC 631 A	Electric and Hybrid Vehicles	2
VOC 632 A	Intelligent Vehicle Technology	2
VOC 635	Laboratory Coursework – Wheel Alignment and Balancing	3
VOC 636	Laboratory Coursework – Solid Modelling	3
VOC 635 A	Laboratory Coursework - Suspension system laboratory	3
VOC 637	Major Project – Phase II	2
VOC 638	In-plant Training/Field work/Mini Project – IV (AU)	2
Total Credits = General Education Components + Skill Development Components		12+18= 30
	Total Credits (Semester I to VI)	180

General Education Components

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

Course Outcomes:

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

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

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:
Basic Computing

Course Outcomes:

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

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

VOC 103 Auto Service Technician (Theory)

Course Outcomes:

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

CO1	Assist senior technician in diagnosing faults in a given motor vehicle
CO2	Perform servicing and minor repairs of a given motor vehicle
CO3	Plan and organize work to meet expected outcomes
CO4	Perform effectively in teams
CO5	Maintain healthy, safe and secure working environment
CO6	Prepare report

VOC 104 Auto service technician (Practical)

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Explain various precautions to be taken to avoid damage to the vehicle and its components while working on diagnosis or troubleshooting the vehicle for any faults
CO2	ensure all workshop tools, equipment and workstations are adequately maintained by carrying out scheduled checks, calibration and timely repairs where necessary
CO3	identify the auto component manufacturer specifications related to the various components/ aggregates in the vehicle,
CO4	record all service and repairs carried out and ensure completeness of tasks assigned before releasing vehicle for the next procedure
CO5	Analyze carry out adjustments, replacement of vehicle components and replenishment of consumable materials following the manufacturer's current

	specification for the particular maintenance interval, working methods and procedures, use of equipment, the tolerances for the vehicle
CO6	Plan for how suspension systems, steering systems, braking systems, non-electrical body systems, wheels and tyres operate for the type of vehicle on which you are working (including regenerative braking systems and other energy recuperation systems used on hybrid / electric and alternative fuel vehicles)

VOC 105 Occupational Practice Essentials

Course Outcomes

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

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

VOC-131: Automobile Technology

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Demonstrate automobile vehicle components (two and four wheeler)
CO2	Differentiate and demonstrate all types of engine components
CO3	Apply knowledge of identify engine and vehicle components.
CO4	Clarify engine and vehicle specifications
CO5	Apply knowledge to for better driving skills and their safeties.
CO6	Identify various electrical equipments used in automobile.

VOC 132 Automobile Tools and Equipments

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Define tools and equipment used in automobile workshop.
CO2	Describe method of 5 s operation.
CO3	Demonstrate use of measuring and marking tool.
CO4	Selection of proper tools and equipment for prescribed operation.
CO5	Recommend tools and equipment for different automotive application

VOC 133 Workshop Technology

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Define Manufacturing Machines used in automobile workshop.
CO2	Describe method of Wheel Alignment machine. Wheel balancer machine.
CO3	Demonstrate use of General Purpose Machine and its Cutting tools.
CO4	Demonstrate use of Special Purpose Machines in manufacturing industry.
CO5	Selection of manufacturing process and Machine for prescribed operation.
CO6	Recommend Machines and equipment for different automotive application.

VOC 134: Engineering Drawing

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Distinguish between isometric drawing and orthographic drawing.
CO2	Adapt the necessary nomenclature, specifications, rules, tools required for Engineering drawing.
CO3	Interpret different types of planes.
CO4	Distinguished between Aligned and unidirectional system of dimensioning.

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

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Apply knowledge on differentiating two and four wheeler vehicle
CO2	Identify various engine and vehicle components
CO3	Differentiate various types of engine their working, construction application
CO4	Apply knowledge on road safety and safe driving techniques
CO5	Apply knowledge to identify various automobile dealers, their functions, various activities under dealership

VOC 136 Lab Course on Automobile Tools and Equipments

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Describe the procedure of using general purpose tools and equipments.
CO2	Practice general safety procedure in Automobile Garages.
CO3	Practice 5 S technique
CO4	Operating special purpose automotive tools and equipments.
CO5	Checking the battery for charging, connecting the battery for charging

VOC 137 Lab Course on Workshop Technology

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Describe the workshop, work done in workshop
CO2	Demonstrate use of various Machines in Automobile Industries
CO3	Examine General Purpose machines and analyze it.
CO4	Recognize special purpose machine and explain it.
CO5	Design to plan Jobs on Machining operations.

VOC 138 Lab Course on Engineering Drawing

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Draft the orthographic view of Mechanical parts.
CO2	Differentiate between types of line used in engineering drawing.
CO3	Draft the isomeric view of Mechanical parts.
CO4	Read isometric and orthographic drawing completely.

VOC - 201: Linguistic Proficiency-II

Part - A: English

Course Outcomes:

On completion of the course, students will be able to

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

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)

Course Outcomes:

On completion of the course, students will be able to

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

VOC 204: Environment Management

Course Outcomes:

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

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

VOC-231Engine System

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Describe engine and its classification, various systems provided on engine, performance parameters.
CO2	Define ignition system its type, advance technology used on it, and identify various components.
CO3	Define cooling system its type, advance technology used on it, and identify various components.
CO4	Define lubrication system its type, advance technology use on it, and identify various components.

VOC 232 Engineering Materials

Course Outcomes: At the end of the course, the student will be able to:

CO1	Aware of engineering materials used in automobile systems.
CO2	Explain properties of engineering materials.
CO3	Explain ferrous materials and their alloys.
CO4	Explain non-ferrous materials and their alloys.
CO5	Explain Composites and Non Metallic Materials.

VOC - 233 Manufacturing Processes

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Explain Manufacturing processes required to manufacture different parts of automobile.
CO2	Explain Metal Casting process.
CO3	Explain Forging and Rolling Processes.
CO4	Explain Extrusion and Drawing Process.
CO5	Explain Powder Metallurgy Process.
CO6	Prepare Presentations

VOC 234 Engineering Drawing II

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Distinguish between developed and undeveloped view of drawing.
CO2	Interpret the sections of solids such as prism and pyramid.
CO3	Interpret sectional orthographic view of Mechanical parts.
CO4	Design and development of lateral surfaces for industry applications.

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

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Demonstrate how two stroke, four stroke engine disassemble and assemble
CO2	Demonstrate how conventional ignition and advance ignition system work and identify faults.
CO3	Demonstrate how cooling system works, locate the components and identify faults.
CO4	Demonstrate how lubrication system works, locate the components and identify faults.
CO5	Apply knowledge to replace of oil, repairing of alternator.

VOC 236 Two wheeler servicing

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Perform Assembly and disassembly of Multi plate Clutch.
CO2	Perform Assembly and Disassembly of Constant mesh gear box.
CO3	Perform Overhauling of gearbox; replacing gear oil, 4 stroke Engine; replacing engine oil.
CO4	Explain various components of Telescopic shock Absorber.

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

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Perform Lap welding joint.
CO2	Perform Step turning and Taper Turning operation on lathe machine
CO3	Perform fitting shop (‘V’ Fitting)
CO4	Perform Butt welding joint.

VOC 238 Lab course based on Engineering Drawing II

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Draw the orthographic projections of regular solids.
CO2	Analyze the sections of solids such as prism and pyramid.
CO3	Draft sectional orthographic view of Mechanical parts.
CO4	Draft development of lateral surfaces for industry applications.

VOC: 301: Linguistic Proficiency - III

Course Outcomes

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

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

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

Course Outcomes

On completion of the course, students will be able to

1	Define and Discuss Basic architecture, hardware aspects, peripherals (memory, input/output devices) of Computers
2	Explain step by step hardware assembly of Computers
3	Compare printer categories, describe printing principles and types of scanners
4	Describe hardware features, maintenance basics and develop wi-fi network related troubleshooting skill with laptops

5	Assemble a desktop computer and install operating system/ softwares , while identifying components in Bios set-up and address problems related to installation

VOC 303: Statistical Tools: Probability and Statistics

Course Outcomes:

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

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

VOC 331 Machine Drawing

Course Outcomes:

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

CO1	Explain the Machine drawing and its conventions.
CO2	Explain Applications of screw and Fasteners.
CO3	Draw detail and assembly drawing of machine components

VOC 332 Thermodynamics

Course Outcomes:

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

CO1	Explain the concept of various thermodynamic cycles and their applications
CO2	Explain Steam generators and their performance evaluation
CO3	Explain Types of fuels and the process of combustion

VOC 333 Automotive Petrol Engines

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Apply knowledge for identify petrol engine parts, construction and working of petrol engine.
CO2	Demonstrate of various combustion chambers and combustion process of petrol engine.
CO3	Identify different problems occurred due to in complete combustion of fuel.
CO4	Describe methods of fuel supply system, its components, their functions.
CO5	Describe the various advance system used on petrol engine to increase performance.

VOC 335 Laboratory Coursework based on Machine Drawing

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Explain Representation of Machine components and conventions.
CO2	Explain Representation of Fits, geometric tolerance and surface roughness on machine part.
CO3	Draw Assembly and Detail drawing of Piston- connecting rod, Knuckle joint, Rigid and Flexible Flange coupling.

VOC 336 Lab. Automotive petrol engine (AU)

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Examine Engine Construction and Operation: Constructional details of 4-stroke petrol engine. Working principle, Otto cycle and actual indicator diagram. Two stroke engine construction and operation
CO2	Describe four stroke and two-stroke engine operation. Firing order and its significance. SI Engine Fuel System: Carburettor working principle. Requirements of an automotive carburettor; Starting, idling, acceleration and normal circuits of carburettors, compensation, Maximum power devices, constant choke and constant vacuum carburettors. Fuel feed systems, Mechanical and electrical pumps. Petrol injection
CO3	Classify Cooling and Lubrication System: Need for cooling system. Types of cooling system, Liquid cooled system, Thermosyphon system, Pressure cooling system. Lubrication system, Mist lubrication system, Wet sump and dry sump lubrication. Properties of lubricants. Properties of coolants.
CO4	Distinguish between two stroke and four stroke petrol engine.
CO5	Summaries Combustion and Combustion Chambers: Combustion in SI engines, stages of combustion, Calculate Friction power, Brake power, Indicated power, etc.
CO6	Rearrange Heat Balance sheet for Multi-cylinder Petrol Engine, Multi-cylinder Petrol Engine, Electric Fuel Pump.

VOC 338 Two wheeler Overhauling

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Perform Overhauling of clutch, 4 stroke engine, Two Wheeler gear box, Suspension system.
CO2	Perform replacement of two wheeler wheel bearings.
CO3	Perform carburetor tuning and emission testing.

VOC 401: Industrial Ethics and Safety Management

Course Outcomes

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

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

VOC- 402: Business Software Tools

Course Outcomes:

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

1	Discuss and apply CSS and Photoshop
2	Discuss and apply Dreamviewer and Flash
3	Explain and apply key concepts of CMS (Computer Management System)
4	Create different projects using CMS
5	Discuss and apply key concepts of hypertext processor

VOC 403: Fundamentals of Business and Accounting

Course Outcomes:

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

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

VOC 431 Fundamentals of Machines and Mechanism(AU)

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Define Rigid body and resistant body, Types of links, joints, gears, fly wheels, cams, Followers.
CO2	Explain Functions of governor, wheels, gears
CO3	Sketch Cam and follower diagram, cycloidal profile, involute profile, Calculate, Co-efficient of energy, Co-efficient of speed.
CO4	Distinguish between Cam And follower, Single slider and double slider crank chain.
CO5	Test different types of mechanism, single slider crank chain, old hams couplings, Ackerman's link, withworth return mechanism.
CO6	Design different types of gears, and its meshing, design cam and followers,

VOC 432 Automobile Transmission

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Identify the components of transmission system.
CO2	Analyze the steering system.
CO3	Demonstrate the functional requirement of automobile transmission
CO4	Demonstrate the construction and working of Differential Mechanism

VOC-433: Auto-Electrical System

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Introduction to electrical system its fundamentals and starting system
CO2	Explain charging system its requirement, Generator (dynamo), Alternator etc.
CO3	Explain Troubleshooting of Generator (dynamo), Alternator.
CO4	Explain ignition system its purpose requirement etc.
CO5	Explain lighting and accessory system in automobile.

VOC 434 Automobile Systems

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Explain Fuel system S.I. engine.
CO2	Explain Fuel system C.I. engine.
CO3	Explain Lubrication system and cooling system, necessity of engine cooling.
CO4	Explain Braking System and its type.

VOC 435 Lab course based on Automobile Transmission

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Assemble and Dismantle the Single plate and multi plate clutch of automobile.
CO2	Diagnose and Repair faults in gearbox.
CO3	Assemble and Dismantle all types of steering gearbox

CO4	Demonstrate the construction and working of power steering system.

VOC-436 Laboratory Course based on Auto Electrical System

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Explain battery charging and its precaution and show how it works actually.
CO2	Explain of battery testing by different types of test show how it works actually..
CO3	Explain battery ignition system and its types show how it works actually.
CO4	Explain Electronic ignition system show how it works actually.
CO5	Explain lighting and accessory system in automobile.

VOC-437 Laboratory Course based on Automobile System

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Define what is SI system, its working
CO2	Demonstration of MPFI system
CO3	Explain Air brake system
CO4	Demonstration of Trouble shooting of Hydraulic Break system
CO5	Demonstration of Trouble shooting of fuel system

VOC-438 Laboratory Course based on Auto-CAD

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Explain Auto Cad user interface.
CO2	Explain commands used in Auto-Cad.
CO3	Explain difference between 2D and 3D drawings.
CO4	Draw 2D drawings of various machine components.

VOC 501: Personality Development and Stress Management

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

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

VOC 502 Operation Management

Course Outcomes:

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

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

VOC- 503: Business Communication

Course Outcomes:

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

1	Explain characteristics of successful communication, communication structure in organization
2	Apply communication as a tool to resolution of conflicts
3	State and use principles of effective writing

4	Discuss analyze and present a case study
5	Categorize communication areas and construct monologues/ dialogues for effective communication as per situation

VOC 504 Production Engineering

Course Outcomes:

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

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

VOC 531 Vehicle Testing

Course Outcomes:

CO1	Select a standard for TA and COP of a given entity in India
CO2	Perform testing of an engine for a given performance parameter
CO3	Perform testing of a vehicle for a given performance
CO4	Identify a standard being followed in testing a given vehicle, a system or an aggregate
CO5	Update for latest developments in vehicular standards

VOC 532 Engine Diagnostics and Troubleshooting

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Diagnoses engine faults, identify correct cause and apply remedies to remove fault.
CO2	Diagnoses cooling system faults identify correct cause and apply remedies to remove fault.
CO3	Diagnoses lubrication system faults identify correct cause and apply remedies to remove fault.
CO4	Diagnoses fuel supply system faults identify correct cause and apply remedies to remove fault.
CO5	Diagnoses electrical system faults identify correct cause and apply remedies to remove fault.

VOC 533 Metrology

Course outcomes:

Upon completion of this course, the Students can.

CO1	demonstrate different measurement technologies and use of them in Industrial Components
CO2	Explain correct procedure to be adopted to measure the dimension of the components.
CO3	Explain various Metrological equipments available to measure the dimensions of the components..

VOC 532 A Heat, Ventilation, and Air conditioning (HVAC)

Course outcomes

At the end of the course, student will be able to

CO1	1. Explain the basic concepts of Heat, Ventilation, and Air conditioning.
CO2	2. Solve heating and cooling load calculations for different ambient conditions.
CO3	3. Equip themselves familiar with functions of refrigerating components.
CO4	4. Select refrigerant with less GWP and ODP

CO5	5. Explain the different types of fan and its characteristics

VOC 534 Hydraulics and Pneumatics

CO1	Explain basic properties of fluid, important principles of hydraulics with their applications and hydraulic devices used in practice
CO2	Explain construction & working of Elements of Hydraulic and Pneumatic system.
CO3	Carry out troubleshooting and maintenance of Hydraulic & Pneumatic Systems.

VOC 531 A Fuel Testing and Standards

Course outcomes

At the end of the course, student will be able to

CO1	Explain the different types of fuels used in automotive industry and importance of fuel testing.
CO2	Explain Regulations and different Standards, A retrospection of fuel quality improvement and related amendments
CO3	Explain Properties of fuels influencing IC engine performance.
CO4	Explain testing methods for gasoline and diesel.
CO5	Explain testing methods for biodiesels, CNG and LPG.

VOC 535 Lab course on Engine Diagnostic and Troubleshooting.(AU)

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Identify Various troubles related to engine and vehicle, identify various engine scanner available in Indian as well as other than Indian markets
CO2	Explain characteristics of automobile petrol engine and automobile diesel engine also Alternate fuel used in the vehicles.
CO3	Apply necessary remedies on Charging system, Fuel supply system, Ignition system and Electrical system.
CO4	Distinguish between C.I. Engine and S. I. Engine

CO5	Troubleshoot of various problem such as Charging system, Fuel supply system, Ignition system and Electrical system.
CO6	Modify new technical to solve Heavy fuel consumption, Reach and lean mixture, hard staring and cold starting,

VOC 535 A Engine and Fuel Testing Laboratory

Course outcomes

At the end of the course, student will be able to

CO1	Test the lubricants and fuels used for IC engines
CO2	Conduct the performance and heat balance test on IC engines using various dynamometers
CO3	Conduct the test of fuels

VOC 537
Major Project – Phase I

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

Course outcomes

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

1	Effectively communicate read, write Hiragana and Katakana of Japanese scripts,
2	Explain basic kanjis
3	Can participate in simple Japanese conversation.

VOC-- 602: ENTREPRENEURSHIP DEVELOPMENT

- **Course Outcomes:**

After completion of this course, students will be able to

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

VOC 603 Production Management

- **Course Outcomes:**

After completion of this course, students will be able to

CO1	Describe principles and decision analysis related to the effective utilization of the factors of production.
CO2	Describe the nature of how production management is carried out in an organization.
CO3	Analyze the efficiency and effectiveness of processes.
CO4	Describe the nature of products or services in the organization.

VOC 631 Autotronics

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Describe the Electronics system for engine.
CO2	Demonstrate the usage of intelligent sensors such as MAP, CKP,CMP, Lambda.
CO3	Analyze the auxiliary system for electronics troubleshooting.
CO4	Scan the engine for diagnosis by using Engine scanner.

VOC 632- Farm Equipments and Machinery

Course Outcomes:

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

CO1	Describe the working of farm tractor, farm equipment's and machinery .
CO2	Students will be able to perform servicing and general repairing work of tractors,

	farm equipment's and machinery.

VOC 633 - Transport Management and Safety Regulations

Course Outcomes:

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

CO1	Explain the current development in transportation and logistics system.
CO2	Perform the critical analysis of transportation system and logistic strategy.

VOC 631 A Electric and Hybrid Vehicle

Course outcomes

At the end of the course, student will be able to

CO1	Explain electric vehicle technology and electric vehicles
CO2	Explain the basics of hybrid and electric drive trains
CO3	Explain design calculations of hybrid system under study.
CO4	Explain the various vehicle power sources in hybrid vehicle technology

VOC 634 - Design of Automotive Components

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Describe basic concepts in design.
CO2	Describe functional requirements for different components of Automobile.
CO3	Determine static and dynamic loading on different components of Automobile.
CO4	Determine stresses generated due to loading in various components of Automobile.
CO5	Determine dimensions for various components of Automobile.

VOC 632 A Intelligent Vehicle Technology

(2 credits- 50 marks)

Course outcomes

At the end of the course, student will be able to

CO1	Explain the intelligent vision system used in automobiles
CO2	Explain the architecture of intelligent transportation system
CO3	Explain adaptive control techniques of an autonomous vehicle.
CO4	Explain about the successful autonomous vehicle projects.

VOC 635 Laboratory Coursework based on Wheel Balancing and Wheel Alignment

(2 Credits: 50 Marks)

Course Outcomes: At the end of the course, the student will be able to:

CO1	Explain static and dynamic balancing.
CO2	Explain Castor, Camber, Toe-in and Toe-out.
CO3	Carry out balancing of tyres.
CO4	Carry out 3D wheel Alignment of automobiles.

VOC 635 A Suspension system laboratory

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Explain Suspension system.

CO2	Explain Castor, Camber, Toe-in and Toe-out.
CO3	Carry out replacement of worn out ball joint..
CO4	Carry replacement of worn out suspension components of automobiles.

VOC 636 : Laboratory Coursework based on Solid Modeling

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Explain interface required for Computer aided design and drawing.
CO2	Explain commands used in Solid works.
CO3	Design and draw 3D objects in solid works workbench.
CO4	Perform Simulation of objects in interface.

VOC 637 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.

VOC 638 In-plant Training/Field work/Mini Project – IV (AU)

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

Course Structure

B. VOC. INDUSTRIAL AUTOMATION

Paper No	Paper Title	Credits
Semester - I		
General Education Components		
VOC 101	Functional English and Marathi	4
VOC 102	Basic Computing	2
VOC 103	UPS Repairing (Theory)	2
VOC 104	UPS Repairing (Practical)	2
VOC 105	Occupational Practice Essentials	2
Skill Development Components - Industrial Automation (A)		
VOC 111	Analog and Digital Electronics	2
VOC 112	Electrical Systems	2
VOC 113	Industrial Electronics	2
VOC 114	Industrial Instrumentation	2
VOC 115	Laboratory Coursework – I (IA)(Analog and Digital Electronics)	2
	Laboratory Coursework – II (IA) (Electrical Systems)	2

VOC 116 **VOC 117** **VOC 118**	Laboratory Coursework – III (IA) (Industrial Electronics) Laboratory Coursework – IV (IA) (Industrial Instrumentation)	2 2
Total Credits = General Education Components + Skill Development Components		12+16= 28
Semester - II		
General Education Components		
VOC 201 **VOC 202** **VOC 203** **VOC 204**	Communicative English and Hindi Basic Computer Hardware System : Theory Basic Computer Hardware System : Lab- Course Environment Management	4 2 2 4
Skill Development Components - Industrial Automation (A)		
VOC 211 **VOC 212** **VOC 213** **VOC 214** **VOC 215** **VOC 216** **VOC 217** **VOC 218** **VOC 219**	Interfacing and Signal Conditioning Control Systems Fundamentals Fundamentals of Drives PLC Fundamentals Laboratory Coursework–V (IA)(Interfacing and Signal Conditioning) Laboratory Coursework – VI(IA) (Control Systems Fundamentals) Laboratory Coursework – VII (IA) (Fundamentals of Drives) Laboratory Coursework – VIII (IA) (PLC Fundamentals) In-plant Training – I (IA)	2 2 2 2 2 2 2 2 4
Total Credits = General Education Components + Skill Development Components		12+20= 32
Semester – III		
General Education Components		
VOC 301 **VOC 302** **VOC 303**	Linguistic Proficiency-III Business Software Tools –I Statistical Tools (Probability and Statistics)	4 4 4
Skill Development Components - Industrial Automation (A)		
VOC 311 **VOC 312** **VOC 313** **VOC 314** **VOC 315** **VOC 316** **VOC 317** **VOC 318**	Analog and Digital Circuit Design Mechanical Power Transmission Fundamentals of Hydraulics Embedded System Concepts Laboratory Coursework–IX (IA)(Analog and Digital Circuit Design) Laboratory Coursework–X(IA) (Mechanical Power Transmission) Laboratory Coursework – XI (IA) (Fundamentals of Hydraulics) Laboratory Coursework – XII (IA)(Embedded Systems Concepts)	2 2 2 2 2 2 2 2
Total Credits = General Education Components + Skill Development Components		12+16= 28
Semester – IV		
General Education Components		

VOC 401	Industrial Ethics and Safety Management(for Industrial Automation and Automobile) / Ethical, Legal and Regulatory Aspects of Tourism(for Travel & Tourism)	4
VOC 402	Business Software Tools-II	4
VOC 403	Fundamentals of Business and Accounting	4
Skill Development Components - Industrial Automation (A)		
VOC 411	PLC based Automation	2
VOC 412	Process Control	2
VOC 413	Fundamentals of Pneumatics	2
VOC 414	Embedded System Applications	2
VOC 415	Laboratory Coursework–XIII (IA)(PLC based Automation)	2
VOC 416	Laboratory Coursework–XIV(IA) (Process Control)	2
VOC 417	Laboratory Coursework – XV (IA) (Fundamentals of Pneumatics)	2
VOC 418	Laboratory Coursework – XVI(IA)(Embedded System App.)	2
VOC 419	In-plant Training/Field work/Mini Project – II (IA)	4
Total Credits = General Education Components + Skill Development Components		12+20= 32
Semester – V		
General Education Components		
VOC 501	Personality Development and Stress Management	4
VOC 502	Operations Management	4
VOC 503	Business Communication	2
VOC 504	Production Engineering	2
Skill Development Components - Industrial Automation (A)		
VOC 511	Workshop Technology	2
VOC 512	Introduction to Robotics	2
VOC 513	Networking Essentials	2
VOC 514	Advance Microcontrollers	2
VOC 511A	Fundamentals of Microprocessor 8086	2
VOC 512A	Interfacing with Microprocessor 8086	2
VOC 515	Laboratory Coursework – XVII (IA)(Pertaining to VOC 511 and VOC 512)	3
VOC 516	Laboratory Coursework – XVIII(IA)(Pertaining to VOC 513 and VOC 514)	3
VOC 515A	Lab. Coursework – XVIV(IA)(Pertaining to VOC 511A and VOC 512A)	3
VOC 517	Major Project – Phase I	2
VOC 518	In-plant Training/Field work/Mini Project – III (IA)	2
Total Credits = General Education Components + Skill Development Components		12+ 18= 30
Semester – VI		
General Education Components		

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

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

Learning Outcomes

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

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

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: Basic Computing

Learning Outcomes

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

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

VOC-103 : UPS Repairing

Learning Outcomes

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

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

VOC 104 : UPS Repairing(Practical)

Learning Outcomes

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

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

VOC-105: Occupational Practice Essentials

Learning Outcomes:

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

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

VOC-111: Analog and Digital Electronics

Learning Outcomes

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

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

VOC-112: Electrical Systems

Learning Outcomes

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

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

VOC 113: Industrial Electronics

Learning Outcomes:

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

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

VOC-114: Industrial Measurements and Instrumentation

Learning Outcomes

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

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

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

Learning Outcomes

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

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

VOC 116: Laboratory Coursework – II
(Electrical Systems)

Learning Outcomes

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

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

VOC 117: Laboratory Coursework – III

(Industrial Electronics)

Learning Outcomes:

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

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

VOC 118: Laboratory Coursework – IV
(Industrial Instrumentation)

Learning Outcomes

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

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

VOC - 201: Linguistic Proficiency-II

Part - A: English

Learning Objectives

To improve the writing skills of students in English and Hindi

Learning Outcomes

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

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

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 Hardware System: Theory

Learning Outcomes

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

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

VOC – 203: Computer Hardware System : Lab- Course

Learning Outcomes

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

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

VOC-204: Environment Management

Learning Outcomes

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

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

VOC-211: INTERFACING AND SIGNAL CONDITIONING

Learning Outcomes

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

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

VOC-212 : Control Systems Fundamentals

Learning Outcomes

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

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

VOC-213: FUNDAMENTALS OF DRIVES

Learning Outcomes

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

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

VOC-214: PLC FUNDAMENTALS

Learning Outcomes

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

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

VOC - 215: Lab course V
(Interfacing and Signal Conditioning)

Learning Outcomes

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

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

VOC-216: Lab Course VI
(Control Systems Fundamentals)

Learning Outcomes

On completion of this course, students will be able to

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

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

Learning Outcomes

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

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

VOC-218: Lab course VIII
(PLC Fundamentals)

Learning Outcomes

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

1	Interface basic input / output devices to PLCs
2	Develop ladder program for basic input –output operations with PLCs
3	Troubleshoot in ladder programs

VOC 219: In-plant Training – II (IA)

In-plant coursework on Control Panel Design and Wiring

VOC 301: Linguistic Proficiency – III

Learning Outcomes

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

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

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

Learning Outcomes

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

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

VOC 303: Statistical Tools: Probability and Statistics

Learning Outcomes

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

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

VOC – 311: Analog and Digital Circuit Design

Learning Outcome

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

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

VOC – 312:Mechanical Power Transmission

Learning Outcomes

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

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

VOC – 313: Fundamentals of Hydraulics

Learning Outcomes

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

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

VOC- 314:Embedded System Concepts

Learning Outcomes

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

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

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

Learning Outcomes

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

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

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

Learning Outcomes

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

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

VOC- 317:Laboratory Coursework–XI
(Fundamentals of Hydraulics)

Learning Outcomes

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

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

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

Learning Outcomes

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

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

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

VOC 401: Industrial Ethics and Safety Management

Learning Outcomes

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

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

VOC- 402: Business Software Tools

Learning Outcomes

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

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

VOC 403: Fundamentals of Business and Accounting

Learning Outcomes

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

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

VOC-411:PLC Based Automation

Learning Outcomes

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

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

VOC-412: PROCESS CONTROL

Learning Outcomes

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

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

VOC-413: Fundamentals of Pneu

matics

Learning Outcomes

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

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

VOC – 414: Embedded System Applications

Learning Outcomes

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

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

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

Learning Outcomes

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

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

4	Develop Ladder diagram for Allen Bradley PLCs with different sensors and actuators for automated industrial operations

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

Learning Outcomes

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

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

VOC – 417: Laboratory Coursework–XV

(Fundamentals of Pneumatics)

Learning Outcomes

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

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

VOC – 418 : Laboratory Coursework–XVI

(Embedded System Application)

Learning Outcomes

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

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

VOC 501: Personality Development and Stress Management

Learning Outcome

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

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

VOC-502: Operation Management

Learning Outcomes:

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

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

VOC- 503: Business Communication

Learning Outcomes

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

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

VOC 504 Production Engineering

Learning Outcomes

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

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

VOC- 511: Workshop Technologies

Learning Outcomes

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

1	Categorize welding processes, cutting and cutting tools, basic operations in sheet metal working

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

VOC 512- Introduction to Robotics

Learning Outcomes

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

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

VOC- 513 Networking Essentials

Learning Outcomes:

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

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

VOC- 514: Advance Embedded Systems

Learning Outcomes

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

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

VOC- 511A: Fundamentals of Microprocessor 8086

Learning Outcomes

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

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

VOC- 512A: Interfacing with Microprocessor 8086

Learning Outcomes

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

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

VOC – 515: Laboratory Coursework -XVII

(Lab Course pertaining to VOC 511 and 512)

Learning Outcomes

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

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

VOC – 516: Laboratory Coursework -XVIII

(Lab Course pertaining to VOC 513 and 514)

Learning Outcomes

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

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

VOC – 515A: Laboratory Coursework -XVIIA

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

Learning Outcomes

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

1	Develop Assembly Language Program with 8086 microprocessors for data movement, arithmetic and logic instructions
2	Develop Assembly Language Program with 8086 microprocessors for program control instructions

3	Interface real-time devices with 8086 microprocessors through 8255 PPI

VOC 517:Major Project – Phase I

(04 credits – 100 marks)

(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

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

Learning Outcomes:

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

VOC-602: ENTREPRENEURSHIP DEVELOPMENT

Learning Outcomes

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

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

VOC-603: Production Management

Learning Outcomes

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

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

VOC 611- Flexible Manufacturing System

Learning Outcomes:

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

1	State the basic concepts of FMS, cell, JIT, KANBAN system and CMM
2	Classify and compare different types of FMS, machining centers, Kanban, CMM, AGVS, AS/RS; also differentiate between FMS and FMC
3	Illustrate area of applications of a FMS, CMM, JIT, various equipments and their functions required for an FMS

4	Analyze the reasons for adopting group technology, analyze the AGV Systems, AS/RS as well as distinguish between Axes and Format of Machining Centers, Horizontal and Vertical Machining Centers
5	Explain the visual inspection aspects

VOC 612- Industrial Robotics

Learning Outcomes

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

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

VOC-613: SCADA

Learning Outcomes

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

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

VOC 614- IOT (Internet of Things)

Learning Outcomes:

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

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

VOC 611A- Numerical Control

Learning Outcomes:

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

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

VOC 612A- Single Station Manufacturing Cells

Learning Outcomes:

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

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

VOC 615 : Laboratory Coursework – XIX

(Pertaining to VOC 611 and VOC 612)

Learning Outcomes:

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

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

VOC 616 : Laboratory Coursework – XX

(Pertaining to VOC 613 and VOC 614)

Learning Outcomes:

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

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

MASTER OF VOCATION- AUTOMOBILE

Course Structure

M.VOC. - AUTOMOBILE

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**	Generic Elective – I	2	2
	ATC 322	Generic Elective – II	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 Generic Elective I	3	1.5
	ATLC 333	Laboratory Coursework based on Generic Elective – II	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	39	19.5

		(Experimental Work Continued, Organization and Interpretation of Result, Dissertation, Presentation)		
	Assignments/Tutorials will remain integral part of all courses			
		Total Credits for Semester – IV		**25**

Electives for Semester – III

(Any Two 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	**ATC 321**	Vehicle Testing	**Generic Elective-I (Lab)**	**ATLC 332**	Laboratory Coursework based on Vehicle Testing
	ATGE 323	Automotive Maintenance & Management		**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 Elective-II	**ATC 322**	Transport Management	**Generic Elective-II (Lab)**	**ATLC 333**	Laboratory Coursework based on Wheel Balancing and Wheel Alignment
	ATGE 326	Autotronics		**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
Electiv	**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-II	**ATOE 424**	Applied Hydraulics and Pneumatics			
	ATOE 425	Industrial Robotics			
	ATOE 426	Advanced Electrical Drives			

ATF 121 - Automotive Engines

Course Outcomes:

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

CO1	Distinguish between petrol engine and diesel engine by observing it.
CO2	Identify all parts and accessories of petrol and diesel engine.
CO3	Demonstrate GDI, HCCI and CRDI engine.
CO4	Perform all performance tests on engine.

ATF 122 - Automotive Transmission Systems

Course Outcomes:

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

CO1	Differentiate various types of gearbox and its working.
CO2	Analyze gear ratios for Manual and Semi-Automatic types of gear boxes for real time applications.
CO3	Select tyre for passenger as well as heavy vehicles.
CO4	Select the proper clutch for real time applications.

ATF 123 - Fuels and Combustion

Course Outcomes:

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

CO1	Describe alternative fuels used in IC engines.
CO2	Evaluate performance of alternative fuels.
CO3	Prepare report of performance of alternative fuels.
CO4	Suggest alternative energy source for various applications of IC engines.
CO5	Explain combustion in CI and SI engines.
CO6	Compare performance of SI and CI engines.

ATC 124 - Automobile Control Systems

Course Outcomes:

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

CO1	Identify necessary system requirements for control systems,
CO2	Compare the developments in control systems and safety equipment
CO3	Demonstrate the braking system and its functional requirements
CO4	Select the suspension system for two wheeler and four wheeler vehicle

ATC 125 - Automobile Engine Components Design

Course Outcomes:

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

CO1	Differentiate between various types of stresses and failures of material.
CO2	Identify the failure of piston rings, valves and crankshaft bearings.
CO3	Select the material for engine cylinder, piston and crank shaft.
CO4	Design the cylinder head, piston and piston rings.

ATC 126 - Automobile Air Conditioning

Course Outcomes:

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

CO1	Identify various HVAC systems and sub systems.
CO2	Explain working and construction of HVAC systems and sub systems.
CO3	Carry out repair and maintenance of HVAC systems and sub systems.
CO4	Carry out retrofitting and alteration of HVAC systems.
CO5	Explain environmental aspects related to HVAC systems.

CF 101 - Research Methodology

Course Outcomes:

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

CO1	Do systematic literature survey, formulation of a research topic, study design, analysis and interpretation of data.
CO2	Select a suitable analytical method for a specific research approach.
CO3	Demonstrate a good understanding of how to write a research report
CO4	Design a research approach for a specific research issue of their choice.

EF 130 - Operations Management

Course Outcomes:

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

CO1	Define ‘operations’ and ‘operations management’
CO2	Identify the roles and responsibilities of operations managers in different organizational contexts

CO3	Apply the 'transformation model' to identify the inputs, transformation processes and outputs of an organization
CO4	Identify operational and administrative processes

EF 131 - Materials Management

Course Outcome

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

CO1	Define Materials and its Management
CO2	Identify Integrated Approach to Materials Management
CO3	Apply techniques for material planning and management
CO4	Prepare the procedure and documentation related to import and custom

ATLF 127 - Laboratory Coursework based on Automobiles Engines and Engine Design (Auto-CAD)

Course Outcomes:

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

CO1	Draw Orthographic projection of drawings (Front, Top and side) of machine part in AutoCAD.
CO2	Draw Isometric dimensioned drawing of engine parts
CO3	Apply various commands and used 3D primitives to draw 3D model of machine component
CO4	Perform morse, retardation test on engine for its performance.

ATLF 128 - Laboratory Coursework based on Automotive Transmission Systems

Course Outcomes:

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

CO1	Identify the parts of clutches, gear box, transmission system
CO2	Distinguish between types of gear boxes.
CO3	Calculate the gear ratios for single stage gear box.
CO4	Perform demonstration on automatic transmission system

ATLF 129 - Laboratory Coursework based on Fuels and Combustion

Course Outcomes:

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

CO1	Explain construction of combustion chambers in SI and CI engines.
CO2	Assemble various components of LPG and CNG fuel supply system.
CO3	Prepare Heat Balance for engine after trial.
CO4	Conduct performance test on SI and CI engine.
CO5	Perform exhaust gas analysis using exhaust gas analyzer.

ATLC 130 - Laboratory Coursework based on Automobile Control Systems

Course Outcomes:

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

CO1	State various parts and its working of automobile control system
CO2	Draw layout of Front Axles, hydraulic braking system, air suspension system, air brakes, power steering system

CO3	Dismantle hydraulically operated air/vacuum assisted braking system, suspension system, power steering system
CO4	Reassemble hydraulically operated air/vacuum assisted braking system, suspension system, power steering system

ATLC 131 - Laboratory Coursework based on Automobile Air Conditioning

Course Outcomes:

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

CO1	Explain working of Automobile Air Conditioning system and sub system.
CO2	Describe procedure for evacuation and charging of refrigerant in AC system.
CO3	Perform test on vapor compression AC system to determine its COP.
CO4	Diagnose control system faults; write its causes and remedies.
CO5	Prepare report of troubleshooting of AC system.

ATF 221 Transmission System Design

Course Outcomes:

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

CO1	Analyze the stresses in shaft and design the shaft for any application
CO2	Design the single plate, Multi plate and centrifugal clutch for automotive application
CO3	Analyze the gear ratio for multi stage gearbox and design of gearbox
CO4	Select, analyze and design the spring for automotive application

ATF 222 - Automobile Systems Design

Course Outcomes:

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

CO1	Explain the construction and working of automobile systems.
CO2	Design automobile systems as per specifications.

CO3	Draw 2D drawings of designed components.
CO4	Prepare report on design of components and its drawings.
CO5	Prepare the design report in power point.

ATF 223 - Hydraulic and Pneumatic Systems

Course Outcomes:

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

CO1	Identify the conditions of fittings, oil, pipes, seals & packing of hydraulic systems in automobile vehicles.
CO2	Carry out troubleshooting and maintenance of Hydraulic & Pneumatic Systems
CO3	Construct the Hydraulic circuits for various applications.
CO4	Construct the Pneumatic circuits for various applications.

ATF 224 - Noise and Vibration

Course Outcomes:

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

CO1	Demonstrate vehicle noise and vibration level measurement techniques.
CO2	Identify causes and remedies for noise and its environmental impact.
CO3	Identify causes and remedies for vibrations.
CO4	Carry out troubleshooting and maintenance to control noise and vibration in a vehicle.

ATC 225 - Automobile Body Engineering

Course Outcomes:

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

CO1	Analyze the physics of fluid flow over vehicle body and its optimization techniques.
CO2	Demonstrate the various car body parts and its functions
CO3	Identify painting defects and describe their causes and remedies.
CO4	Carry out repair methods of body and repainting.

ATC 226 - Vehicle Dynamics

Course Outcomes:

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

CO1	Differentiate between sprung mass and unsprung mass of vehicle.
CO2	Explain the gyroscopic effect, ride and handling in vehicle design
CO3	Demonstrate acceleration and braking characteristics, effect on vehicle due to various forces.
CO4	Distinguished between vehicle coordinate system and earth fixed coordinate system.

ATLF 227 - Laboratory Coursework based on Hydraulic and Pneumatic Systems

Course Outcomes:

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

CO1	Identify various pumps and its parts used in hydraulics application.
CO2	Build the meter in and meter out circuit.
CO3	Find faults, probable causes and remedial action to trouble shoot problems in hydraulic circuits.
CO4	Demonstrate Bernoulli's principle and its application

ATLF 228 - Laboratory Coursework based on Noise and Vibration

Course Outcomes:

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

CO1	Perform pass by noise test
CO2	Find fault for creation of engine noise, transmission noise and their remedies.
CO3	Do Vibration measurement in passenger compartment.
CO4	Handle vibration measurement instruments like vibrometer.

ATLC 229 - Laboratory Coursework based on Solid Modeling

Course Outcomes:

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

CO1	Explain commands used in solid modelling.
CO2	Design and Drawing of Piston, Piston pin, and Piston rings.
CO3	Design and drawing of connecting rod, inlet and exhaust valves.
CO4	Design and drawing of crankshaft, camshaft and gears.
CO5	Assemble drawn components with major components of engines.

ATLC 230 - Laboratory Coursework based on Automobile Body Engineering

Course Outcomes:

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

CO1	Analyze effect of drag force on various automobile body parts.
CO2	Calculate Aerodynamic forces during pitching, rolling and yawing.
CO3	Demonstrate various painting techniques used in automobile.
CO4	Use denting tools for minor repairs and denting process.

ATLC 231 - Laboratory Coursework based on Automotive Electrical System Diagnosis

Course Outcomes:

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

CO1	Use oscilloscope to test vehicle components like sensors and actuators
CO2	Demonstrate Engine analyzer in vehicle engine management system.
CO3	Diagnose the lighting and auxiliary system in vehicle.
CO4	Diagnose battery faults and perform battery testing.

ATR 232 - Research / Industrial Project (Phase-I)

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

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.

ATC 321 - Vehicle Testing

Course Outcomes:

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

CO1	Classify various vehicle approval methods.
CO2	Describe vehicle testing procedures.
CO3	Measure engine pollution using exhaust gas analyzer.
CO4	Describe Automobile Testing Standards.

ATC 322 Transport Management

Course Outcomes:

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

CO1	Explain the evolution of transport management.
CO2	Administer the organization, personal, and operational requirement for successful transportation department.
CO3	Prepare model of traffic flow, transportation demand and supply.
CO4	Perform analysis of transport and logistic strategy.
CO5	Practice road safety activities.

ATGE 323 - Automotive Maintenance & Management

Course Outcomes:

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

CO1	Carry out the complete maintenance and management of automotive system.
CO2	Do the critical analysis of breakdown and preventive maintenance.
CO3	Inspect engine components to ensure proper performance.
CO4	Design layout of garage.

ATGE 324: Finite Element Methods

Course outcomes

The student should be able to–

CO1	Formulate numerical model for a given system.
CO2	Obtain numerical Solutions for boundary value problems.
CO3	Solve mechanical engineering problems using Finite Element Method
CO4	Explain the weighted residual methods

ATGE 325: Vehicle Aerodynamics and Design

Course outcomes

The student should be able to–

CO1	Explain vehicle aerodynamics.
CO2	Analyse stability, safety and comfort of vehicles
CO3	Explain wind tunnels and testing techniques.
CO4	Apply CFD for aerodynamic design of vehicle.

ATGE 326 Autotronics

Course Outcomes:

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

CO1	Identify various types of display device.
CO2	Carry out the instrumentation in vehicle and intelligent vehicle system.
CO3	Elaborate embedded system application in automotive.
CO4	Demonstrate the working of serial communication using I2C, CAN, USB buses and parallel communication using ISA, PCI.

ATGE -327 Automotive Metallurgy

Course Outcomes:

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

CO1	Define Selection criteria for various components and importance
CO2	Sate different class of materials and their applications
CO3	Select heat treatment and surface modification technique for specific component
CO4	Select material for automotive component

ATGE -328 Special Purpose Vehicles

Course Outcomes:

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

CO1	Describe the combat vehicles
CO2	Describe the working of stratified charged/lean burn engines
CO3	Describe the working of drive line in combat vehicles and earth moving vehicles compared with commercial vehicles
CO4	Describe the construction of farm equipments
CO5	Describe the working of power trains in heavy vehicles and able to analyze the ride characteristics of tractors

ATOE -329 Robotics

Course Outcomes:

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

CO1	Configure robots with components and devices.
CO2	Make automation module based on sensor inputs.
CO3	Demonstrate the working of actuators, feedback components, and position sensors.
CO4	Find the scope of robotics in material handling in manufacturing.

ATOE 330: CNC Technology

Course Outcomes:

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

CO1	1 Define the basic of CNC machine.
CO2	2 Apply Features of CNC Machines and Retrofitting
CO3	3 Design CNC part programming.
CO4	4 Describe types of measuring systems in CNC machines.

ATOE 331: Automated and Computer Integrated Manufacturing (CIM)

Course Outcomes:

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

CO1	Develop an understanding of CAD systems and graphical modeling.
CO2	Explain data bases and numerical analysis related to CIM
CO3	Describe Computer Aided Process Planning (CAPP) Systems, Robotic Systems, Group Technology and Cellular Manufacturing Systems
CO4	Analyse Automated Material Handling Systems, Automated Inspection Systems, and Flexible Manufacturing Systems.

ATLC 332 Laboratory Coursework based on Vehicle Testing

Course Outcomes:

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

CO1	Demonstrate Morse Test on Petrol Engine.
CO2	Measure performance of two wheeler using two wheeler chassis dynamometer.
CO3	Perform cleaning and Testing of fuel injectors.
CO4	Measure Indicated Power, Brake Power of single cylinder engines.
CO5	Perform exhaust gas analysis using exhaust gas analyzer.

ATLC 333 Laboratory Coursework based on Wheel Balancing and Wheel Alignment

Course Outcomes:

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

CO1	Explain the use of wheel alignment and balancing machine.
CO2	Demonstrate the wheel geometry and different wheel angles.
CO3	Diagnose various faults in wheel geometry and wheel angles.
CO4	Design wheel geometry and wheel angles for different working condition.
CO5	Prepare a report on performance of vehicle using particular wheel geometry and wheel angle.

ATLE 334 Laboratory Coursework based on Automotive Maintenance & Management (Generic Elective – I)

Course Outcomes:

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

CO1	Distinguished between preventive and breakdown maintenance
CO2	Prepare Automotive Maintenance chart.
CO3	Analyze Automotive Maintenance Standard of a vehicle.
CO4	Use various devices to test wiring harness.

ATLE 335: Laboratory Coursework based on Finite Element Methods

Course outcomes:

After completion of the course, The student should be able to:

CO1	Solve 1-D Element Problems on structural analysis.
CO2	Solve 2-D Element Problems on structural analysis
CO3	Solve 3-D Element Problems on structural analysis
CO4	Solve problems on thermal analysis

ATLE 336: Laboratory Coursework based on Vehicle Aerodynamics and Design

Course outcomes

After completion of the course, The student should be able to:

CO1	Explain wind tunnels and testing techniques
CO2	Apply CFD for aerodynamic design of vehicle
CO3	Solve problems using commercial CFD software.

ATLE 337 Laboratory Coursework based on Autotronics (Generic Elective – II)

Course Outcomes:

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

CO1	Carry out Addressing in TCP/IP and Ping Command
CO2	Demonstrate the working of Microcontrollers
CO3	Analyze networking in vehicle system
CO4	Interface Stepper Motor using 8051 microcontroller

ATLC 338 Laboratory Coursework based on Automotive Metallurgy

Course Outcomes:

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

CO1	Define basic concept of Material Science and Metallurgy
CO2	Know about the ferrous and nonferrous metals and alloys and their applications
CO3	State different non-destructive testing methods
CO4	Find the causes and prevention of metallic corrosion
CO5	Judge the Scope and limitations of different materials

ATLC 339 Laboratory Coursework based on Special Purpose Vehicles

Course Outcomes:

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

CO1	State special type of vehicles based on the need and purpose
CO2	Describe the working principles of individual SPV
CO3	Describe both technical and operational features of SPV
CO4	Design considerations and features of SPV.

ATR 340

Research/ Industrial Project – Phase II

(Experimental Work)

ATGE 421- Automotive Emission and controls

Course Outcomes:

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

CO1	Explain the formation mechanism of various types of pollutants from SI and CI engines.
CO2	Analyze the effect of vehicle population and emitted pollutant on human health environment.
CO3	Explain emission control techniques.
CO4	Explain emission standards and test procedure.

ATGE 422- Hybrid Vehicles

Course Outcomes:

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

CO1	Explain the fundamentals of hybrid Electric vehicle.
CO2	Select the powertrain for hybrid vehicle.
CO3	Identify the architecture of Hybrid Vehicles.
CO4	Elaborate Fuel Cell Energy system and Diagnostics of HEV

ATGE 423- Automotive Safety

Course Outcomes:

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

CO1	Identify different safety systems and its role in automobiles
CO2	Determine vehicle structural crashworthiness.
CO3	Analyze pedestrian safety by use of pedestrian simulator.
CO4	Analyze and simulate vehicle in barrier impacts.

ATOE 424: Applied Hydraulics and Pneumatics

Course Outcomes:

On completion of the Course, students should be able to

CO1	Recall the basic concepts of in hydraulic systems and fluidics and hydropneumatics
CO2	Describe function of hydraulic system, servo systems, torque motors, Bistable flip flop, turbulence amplifier, Pneumatic controls,
CO3	Illustrate area of applications of a Hydraulic transmission, fluidics and pneumatic Circuit
CO4	Analyze the designing aspects of hydraulic system and pneumatic system
CO5	Discriminate hydropneumatics, hydraulic and hydropneumatc system, Types of Transmission
CO6	Design and construct hydraulic circuit with servo valve, hydraulic circuit with proportional valve, pneumatic sequencing circuit, pneumatic circuit with quick exhaust valve, pneumatic circuit with time delay valve, pneumatic speed control circuit, Hydraulic regenerative circuit

ATOE -425 Industrial Robotics

Course Outcomes:

On completion of the Course, students should be able to

CO1	1 Familiar with the applications of robotic systems as they are currently used in industry and research
CO2	2 Define the needs acquire necessary information
CO3	3 Select appropriate robots for various industrial applications
CO4	4 Apply the knowledge gained for the design and development of simple robotic Aspects

ATOE 426 Advanced Electrical Drives

Course Outcomes:

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

CO1	Select the drive for appropriate application.
CO2	Explain the speed control characteristics of drives.
CO3	Select the size of magnets in Permanent magnet motors.
CO4	Calculate eddy current losses in the magnets.

ATLE 427 Laboratory Coursework based on Automotive Emission and controls

Course Outcomes:

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

CO1	Perform the emission test on Heavy duty diesel engine and on Tractor.
CO2	Compare the performance of Heavy duty diesel engine and Tractor / Genset diesel engine.
CO3	Analyze carbonyl compound from exhaust emission.
CO4	Measure and analyze various exhaust gases.

ATLE 428 Laboratory Coursework based on Hybrid Vehicles

Course Outcomes:

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

CO1	Select DC motor for various applications.
CO2	Analyze different types of DC motor's speed control characteristics
CO3	Explain V-I Characteristics of Buck and Boost converters.
CO4	Demonstrate speed-torque characteristics of DC motor.

ATLE 429 Laboratory Coursework based on Automotive Safety

Course Outcomes:

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

CO1	Explain working and importance of air bags.
CO2	Perform a proper rear mirror view setting and testing.
CO3	Perform a G lock testing of seat belt and explain seat belt anchorage.
CO4	Perform an impact testing of bumpers.

ATR 430

Research/ Industrial Project – Phase III

(Experimental Work Continued, Organization and Interpretation of Result, Dissertation, Presentation)

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,	10	5

		Formulation of Topic, Experimental Plan)		
	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 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**	Automotive Engines			
	IAOE 322	Automobile Control Systems			

Electives for Semester – IV

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

(Any one theory paper have to be chosen from open electives)

	Paper Code	Paper Title	Generic(L	Paper Code	Paper Title
Ge	**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
	IAGE 412	Micro Mechatronic Systems		**IALE 432**	Technology Lab Course based on Micro Mechatronic Systems
Open	**IAOE 420**	Automated Manufacturing			
	IAOE 421	Industrial Robotics			
	IAOE 422	Mechatronics Fundamentals			

IAC - 110

Electronic Systems

Course Outcomes:

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

1	Recognize OP-AMPs for building systems to develop application oriented platforms
2	Associate with controlled oscillations and monolithic frequency synthesizers
3	Experiment analog/digital timing and counting circuits
4	Classic treatments on Phase locked loops and frequency to voltage conversion
5	Interpret active filter operations
6	Identify necessary system requirements
7	Address and resolve complex application challenges

IAC - 111

Power Electronics

Course Outcomes:

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

1	Memorize various Power Converter topologies and configurations.
2	Classify various Power devices and know their construction, working principle, how they are controlled by small power, advantages, disadvantages
3	Experiment with converter, inverter, cycloconverter
4	Construct and relate power devices with different loads
5	Assess and modify control related application of power electronics

IAC - 112

Transducer Technology

Course Outcomes:

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

1	Observe, monitor, analyze and sympathy towards the instruments form the basis of measurement.
2	Distinguish between transducers, sensors and transmitters
3	Define principle behind strain gauge and pressure sensors
4	Explain working of displacement, position, motion & temperature sensors
5	Work with different sensors

IAC - 113

Electric Drives

Courser Outcomes:

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

1	State starting and braking of Drives
2	Observe Speed-torque characteristics of Drives
3	Demonstrate Chopper, Inverter, Cycloconverter and PWM based Control
4	Select drive for specific application
5	Categorize speed controlling of Motors

IAF – 120

Embedded Systems Design

Course Outcomes:

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

1	State the concepts of interfacing 8051 microcontroller to real world elements
2	Recognize protocols for interfacing 8051 microcontroller to real world elements
3	Demonstrate interfacing concepts and protocols for 8051 microcontroller.
4	Develop programs for interfacing real world elements to 8051 microcontroller
5	Implement 8051 microcontroller for process automation applications

IAF - 121

Programmable Logic Controllers

Course Outcomes:

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

1	Recognize typical components of a Programmable Logic Controller.
2	Explain the basic concepts of a Programmable Logic Controller
3	Develop basic programming skills for process automation with PLC's
4	Employ Allen Bradley PLCs for industrial applications

5	Design and program basic PLC circuits for entry-level PLC applications
6	Compose and develop a small, automated Industrial production line.

CF 101

Research Methodology

Course Outcomes:

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

1	Define research and describe the research process and research methods
2	Estimate qualitative research and methods used to execute and validate qualitative research
3	Relate basic aspects of the research process in order to plan and execute a research project
4	Select a suitable analytical method for a specific research approach
5	Demonstrate a good understanding of how to write a research report
6	Critically assess published quantitative research with regard to the statistical methods and approaches adopted .

EF 130
Operations Management

Course Outcomes:

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

1	Define 'operations' and 'operations management'
2	Identify the roles and responsibilities of operations managers in different

	organizational context.
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

EF-131

Materials Management

Course Outcome:

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

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

IALC - 140

Electronic Systems Lab

Course Outcomes:

On completion of the course, students should able to –

1	Demonstrate working of different types of amplifiers, timers, counters, oscillators and filters.
2	Illustrate operation of industry standard programmable timer.
3	Apply different amplifiers/ timers/ counters/ oscillators/ filters for real time applications

IALC - 141

Power Electronics Lab

Course Outcomes

On completion of the course, students should able to –

1	Demonstrate working of different types of converter/ inverter and cyclo converter.
2	Illustrate operation of zero voltage switching.
3	Apply different converter/ inverter and cyclo converter for real time applications

IALC - 142

Instrumentation Lab

Course Outcomes

On completion of the course, students should able to –

1	Demonstrate working of different transducers.
2	Illustrate working of optical rotary/ angle encoder for speed / position measurement.
3	Apply different transducers for real time applications.

IALC - 143

Electric Drives lab

Course Outcomes

On completion of the course, students should able to –

1	Demonstrate working of different comparators.
2	Illustrate working of single/ three phase cycloconverter AC Drive.
3	Apply different single/ three phase PWM/ cycloconverter AC drive for real time applications.

IALF - 150

Embedded Systems Lab

Course Outcomes

On completion of the course, students should able to –

1	Develop algorithms to perform real time operations using microcontroller
3	Apply embedded systemknowledge for real world device interfacing.

IALF - 151

PLC Lab

Course Outcomes

On completion of the course, students should able to –

1	Develop miniprojects employing PLCs
3	Apply knowledge PLCs for real world device interfacing and applications.

IAC – 210

Communication Protocols for Instrumentation

Course Outcomes:

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

1	Identify the issues and challenges in the architecture of computer network
2	Explain the concept of communication model, OSI reference model, Recent Industry Networks.
3	Classify the Network selection applicable for specific industrial needs.
4	Differentiate the Network Architecture and describe the concepts of Industrial protocols.
5	Classify and Compare various Wireless Networking protocols

IAC - 211

Mechatronics

Course Outcomes:

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

1	Define and Classify mechatronics system.
2	Classify and Compare different types of Transducers.
3	Define various performance terminologies in Sensors.
4	Explain different types of actuators used in mechatronics
5	Analyze various types of sensors and selection procedure for various applications.
6	Design the real time application of Mechatronics based System.

IAC - 212

Advanced Transducers

Course Outcomes:

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

1	Discuss calibration protocol for test various types of sensors
2	Explain different types of errors in Sensor Systems.
3	Classify different types of Flow sensors based on flow measurements.
4	Identify techniques to measure viscosity and density
6	Discuss on different types of sensors in robotics

IAF - 220

Robotics

Course Outcomes:

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

1	Classify Robots in different categories.
2	Explain robot kinematics and dynamics.
3	Analyze forward and reverse kinematics
4	Summarize path planning by a Robot.
5	Describe robot manipulator.
6	Program Robot for various applications

IAF - 221

Process Control

Course Outcomes:

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

1	Define Process Modeling Fundamentals.
2	Describe various modeling techniques of process control
3	Explain the Characteristics of Controller.
4	Summarize Control System configurations.
5	Describe Control systems with multiple loops.
6	Analyze Different Process loop and tuning techniques.

IAF - 222

Industrial Automation

Course Outcomes:

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

1	Explain the requirements of modern day industries.
2	Classify the different types of automated techniques used.
3	Describe high volume manufacturing automation.
4	Explain various flexible manufacturing concepts.
5	Summarize Assembly Automation.
6	Analyze Performance evaluation and economics of assembly systems.

IALC - 230

Industrial Networking Lab

Course Outcomes:

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

1	Identify necessary protocol for a particular application
2	Interface real time devices to microprocessors/ computers using standard protocols
3	Design a simple fieldbus/profibus network

IALC - 231

Mechatronics Lab

Learning Outcomes:

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

1	Illustrate different supplementary operations of sensors and actuators in combination
2	Design simple mechatronics systems pertinent to real life operations

IALC - 232

Instrumentation Lab-II

Course Outcomes:

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

1	Illustrate concept of calibration of sensors
2	Apply industry grade sensors for various measurements

IALF - 240

Robotics Lab

Course Outcomes:

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

1	Identify components of a robot
2	Describe different links and joints used in robots
3	Perform basic programming for simple operations with different robotic platforms

IALF - 241

Process Control Lab

Course Outcomes:

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

1	Illustrate closed loop operations
2	Tune a PID controller installed in real time systems
3	Illustrate cascade control system

IALF - 242

Industrial Automation Lab

Course Outcomes:

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

1	Illustrate concept of Automation in manufacturing through a modular FMS platform
2	Identify components of a modular FMS platform
3	Operate independent elements of the modular FMS platform
4	Develop PLC (Allen Bradley) based programs for performing automated steps in a modular FMS platforms

IAR – 250

Research/Industrial Project (Phase-I)

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

(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

IAGE – 310

Industrial Processes and Instrumentation

Course Outcomes:

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

1	Interpret type of controller that can be used for specific problems in chemical industry
2	Design of controllers for interacting multivariable systems
3	Work with controller tunning
4	Ability to design feed forward anf cascade control system
5	Predict multivariable system

IAGE-311: SCADA System and Applications

Course Outcomes:

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

1	State the basic features of SCADA, HMI
2	Develop architecture of SCADA and explain the importance of SCADA in critical infrastructure.
3	Analyze the theory and applications of SCADA
4	Develop projects with SCADA and HMI
5	Implementation of SCADA application.

IAGE - 312

Applied Hydraulics and Pneumatics

Course Outcomes:

On completion of the Course, students should be able to

1	Recall the basic concepts of in hydraulic systems and fluidics and hydropneumatics
2	Describe function of hydraulic system, servo systems, torque motors, Bistable flip flop, turbulence amplifier, Pneumatic controls,
3	Illustrate area of applications of a Hydraulic transmission, fluidics and pneumatic circuit
4	Analyze the designing aspects of hydraulic system and pneumatic system
5	Discriminate hydropneumatics, hydraulic and hydropneumatc system, Types of transmission
6	Design and construct rehydraulic circuit with servo valve, hydraulic circuit with proportional valve, pneumatic sequencing circuit, pneumatic circuit with quick exhaust valve, pneumatic circuit with time delay valve, pneumatic speed control circuit, Hydraulic regenerative circuit

IAGE - 313

Industrial Robotics

Course Outcomes:

On completion of the Course, students should be able to

1	Recall the fundamental aspects of automation and robotics
2	Discuss brief history of robotics, robotics market and future prospectus
3	Use the robots in various manufacturing processes
4	Explain the safety training and maintenance and quality improvement aspects; social issues and future of robotics
5	Reframe the robot programming
6	Develop simple programs to define pre-coordinated trajectory of robots, for pick and place operation with a six axis industrial robot, for stacking operation with a six axis industrial robot

IAGE – 314

Advanced Sensor Technology

Course Outcomes:

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

1	Describe basic characteristics of measurement system
2	Discuss elements of motion and dimensional measurements
3	Explain working of basic force and torque measurement
4	Explain working of advanced temperature transducers

IAGE - 315

Kinetics and Dynamics of Robotics

Course Outcomes:

On completion of the Course, students should be able to

1	Recall the fundamental aspects of automation and robotics
2	Discuss various co-ordinate systems
3	Use the robots in various manufacturing processes
4	Explain the kinematic and Dynamic model
5	Model the Robot
6	Develop programs for pick and place operation with a six axis industrial robot, for stacking operation with a six axis industrial robot and for other industrial applications

IAGE 316: Mechatronics System Design

Course Outcomes:

On completion of the course, students should able to –

1	Explain various mechanical elements of mechatronics
2	Discuss elements of mechatronics process design
3	Explain advance control mechanisms in mechatronics

IAGE - 317

Distributed Control System

(Process Automation)

Course Outcomes:

On completion of the Course, students should be able to

1	Recall basics of automation , PLC, DSC and SCADA
2	Classify and compare types of plant and control, PLC and SCADA
3	Illustrate Control system architecture, Architecture and working of PLC, DCS architecture and specifications
4	Analyze the various systems of SCADA
5	Summarize advanced PLC instructions, integration of PLC and computer, integration of DCs and computer
6	Program DCS for control of remote process

IAGE-318: Advanced Electrical Drives

Course Outcomes:

On completion of the course, students should able to –

1	Understand the various drive mechanisms and methods for energy conservation.
2	Apply power electronic converters to control the speed of DC motors and induction motors.
3	Evaluate the motor and power converter for a specific application.
4	Develop closed loop control strategies of drives.

IAGE – 319

Advanced Microcontrollers

Course Outcomes:

On completion of the Course, students should be able to

1	State configuration of ARM Microcontroller, Registers, addressing modes, interfacing methods, ISR, Timing generations and measurements
2	Classify Data types , Thumb instructions used in programming,
3	Illustrate ARM architecture and architectural support for system development & operating system
4	Explain implementation of ARM
5	Summarize instructions used for high level language
6	design an embedded hardware using ARM series of Microcontroller

Open Electives
IAOE 321
Automotive Engines

Course Outcomes:

On completion of the Course, students should be able to

1.	Define the key terms like Supercharging, Turbocharging
2	Differentiate the fuel dynamics for SI and CI engines
3	Acquainted with the latest technologies.

IAOE 322
Automobile Control Systems

Course Outcomes:

On completion of the Course, students should be able to

1.	Define the key terms in Automotive Control System
2.	State various criteria's in components selection
3	Explain steering system, braking system and suspension system
4	Acquaint with the latest technologies

IALE - 330

Industrial Process Control Lab

Course Outcomes:

On completion of the course, students should able to –

1	Explain the various loops of industrial process control.
2	Develop complex loop system.

3	Design and Implementation of Advance process controller.

IALE-331

SCADA System and Applications Lab

Course Outcomes:

On completion of the course, students should able to –

1	Observe Parameter reading of PLC in SCADA.
2	Different controls using SCADA system.
3	Design complex control system using SCADA.

IALE 332

Applied Hydraulics and Pneumatics Lab

Course Outcomes:

On completion of the course, students should able to –

1	Construct Hydraulic and Pneumatic circuit for different valves.
2	Design Pneumatic circuit for control operations
3	Design sequential Hydraulic / Pneumatic circuit.

IALE 333

Industrial Robotics Lab

Course Outcomes:

On completion of the course, students should able to –

1	Develop simple programs to define pre-coordinated trajectory of robots.
2	Program a parallel kinematic robot for a palletizing application.

3	Calibrate External TCP and Moving Base / Frame Coordinate.

IALE - 334

Advanced Sensor Technology Lab

Course Outcomes:

On completion of the course, students should able to –

1	Apply sensors pertinent to Course IAGE 314 for real time applications

IALE - 335

Kinematics and Dynamics of Robot Lab

Course Outcomes:

On completion of the course, students should able to –

1	Demonstrate different Industrial grade Robot
2	Describe various Co-ordinate system of Robot
3	Design robot for various applications.

IAGE 336 :

Mechatronics System Design Lab

Course Outcomes:

On completion of the course, students should able to –

1	Identify suitable sensor and actuator for a control system
2	Develop simple mechatronic systems

IALE 337

Distributed Control System Lab

Course Outcomes:

On completion of the course, students should able to –

1	Develop of Human Machine Interface using any SCADA package
2	Control of Pressure and flow using DCS.
3	Create interlock logic in DCS.

IALE 338

Electrical Drives Lab

Course Outcomes:

On completion of the course, students should able to –

1	Apply concepts of chopper control for motoring and generating control
2	Control of AC and DC motor using suitable drive
3	Develop application of Electric Drive

IAGE – 410

Automated and Computer Integrated Manufacturing

Course Outcomes:

On completion of the Course, students should be able to

1	Identify elements of an automated manufacturing cell in modern production Module
2	Explain Fundamentals of NC Technology
3	Apply knowledge of CAM, CAD/CAM, CIM for automated manufacturing
4	Analyze various quality control systems
5	Evaluate Positioning System, NC part programming, Automated assembly systems

6	Work in a flexible manufacturing workstation

IAGE- 411: CNC Technology

Course Outcomes:

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

1	Define the basic of CNC machine.
2	Apply Features of CNC Machines and Retrofitting
3	Design CNC part programming.
4	Describe types of measuring systems in CNC machines.

IAGE - 412

Micro Mechatronic System

Course Outcomes:

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

1	Define Micromechatronics system.
2	Classify Piezoelectric Actuators.
3	Define various performance terminologies in Sensors.
4	Explain different types of actuators used in Micro-mechatronics.
5	Analyze Control Techniques For Piezoelectric Actuators.
6	Develop prototype of Micro-Mechatronic System.

IALE 430

Automated and Computer Integrated Manufacturing Lab

Course Outcomes:

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

1	Perform simple automated manufacturing task of a flexible manufacturing cell
	Analyze automated workpiece loading/unloading in CNC machining stations by

2	articulated robot

IALE 431

CNC Machines Lab

Course Outcome:

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

1	Develop basic competency to perform CNC machining operations
2	Illustrate concepts of synchronized CNC operation in a CNC based FMS cell

IALE - 432

Micro Mechatronic System Lab

Course Outcomes:

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

1	Develop basic simulation concepts for design of micromechatronic/micro-electromechanical elements

IAGE - 420

Automated Manufacturing

Course Outcomes:

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

1	Define Manufacuring
2	Classify schemes of manufacturing systems.
3	Define various principles and strategies of Automation.
4	Explain Production lines and Assembly ststions.
5	Analyze parts delivery systems at workstations.

IAOE 421

Industrial Robotics

Course Outcomes:

On completion of the Course, students should be able to

1	Familiar with the applications of robotic systems as they are currently used in industry and research
2	Define the needs acquire necessary information
3	Select appropriate robots for various industrial applications
4	Apply the knowledge gained for the design and development of simple robotic aspects

IAOE 422

Mechatronics Fundamentals

Course Outcomes:

On completion of the course, students should able to –

1	Explain the various Analog & Digital circuit elements.
2	Develop the program using PIC Microcontroller.
3	Differentiate the different sensor technology.
4	Describe design aspects for the mechatronics system.