SCOPE OF DIPLOMA IN AUTOMOBILE ENGINEERING

Automobiles have a unique and important position in the development of modern civilization. Modern automobile vehicles are inseparable part of the human life. Because of automobiles there is a tremendous save in time.Inspite of fuel shortage, pollution threats to the environment we cannot imagine a life without automobiles. With advancement of technology, role of automobiles is changing and it has become a true vehicle not only as means of transportation but for enhancing the social, commercial and economic aspects of the life of an individual.

With rapid change in the technologies, Automobile vehicles have also undergone sea changes in their designs, aesthetic aspects, and Ergonomic considerations and most importantly in the fuel economy and alternative fuels considerations.

Due to computer based advanced technologies; there is a modern trend for using computers/microprocessor based designs of engines such as MPFI, DI and CRDI in automobile engines. Alternatively the use of Mechatronics systems is also being extensively used in the modern automobiles.

Automobile market in India is growing rapidly and it is maturing at a faster pace, not only in terms of size and variety, but in terms of technological advancement in cars. The Automotive technology is becoming more and more sophisticated with stringent pollution regulations and increased customer awareness. India is emerging as a key player for contributing to the growth of automobile industry at global level.

India is the 4^{th} largest car market in the world. With over 3 million cars added to Indian roads in 2010, the automobile industry provides direct employment to 6, 50,000 + persons and indirect employment to over 20 million people in India.

In tune with this, there is a growing trend towards use of microprocessor based systems in the modern automobile vehicles, along with advances in the hardware systems. Many leading players like Mercedes, Skoda, Audi, Mitsubishi, Suzuki have introduced their cars with advanced microprocessor based systems in India. Virtually all the critical parameters governing the operation of the engine and automobile are accurately controlled by the microprocessors in the modern cars.

This has generated the need of technically trained (Specifically in Automobile and Mechatronics areas) technicians to maintain these technologically advanced vehicles. Well-qualified and well-versed technical manpower is required all over the country. Presently there is huge gap between the knowledge required and knowledge possessed by the technicians. There

is no specific training facility available to cater the exact needs of the changing context and exact requirements of the automobile industry.

Considering the rapid pace of development of the Automobile sector in the country there is an express need of automobile diploma engineers with necessary academic qualifications and requisite professional experience.

Now a day's entrepreneurship assumes great importance. An automobile engineer with requisite skill can set up his own enterprise. He can generate employment opportunities to the society.

At present there is a huge requirement of automobile engineers in the specific areas of production, maintenance and service sector and considering this need the present professionally designed programme in automobile engineering is being offered.

AREAS OF EMPLOYMENT / WORK:

SR. No.	Type of industries/ organizations	Capacity (Designation) in which employed
1	Self owned industry	Entrepreneur/proprietor/Design engineer/Production executive/ Unit In-charge/ Stores Officer/Garage owner
2	Automobile Industries	Production supervisor, Vehicle testing Engineer, Engine testing engineer, Vehicle quality assurance executive, CAD CAM Engineer, Vehicle assembly Engineer
3	Private /Public Limited Companies	Supervisor, Technician, Maintenance Engineer, Quality control Engineer, Vendor development engineer, Store manager, Planning engineer, Development engineer, Design engineer, Marketing Executive, Testing and quality assurance engineer, computer engineer, CAD Designer, Shift engineer, Vehicle Testing Engineer.
4	Banks, Financial corporation	Sales executive, Product Development Executive, surveyor, recovery executive, system in-charge, project manager, software development engineer, system maintenance engineer
5	Indian Railways	Loco Pilots, production engineers, Maintenance engineer, Quality control engineer, supervisor, testing and QC Manager
6	Indian Army	Junior Technical Officer (Short and Long term commissions).

7	Indian Air force	Ground technicians, Ground engineers (Automobiles Div.)
8	Transport Department	Assistant Motor Vehicle Inspector
9	Indian merchant Navy	Junior Technical Officer (automobile)
10	Communication Sector	Junior Telecom Officer (automobile), Marketing engineer
11	Entrepreneur	Proprietor

JOB FUNCTIONS :

Sr. no.	Designations of the diploma holders in various employment	Job functions
1	Entrepreneur	Project Management Plan, estimate, procure and install hardware and software systems. Analyze and design systems Administer and manage networks Marketing skills
2	Supervisor/ Production Engineer/ Production Manager	Supervisor production Plan and execute production schedule Arrange for material and tools supplied for production Supervise and guide workers for quality production Train the workers for new production process/ operations Ensure quality in production Handle labour problems Ensure safety in production Maintenance of progress of production
3	Maintenance engineer	Prepare schedule for preventive as well as routine maintenance. Carry out break down maintenance Organize physical as well as human resources for implementation of maintenance. Maintain records, history sheets Execute maintenance work as per schedule Obtain / make progress report of maintenance at regular intervals and report to higher authorities
4	Quality control / inspection/ quality assurance engineer	Applications of statistical methods to check quality of production Apply and monitor the quality systems like KAIZEN, CANBAN, ZERO DEFECT systems TQM on shop floor

		Inspection of quality control from raw material procurement to finished goods Monitor Just In Time Procurement method Guidance to operators at intermediate stages of production To attain Total Quality Management Educate operators about global quality concept and customer focused quality aspects
5	Sales /Marketing engineer	Execute the marketing strategies of product Interact with customers and sale the product Plan and participate in marketing campaign of product. Use of marketing tools to maximize the sales. Development of feedback mechanism for offering better services.Carry out market survey Plan for selling for achieving the targets of product
6	CAD./ CAM /R andD engineer	Make the product/ part drawing in CAD software like PRO-E, CATIA, Solid Works and Auto CAD etc Modeling of the parts and assemblies Make the CNC programmes from component parts, CAD drawing and execute production cycles on the machines Interact with production and other departments for feedback of design
7	Loco Pilots	Run the loco trains as per schedules Plan and make regular operational maintenance Follow safety procedures during loco driving
8	Junior Technical Officer (Indian Army)	Operate/ test the automobile equipment in army like engines of trucks jeeps. Tanks cannon, generator Maintain the automobile equipments of armed forces Participate in war front and operate / maintain the automobile equipment
9	Ground engineer / Technician (Indian Air Force)	Operate and maintain automobile equipment of air force like engines, turbines, cranes etc. Regularly maintain the above mentioned equipment Participate in war front and maintain above equipment
10	Assistant Motor Vehicle Inspector (AMVI)	Control the transportation activities Act as license, Registration and vehicle passing authority Control the pollution of automobiles by regulating PUC norms
11	Junior telecom officer	Erection / maintenance of Telecom systems and Telephone exchange networks

12	Junior Technical Officer (Navy)	Operate/ maintains various boilers, turbine, generators on ship Maintain missile systems onboard of ships

PROGRAMME AIMS:

- To, produce a diploma holder who have all the skills necessary to excel in automobile field
- To develop the students in order to apply the knowledge

IDENTIFIED COMPETENCIES FOR DIPLOMA IN AUTOMOBILE ENGINEERING

- Development of personality, communication and generic skills in the automobile engineer.
- Acquiring working knowledge of engineering science.
- Acquiring working knowledge of engineering mechanics.
- To prepare and interpret product drawings as per IS code.
- To become familiar with basic workshop processes.
- To acquire working knowledge of various production process, metal forming and finishing process.
- To acquire working knowledge of Thermal engineering areas.
- To know function of various mechanical & automobile elements
- To identify mechanisms and select the component for operation and maintenance of various machines.
- To identify and operate maintenance of various electrical and electronic devices.
- To identify and operate maintenance of various electronics circuits and controls related to automobile field.
- To select, install and operate hydraulically / pneumatically operated devices, circuits, devices and pumps.
- To acquire skills for automation applications.
- To use computer for automobile engineering applications.
- To select appropriate materials and allied process for various automobile components and applications.
- To become conversant with professional and commercial practice.
- To identify, select, assemble and design simple machine elements / auto parts for various applications and draw cad drawing
- To understand fundamentals of various thermodynamics system with a view of their effective operation and maintenance in practice.
- To understand mechanisms used in practical machines and equipments with view of operation and maintenance of machines.
- To get acquainted with metallurgy and manufacturing process and materials with a view to operate them effectively in practical situation.
- To understand about various systems, structures and functions of an automobile
- To understand various equipments & tools for garage practices.
- To get acquainted with maintenance procedure.
- To understand basics and fundamentals of industrial engineering and world class manufacturing practices so as to apply them in practice.
- To understand about various types of auto engines, structure, allied systems performance and related recent developments in engines
- To understand various electrical & electronics systems in automobiles.

- To operate and maintain the automobiles by understanding the basic and principles.
- To understand Transport management laws, modern vehicle aerodynamic principles.
- To develop entrepreneurial skills.
- To create environmental conscious by appreciating various means of reducing the pollution.
- To appreciate alternate energy needs. To get conversant with alternate energy sources.
- To be in tune with advances in automobiles.
- To know various vehicle testing & performance calculation methods
- To acquire the skills in 2D and 3D modeling using different software.
- To understand technical details of all categories of automobiles such as tractors, Forklift Truck, tipper and road roller
- To get acquainted with various safety devices in modern automobiles.
- To understand industry environment, auto systems, actual hands on skills.

CURRICULUM DESIGN AND DEVELOPMENT PROCESS

INTRODUCTION

Curriculum development is a dynamic process, which is governed by the contemporary needs of the user-system. All the activities in any academic institution are guided by the curricula operating in the institution. Design of curricula and their implementation, therefore, requires utmost attention of one and all for its effectiveness.

It was felt that design, review/revision should be based on scientific principles of educational technology and theories of learning and it must reflect the needs, expectations and aspirations of stakeholders/ clients in the technician education system. These needs of user system mainly fall in the following four domains namely

- Personal development domain
- Social development domain
- Continued learning skills domain
- Earning to live' or 'Professional Skills' development domain

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Curriculum is designed on competency based. All competencies needed for automobile diploma holder is first listed. Based on this structure of curriculum is prepared. Attempts have been made in this document to address to the expectations of the user system from the Diploma pass outs. If implemented in right spirit, it would pay much better dividends, it is hoped.

APPROACH TO DESIGN OF CURRICULUM

This Curriculum has been designed on the systematic approach based on competency-based curriculum of educational technology and theories of learning. The data is collected in following ways

Through observational records

1. By study of documents used in industries, expert reports, newspapers and trade literatures etc., their views on different aspects of the curriculum.
2. Through a series of discussions in programme committee.
3. Discussion with industry experts, Pass out students, faculties from outside institutes

Taking into account the knowledge, skills/competencies, attitudes etc. required to be possessed by the diploma pass outs the content of different courses is designed.

While designing the curriculum emphasis is given on following points.

- New/emerging technologies being used in the world of work.
- Personal values and social skills required to be possessed.
- Skills related to life-long learning and independent study.
- Professional skills required for different jobs along a career path.

Describing roles/ functions of a technician

A technician, say for example in a medium size engineering enterprise, working at middle level management position may have to carry out jobs in different departments. These are identified as

- Installation, inspection, production and control
- Repair and maintenance
- Marketing and sales
- Purchase and store
- Observation and analysis of problems at Site
- Analysis, design and costing of product and processes
- Research and development

Designing content of each curriculum area

- Different courses are categorised as
  - Foundation Level
  - Basic Level
  - Allied Level
  - Applied Level
  - Diversified Level
- Curriculum scheme of each course along with course code is given at the beginning
- Competencies to be developed are identified and written.
- Rationale of each course is highlighted.
- Objectives of each course are highlighted and written.
- Content outline in descriptive form was derived. Generally the content outline of a subject was divided into chapters and then from chapters into topic outline.

- Having derived the total content outlines i.e. Theory. At the end of the theory content list of practical is added for each course, following were arrived at by consensus-
    - Time required by a teacher to teach the prescribed theory and practical parts
    - Number of courses per term to be taken.
    - Total no. of hours required to teach the entire course.
    - Total no. of lectures and practicals per week.

- Approach to the assessment of student's learning and types of assessment techniques to be used were decided. An assessment scheme was designed, which is a suitable mix of (a) continuous evaluation of term-work (b) progressive test (c) Term end examination.

- Implementation strategies for each course were identified.

- Learning resources for students were prescribed such as
    - Teacher's lecture notes
    - Basic text-book covering most of the topics in the curriculum and other books
    - Monographs, handbooks, periodicals, articles, journals etc.
    - Data-books, manuals, standards etc

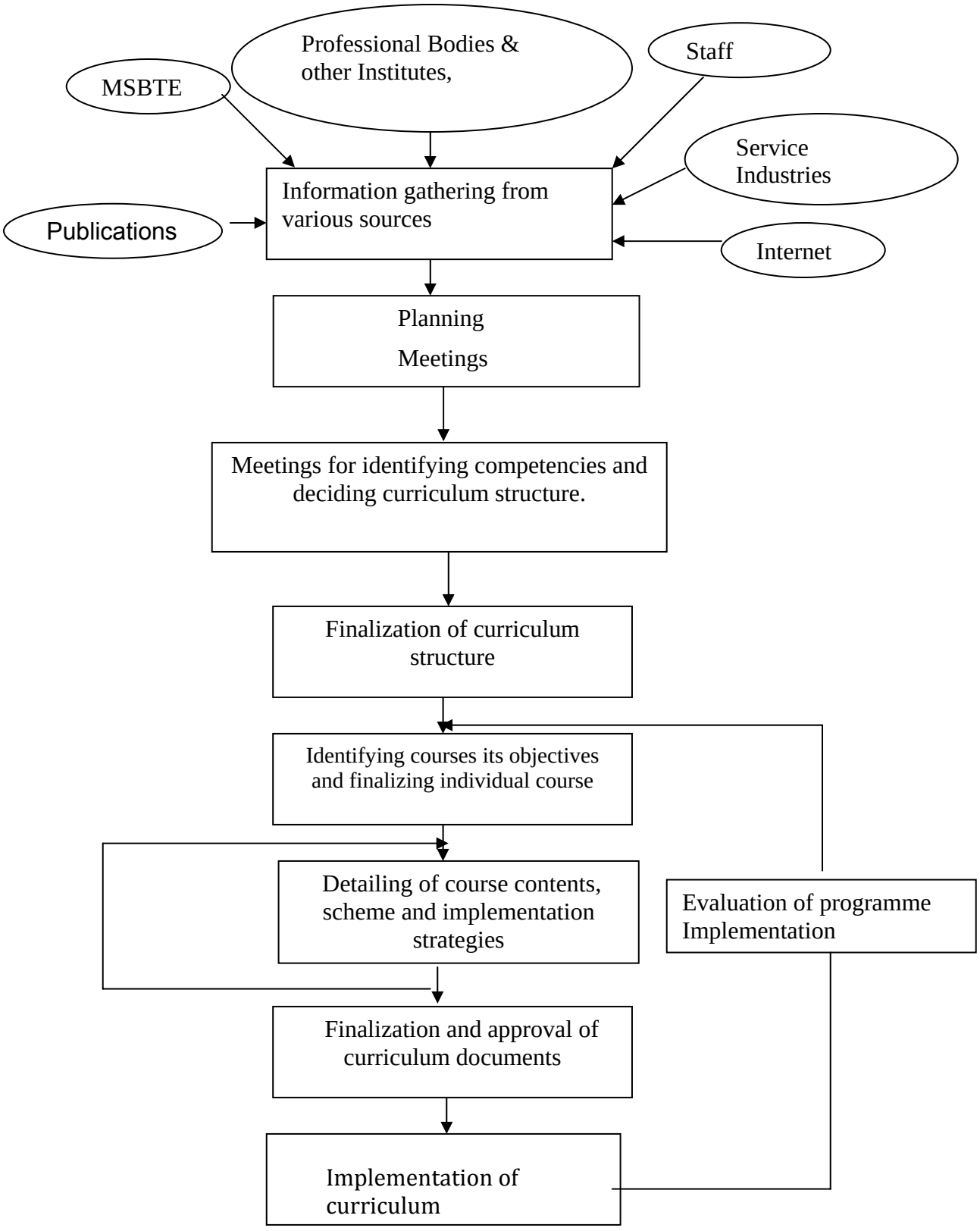
In all these activities, views of senior teachers regarding relevance of course contents and implementation strategies being presently followed are sought.

SALIENT FEATURES OF CURRICULUM

- Developing competencies
- Team building
- Entrepreneurial skills.
- Learning to learn/ self learning
- Information collection, processing, use and management
- Knowledge applications
- Soft skills

DEVELOPING/ FINALISING A PROGRAMME STRUCTURE

Programme structure consisting of teaching and examination schemes was finally arrived at through consensus. The approach followed for curriculum development is shown diagrammatically as follows:-


Professional Bodies & other Institutes,
Staff
MSBTE
Service Industries
Information gathering from various sources
Publications
Internet
Planning
Meetings
Meetings for identifying competencies and deciding curriculum structure.
Finalization of curriculum structure
Identifying courses its objectives and finalizing individual course
Detailing of course contents, scheme and implementation strategies
Evaluation of programme Implementation
Finalization and approval of curriculum documents
Implementation of curriculum

PROGRAMME STRUCTURE AT A GLANCE

SR. NO	LEVELS	COMPULSORY COURSES	OPTIONAL COURSES	CREDITS COMP. + OPTIONAL	MARKING SCHEME		
					COMPULSORY COURSES	OPTIONAL COURSES	TOTAL
1	Foundation	07	--	28+ 00	750	--	750
2	Basic	08	--	42 + 00	1100	-	1100
3	Allied	06	02/20	24 + 04	600		600
4	Applied	13	01/05	52 + 06	1550	150	1700
5	Diversified	04	01/05	22 + 06	600	150	750
	TOTAL	38	04/28	168+16=184	4600	300	4900

Scheme at a glance:

Total number of courses offered : 42

Number of Compulsory courses : 38

Number of Optional course : 04/28

Total courses to be opted : 42/66

Level: 1 Foundation Level Courses

FOUNDATION LEVEL												
Sr. No.	**Course Code**	**Course Name**	**Teaching Scheme**				**Examination Scheme**					
			Th	**Pr**	**Cr**	**Term**	**PT**	**Th**	**Pr**	**Tw**	**Or**	**Total**
1	5G101	Basic Mathematics	4	0	4	I	20	80	0	0	0	100
2	5G102	Engineering Mathematics	4	0	4	II	20	80	0	0	0	100
3	5G103	Engineering Physics	3	2	5	II	20	80	25	25	0	150
4	5G104	Engineering Chemistry	3	2	5	I	20	80	25	25	0	150
5	5G105	Work Shop Practice	0	3	3	I	0	0	0	50	0	50
6	5G106	Engineering Graphics	2	2	4	I	0	0	50	50	0	100
7	5G107	Basics of Computer System	1	2	3	I	0	0	50	50	0	100
			17	11	28		80	320	150	200	0	750

Scheme at Glance

Total number of courses offered : 7
Number of Compulsory Courses : 7
Number of Optional Courses : Nil
Total Courses : 7
Total Credits : 28

Total Marks : 750

G-COURSES COMMON TO ALL BRANCHES
R-COURSES COMMON TO MECHANICAL AND AUTOMOBILE
Q- COURSES COMMON TO MECHANICAL, AUTOMOBILE AND CIVIL
A-COURSES FOR AUTOMOBILE ONLY

Level: 2 Basic Level Courses

Sr. No	Course Code	Course Name	Teaching Scheme				Examination Scheme					
			Th	Pr	Cr	Term	PT	Th	Pr	Tw	Or	Total
1	5R201	Engineering Drawing	2	4	6	II	0	0	50	25	0	75
2	5A202	Auto Systems I	3	2	5	IV	20	80	0	25	25	150
3	5A203	Automobile Manufacturing Process	3	3	6	V	20	80	50	50	0	200
4	5Q201	Applied Mechanics	4	2	6	II	20	80	0	50	0	150
5	5A205	Heat Engineering	3	2	5	IV	20	80	0	25	25	150
6	5R206	Development of Life Skills	0	2	2	III	0	0	0	25	25	50
7	5R207	Professional Practices	0	2	2	IV	0	0	0	25	0	25
8	5R208	Mechanical Technology	2	3	5	II	20	80	0	25	25	150
9	5Q202	Strength Of Materials	3	2	5	III	20	80	0	25	25	150
			20	22	42		600		500			1100

Scheme at Glance

Total number of courses offered : 9
Number of Compulsory Courses : 9
Number of Optional Courses : Nil
Total Courses : 9
Total Credits : 42

Total Marks : 1100

G-COURSES COMMON TO ALL BRANCHES
R-COURSES COMMON TO MECHANICAL AND AUTOMOBILE
Q- COURSES COMMON TO MECHANICAL, AUTOMOBILE AND CIVIL
A-COURSES FOR AUTOMOBILE ONLY

Level: 3 Allied Level Courses

Sr. No.	Course Code	Course Name	Teaching Scheme				Examination Scheme					
			Th	Pr	Cr	Term	PT	Th	Pr	Tw	Or	Total
1	5G301	English	2	2	4	I	20	80	0	25	0	125
2	5G302	Communication Skills	1	2	3	II	0	0	0	50	25	75
3	5G303	Entrepreneurship Development	2	2	4	III	0	0	0	25	25	50
4	5R301	Basics of electrical Engineering and Electronics	4	2	6	IV	20	80	0	50	0	150
5	5G304	Environmental Science	2	0	2	IV	0	0	0	50	0	50
6	5G305	Industrial Management	3	2	5	V	20	80	0	25	25	150
7	5G311 to 5G328	Non- Exam	0	2	2	II	0	0	0	0	0	0
8	5G311 to 5G328	Non-Exam	0	2	2	III	0	0	0	0	0	0
			14	14	28		300		300			600

Scheme at Glance

Total number of courses offered : 8
Number of Compulsory Courses : 6
Number of Optional Courses : 2
Total Courses : 8
Total Credits : 28

Total Marks : 600

G-COURSES COMMON TO ALL BRANCHES
R-COURSES COMMON TO MECHANICAL AND AUTOMOBILE
Q- COURSES COMMON TO MECHANICAL, AUTOMOBILE AND CIVIL
A-COURSES FOR AUTOMOBILE ONLY

Level: 4 Applied Level Courses

S. N	Course Code	Course Name	Teaching Scheme				Examination Scheme					
			Th	Pr	Cr	Term	PT	Th	Pr	Tw	Or	Total
1	5R401	Fluid Power	3	2	5	III	20	80	0	25	25	150
2	5R402	Machine Drawing	2	4	6	IV	20	80	0	50	25	175
3	5R403	Project	0	4	4	VI	0	0	0	100	50	150
4	5R404	Seminar	0	2	2	V	0	0	0	50	50	100
5	5A405	Auto Electrical & Electronics Systems	3	2	5	VI	20	80	0	25	25	150
6	5R406	Theory of Machines	3	2	5	III	20	80	0	25	25	150
7	5R407	3-D Modeling	1	2	3	VI	0	0	0	50	50	100
8	5A408	Vehicle maintenance	2	3	5	V	0	0	0	50	25	75
9	5A409	Advance automobile engines	3	2	5	VI	20	80	0	25	25	150
10	5A410	Auto Systems II	3	2	5	V	20	80	0	25	25	150
11	5R411	Mechanical Engineering Materials	3	2	5	III	20	80	0	25	25	150
12	5R412	Industrial visit	0	2	2	IV	0	0	0	50	0	50
ELECTIVE												
Sr. No.	Course Code	Course Name ELECTIVE ANY ONE GROUP I	Teaching Scheme				Examination Scheme					
			Th	Pr	Cr	Term	PT	Th	Pr	Tw	Or	Total
		GROUP A (Any one)										
1	5A414	Production Engineering	4	2	6	V	20	80	0	25	25	150
2	5A415	Special Purpose Vehicle	4	2	6	V	20	80	0	25	25	150
3	5A416	Vehicle Aerodynamic & Design	4	2	6	V	20	80	0	25	25	150
4	5A417	CAD/CAM & Automation	4	2	6	V	20	80	0	25	25	150
5	5R418	Advance Engineering mathematics	4	2	6	V	20	80	0	25	25	150
			27	31	58		800		900			1700

Scheme at Glance

Total number of courses offered : 17
Number of Compulsory Courses : 12
Number of Optional Courses : 1
Total Courses : 13
Total Credits : 58
Total Marks : 1700

G-COURSES COMMON TO ALL BRANCHES
R-COURSES COMMON TO MECHANICAL AND AUTOMOBILE
Q- COURSES COMMON TO MECHANICAL, AUTOMOBILE AND CIVIL
A-COURSES FOR AUTOMOBILE ONLY

Level: 5 Diversified Level Courses

S.N	Course Code	Course Name ELECTIVE ANY ONE GROUP I & II	Teaching Scheme				Examination Scheme					
			Th	Pr	Cr	Term	PT	Th	Pr	Tw	Or	Total
1	5A501	Automobile component Design	4	2	6	VI	20	80	0	25	25	150
2	5R502	Metrology and Quality Control	3	2	5	VI	20	80	25	25	0	150
3	5A503	Transport Mgt	3	2	5	IV	20	80	0	25	25	150
4	5R504	IC Engines	4	2	6	V	20	80	0	25	25	150
		GROUP B (Any one)										
1	5A505	Automobile Air Conditioning	4	2	6	VI	20	80	0	25	25	150
2	5R506	Alternate Energy Sources	4	2	6	VI	20	80	0	25	25	150
3	5A507	Auto Vehicle Testing	4	2	6	VI	20	80	0	25	25	150
4	5R508	C-Programming	4	2	6	VI	20	80	0	25	25	150
5	5A509	Automotive Mechatronics and systems	4	2	6	VI	20	80	0	25	25	150
			18	10	28		500		250			750

Scheme at Glance

Total number of courses offered : 9
Number of Compulsory Courses : 4
Number of Optional Courses : 1
Total Courses : 5
Total Credits : 28

Total Marks : 750

G-COURSES COMMON TO ALL BRANCHES
R-COURSES COMMON TO MECHANICAL AND AUTOMOBILE
Q- COURSES COMMON TO MECHANICAL, AUTOMOBILE AND CIVIL
A-COURSES FOR AUTOMOBILE ONLY

(LIST OF NON EXAM COURSES)

COURSE CODE	COURSE TITLE	PREQ	TEACHING SCHEME				EXAMINATION SCHEME					
			TH	PR	CR	TERM	PT	TH	PR	TW	OR	TOTAL
Any two of the following												
5G311	Personality Development			02	02							
5G312	EDP(Civil Engg)			02	02							
5G313	Hobby Electronics			02	02							
5G314	Spoken English			02	02							
5G315	German			02	02							
5G316	French			02	02							
5G317	Yoga			02	02							
5G318	Music-Instrumental			02	02							
5G319	Two wheeler Maintenance			02	02							
5G320	EDP(Electrical Engineering)			02	02							
5G321	Electrical Maintenance			02	02							
5G322	Electronics Maintenance			02	02							
5G323	Computer Maintenance			02	02							
5G324	Japanese			02	02							
5G325	Music-vocal			02	02							
5G326	Aerobics			02	02							
5G327	Indian classical dance			02	02							
5G328	Sewing Machine Maintenance			02	02							

AUTOMOBILE ENGG
SAMPLE PATH

Year - I		Year - II		Year - III	
ODD Sem.	**EVEN Sem.**	**ODD Sem.**	**EVEN Sem.**	**ODD Sem.**	**EVEN Sem.**
Course Code Course Title Credits (Th+Pr)	**Course Code Course Title Credits (Th+Pr)**	**Course Code Course Title Credits (Th+Pr)**	**Course Code Course Title Credits (Th+Pr)**	**Course Code Course Title Credits (Th+Pr)**	**Course Code Course Title Credits (Th+Pr)**
Workshop Practice (5G105) (0+3)	Engineering Physics (5G103) (3+2)	Theory of Machines (5R406) (3+2)	Heat Engg (5A205) (3+2)	Industrial Management (5G305) (3+2)	Automobile component Design (5A501) (4+2)
Basic. Mathematics (5G101) (4+0)	Applied Mechanics (5Q201) (4+2)	Fluid Power (5R401) (3+2)	Auto system I (5A202) (3+2)	IC Engines (5R504) (4+2)	Advance automobile engines (5A409) (3+2)
ENGINEERING CHEMISTRY (5G104) (3+2)	Engineering Mathematics (5G102) (4+0)	Strength of Material (5Q202) (3+2)	Machine Drawing (5R402) (2+4)	Elective I (Any one) (5A414-418) (4+2)	3 D Modelling (5R407) (1+2)
Engineering Graphics (5G106) (2+2)	Communicatio n Skill (5G302) (1+2)	Mechanical Engg. Mtrls. (5R411) (3+2)	Professional Practice (5R207) (0+2)	Auto system II (5A410) (3+2)	Elective II (Any one) (5A505-509) (4+2)
Basics of Computer (5G107) (1+2)	Engineering Drawing (5R201) (2+4)	Entrepreneurs hip Development (5G303) (2+2)	Transport Mgt. (5A503) (3+2)	Seminar (5R404) (0+2)	Metrology and Quality Control (5R502) (3+2)
English (5G301) (2+2)	Non exam (5G311-328) (0+2)	Development of Life Skills (5R206) (0+2)	Industrial Visit (5R412) (0+2)	Vehicle Maintenance (5A408) (2+3)	Auto electrical &electronics Systems (5A405) (3+2)
	Mechanical Technology (5R208) (2+3)	Non Exam (0+2) (5G311-328)	Environmental Science (5G304) (2+0)	Automobile Manufacturing Process (5A203) (3+3)	PROJECT (5R403) (0+4)
			Basic of Electrical Engg and Etx (5R301) (4+2)		
23	**31**	**28**	**33**	**35**	**34**
Total Credits	**184**				

5G101BASIC MATHEMATICS

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	00	Max.Marks	20	80	--	--	--	100
TOTAL	04	Duration	1.00	3.00	--	--	--	--

RATIONALE:

The subject is classified under basic sciences and intends to teach students basic facts, concepts and principles of mathematics, as a tool to analyze Engineering problems. Mathematics lies down the foundation to understand core technology subjects.

COMPETENCY STATEMENT(S):

1. To inculcate the practice of mathematic
2 Comprehend the principles of other subjects
3 Solve problems by using analytical and systematic approach**.**
4 The students will be able to develop process of logical thinking

CONTENTS:

COURSE CONTENTS:-

Sr.no.	Name of the Chapter / topic (Follow S.I. units)	Hours	Marks
1.	**Algebra** 1. Logarithms 1.1 Defination natural and common logarithams. 1.2 Laws of logarithams 1.3 Simple numericals. On logarithams	**04**	**04**
2.	**Determinant** 2.1 Definition of Determinant, Order of Determinant 2.2 Expansion of Determinant of order 3 2.3 Properties of Determinant 2.4Cramer's Rule (solution of simultaneous equations in three Unknowns)	**08**	**08**
3.	**Partial fractions** 3.1Definition of Rational fraction, Partial fractions, proper and improper fractions 3.2 To resolve given rational fraction into partial fractions 3.3 Denominator containing Non repeated linear factors	**06**	**08**

	3.4 Denominator containing repeated linear factors 3.5 Denominator containing irreducible non-repeated Quadratic factors		
4.	**Matrices** 4.1 Definition of matrix: Type of matrix: viz.- null, row, column, square, diagonal, scalar, unit, Triangular. 4.2 Algebra of matrices –Addition, Subtraction and Multiplication 4.3 Transpose of a matrix 4.4 Adjoint of a matrix 4.5I nverse of matrix by adjoint method	**08**	**10**
5.	**Trigonometry** 5.1 Trigonometric ratios of allied, compound and multiple angles 5.2 Trigonometric Ratios of allied angles 5.3 Trigonometric Ratios of compound angles 5.4 Trigonometric Ratios of multiple angles Product, sum and difference formulae 5.5 Sub-multiple angles.	**10**	**16**
6.	**Inverse circular functions** 6.1 Definition of Inverse circular functions 6.2 Principle values of Inverse circular functions 6.3 Simple problems	**04**	**08**
7.	**Properties of Triangles** 7.1 Sine rule, Cosine rule, 7.2 Tangent rule(without proof)Simple problems	**06**	**06**
8.	**Calculus** 8.1Cartesian products of sets. 8.2Definition of relation,definition of fuction, real valued fuction,domain,co-domain of a fuction. 8.3 Types of Fuctions. 8.4 value of the fuction at given point. 8.5 composite fuction.	**08**	**08**
9.	**Limits** 9.1Definition and concept of limit Limits of algebraic functions 9.2 Limits of trigonometric functions 9.3 Limits of exponential functions 9.4 Limits of logarithmic functions	**10**	**12**
	TOTAL	**64**	**80**

TEXT B00KS:

Sr. No	Title of Book	Author and Publication
1	Mathematics for polytechnic students for first year	By S.P.Deshpande
2	Mathematics for polytechnic students for first year	By G.V.Kumbhojkar
3	Mathematics for polytechnics	By TTTI Bhopal
4	Applied Mathematics	By Gore and Patil
5	Trigonometry Part I	By Loney

5G102- ENGINEERING MATHEMATICS

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	00	Max.Marks	20	80	--	--	--	100
TOTAL	04	Duration	1.00	3.00	--	--	--	--

RATIONALE:

The subject is classified under basic sciences and intends to teach students basic facts, concepts and principles of mathematics, as a tool to analyze Engineering problems. Mathematics lies down the foundation to understand core technology subjects.

COMPETENCY STATEMENTS:

To inculcate the practice of mathematic
Comprehend the principles of other subjects
Solve problems by using analytical and systematic approach.

COURSE CONTENTS:-

TOPIC NO	Name of the Chapter / topic (Follow S.I. units)	Hours	Marks
1	**Derivatives** 1.1 Definition of derivative, notation. 1.2 Derivative of standard functions. 1.3 Rules of Differentiation (without proof) such as sum, difference, product and quotient. 1.4 Derivative of composite functions. 1.5 Derivative of inverse trigonometric functions. 1.6 Derivative of implicit functions. 1.7 Derivative of parametric functions. 1.8 Logarithmic differentiation. 1.9 Second order derivatives. 1.10 Simple applications of derivative such as equation of Tangent & normal, maxima & minima, radius of Curvature.	**18**	**26**

2	**Integration** 2.1 Definition of integration. 2.2 Integration of standard function. 2.3 Rules of Integration: sum, difference & multiplication. 2.4 Methods of Integration. 2.4.1 Integration by substitution. 2.4.2 Integration by partial fraction. 2.4.3 Integration by parts. 2.5 Definition of Definite integral. 2.6 Simple problems on definite integral.	**18**	**22**
3	**Differential Equations** 3.1 Definition of differential equation, order &degree. 3.2 Formation of differential equation. 3.3 Solution of Diff. equation. 3.3.1 variable separable. 3.3.2 Homogeneous equation. 3.3.3 Exact diff. equation. 3.3.4 Linear diff. equation.	**14**	**16**
4	**Statistics** 4.1 Graphical representation: Histogram & give curve to find Mode and median. 4.2 Measures of dispersion : Range, mean deviation and Standard deviation	**06**	**08**
5	**Probability.** 5.1 Introduction & definitions of different terms permutation & combination. 5.2 Definition of probability. 5.3 Addition Theorem of probability. 5.4 Multiplication Theorem. 5.5 Conditional probability.	**08**	**08**
	TOTAL	**64**	**80**

TEXT BOOKS:

S.No.	Name of Book	Author	Publication
1.	Mathematics for polytechnic students for second Year	S. P. Deshpande	Dhanpatrai publishing Co.
2.	Applied Mathematics	ByPatel & Rawal	S. Chand & Co., N. Delhi
3.	Fundamentals of Mathematical statistics	S.C.Gupta & Kapoor	Pune vidhyarti graham prakshan

5G103- ENGINEERING PHYSICS

COURSE STRUCTURE:

Teaching scheme		Evaluation scheme						
TH	03		PT	TEE	TW	PR	OR	TOTAL
PR	02	MAX MARKS	20	80	25	25		150
TOTAL	05	DURATION	01	03				

COMPETENCY STATEMENT:

The Student will be able to:

1. Analyze different factors on which capacitance depends.
2. Differentiate between field intensity and potential.
3. List advantages of optical fiber.
4. Describe principle of working of optical fiber.
5. Differentiate between conductor, insulator and semiconductor on the

RATIONALE:

Physics provides foundation for core technology subjects. Understanding of any subject is entirely depending on logical thinking and hierarchy of knowledge component. As Physics is considered as basic science its principles, laws, hypothesis, concepts, ideas are playing important role in reinforcing the knowledge of technology.

Deep thought is given while selecting topics in physics. They are different for different groups. This will provide sound background for self-development in future to cope up with new innovations. Topics are relevant to particular programme and student will be motivated to learn and can enjoy the course of Physics as if it is one of the subjects of their own stream.

Topic no	contents	hours	Marks
01	**01 UNITS AND MEASUREMENTS** 1.1 Need of measurement and unit in engineering and science, definition of unit , requirements of standard unit, systems of units-CGS,MKS and SI,fundamental and derived quantities and their units 1.2 Least count and range of instrument, least count of vernier caliper, micrometer screw gauge and sphereometer, 1.3 Definition of accuracy, precision and error, estimation of errors -absolute error, relative error and percentage error, rules and identification of significant figures. 1.4 Scalars & Vectors: Definition, laws of Vectors (Law of Triangle, law of parallelogram) scalar product, Vector product and their characteristics. **(Numerical on percentage error and significant figures, Scalar and vectors)**	**07**	**12**
02	**KINEMATICS** **2.1 Angular Motion:** Definition of Angular displacement, angular velocity, angular acceleration, Relation between angular velocity and linear velocity definition of S.H.M **2.2 Kinetics:** Definition of momentum,impulse,impulsive force, Statements of Newton's law of motion with equations, Application of laws of motion-Recoil of gun, Motion of two connected bodies by light inextensible string passing over smooth pulley, motion of lift. **2.3 work power & energy.** Definition of work, power & energy equation for potential energy & kinetic energy, work done by a torque.	**08**	**10**
03	**GENERAL PROPERTIES OF MATTER** **3.1 Elasticity** Deforming force, restoring force, elastic and plastic body, and stress and strain with their types. Elastic limit, Hooke's law, Young's modulus, bulk modulus, modulus of rigidity and relation between them (no derivation), stress strain diagram. Behavior of wire under continuously increasing load, yield point, ultimate stress, breaking stress, factor of safety. **3.2 Surface Tension.** Molecular force, cohesive and adhesive force, Molecular range , sphere influence, Laplace's molecular theory, Definition of surface tension and its S.I.unit,angle of contact, capillary action with examples, shape of meniscus for water and mercury, relation between surface tension , capillary rise and radius of capillary (no	**14**	**20**

	derivation),effect of impurity and temperature on surface tension **(Numerical on relation between surface tension, capillary rise and radius)** **3.3 Viscosity** Fluid friction, viscous force, Definition of viscosity, velocity gradient, Newton's law of viscosity, coefficient of viscosity and its S.I. unit, streamline and turbulent flow with examples, critical velocity, Reynolds's number and its significance, free fall of spherical body through viscous medium (no derivation), terminal velocity, Stokes law (statement and formula). **(Numerical on coefficient of viscosity Reynolds number and Stroke's formula)**		
04	**HEAT** **4.1 Transmission of heat and expansion of solids** Three modes of transmission of heat -conduction, convection and radiation, coefficient of Thermal conductivity and its S.I. unit, Definition of linear, Aerial and cubical expansion and relation between them.(no derivation)	**02**	**04**
05	**LIGHT, LASER and SOUND** **5.1 Properties of light** Reflection, refraction, Snell's law, physical significance of refractive index, definition of dispersion, polarization and diffraction of light along with ray diagram, principle of superposition of waves, interference of light, constructive and destructive interference. **5.2 LASER** Properties of laser, spontaneous and stimulated emission, population inversion, optical pumping, construction and working of He-Ne laser. **5.3 Sound** Definition of wave motion, amplitude, period, frequency, and wavelength, relation between velocity, frequency and wavelength , equation of progressive wave (no derivation), longitudinal and transverse wave, definition of stationary Wave, node and antinodes, forced and free vibrations, definition of resonance with examples, formula for velocity of sound with end correction (no derivation) **(Numerical on relation v = n λ and resonance)**	**06**	**12**
06	**ELECTROSTATICS & MAGNETISM:** **6.1 ELECTROSTATICS** Coulomb's Inverse square law and Ohm's law Unit charge, Intensity of electric field, Electric lines of force & their properties, flux, flux density. General equation of	**04**	

	Ohms law - Resistances in series & parallel Specific resistance Effect of temp on resistance. Platinum resistance thermometer, Wheat stone's bridge. Principle of potentiometer, **6.2 ELECTRIC POTENTIAL AND ELECTRIC CAPACITANCE:** Principles of condensers Energy stored in condensers, condensers in series & parallel, numerical		**08**
07	**SEMICONDUCTORS:** Conductivity,Classification of conductors,insulators,semiconductors,p-n type semiconductors-n junctions, space-charge region, barrier potential, biasing of p-n junction, diode as a rectifier and its charecteristics,reverse saturation current, cut in voltage, diode capacitance	**03**	**06**
08	**MODERN PHYSICS.** **8.1 Photo electricity** Concept of photon**,** Plank's hypothesis, properties of photon, photo electric effect, Characteristics of photoelectric effect, work function, Einstein's photoelectric equation(no derivation), photoelectric cell-construction ,working and applications. **(Numerical on Energy of photon, work function, Photoelectric equation)** **8.2 X-rays** Introduction to x-rays, types of x-ray spectra-continuous and characteristics, production of x-rays using Coolidge tube, minimum wavelength of x-rays, properties of x-rays, engineering, medical and scientific applications.	**04**	**08**
	TOTAL	**48**	**80**

PRACTICALS

Skills to be developed

1) Intellectual skills-

_ Proper selection of measuring instruments on the basis of range, least count, precision and accuracy required for measurement.

_ Analyze properties of matter & their use for the selection of material.

_ To verify the principles, laws, using given instruments under different conditions.

_ To read and interpret the graph.

_ To interpret the results from observations and calculations.

_ To use these results for parallel problems.

2) Motor skills-

_ Proper handling of instruments.

_ measuring physical quantities accurately.

_ To observe the phenomenon and to list the observations in proper tabular form.

_ To adopt proper procedure while performing the experiment.

_ To plot the graphs.

List of Experiments:

1) To know your Physics Laboratory.
2) To use Vernier Caliper for the measurement of dimensions of given object.
3) To use Micrometer Screw Gauge for the measurement of dimensions (Length,Thickness, Diameter) of given object.
4) To verify Hooke's Law by Searle's method and to calculate Young's modulus of elasticity of steel wire.
5) To verify Law of Parallelogram.
6) To determine coefficient of viscosity of given fluid (Glycerin) using Stoke's Method.
7) To Verify Boyle's law and to find out atmospheric pressure in the laboratory using graph.
8) To determine the velocity of sound by using resonance tube.
9) Determination of specific resistance by Voltmeter-Ammeer method.
10) Determinationof Specific resistance by meterbridge.
11) Detemination of Law of resistance in Series by meterbridge.
12) Detemination of Law of resistance in Parallel by meterbridge.
13) Comparision of E.M.F by Single Cell method.

TEXT BOOKS:

S.No.	Name of Book	Author	Publication
1.	Text book of physics	B.G. Bhandarkar	Nirali publication

REFERENCE BOOKS:

S.No.	Name of Book	Author	Publication
1	Physics-I	V.Rajendran	Tata McGraw hill
2	Applied physics	Arthur Beiser	Tata McGraw hill
3	Physics	S.S. Ratan	Hill publication, New Delhi
4	Fundamentals of Physics	Resnick ,Halliday & Walker	Wiley India Pvt. Ltd.
5	Engg Physics	R.K.Gaur& S.L.Gupta	Dhanpat Rai Publications,New Delhi

5G104- ENGINEERING CHEMISTRY

COURSE STRUCTURE:

Teaching scheme		**Evaluation scheme**						
TH	03		PT	TEE	TW	PR	OR	TOTAL
PR	02	MAX MARKS	20	80	25	25		150
TOTAL	05	DURATION	01	03				

RATIONALE:

Chemistry is a basic science subject which is essential to all engineering courses. It gives knowledge of engineering materials, their properties, related applications & selection of materials for engineering applications.

Due to technological progress there are hazardous effects on environment & human life. The core knowledge of environmental effects will bring awareness in students about the precautions & preventions to be taken to reduce the ill effects.

This subject will generate curiosity of carrying out further development in engineering field

COMPETANCEY STATEMENT:

The student will be able to:

1. Draw the orbital configuration of different elements.
2. Represent the formation of molecules schematically.
3. Describe the mechanism of electrolysis.
4. Identify the properties of metals & alloys related to engineering applications.
5. Identify the properties of non metallic materials, related to engineering applications.

6 Select a proper material for specific purpose.

Topic no	contents	HRS	MARKS
01	**Atomic structure** 1.1 Definition of Atom, element, molecule , introduction to different atomic theories, 1.2 Bohr's atomic theory, Fundamental Particles of Atom their Mass ,Charge, Location, 1.3 Atomic no, Atomic Mass no. numerical problems on it , orbit & orbitals, 1.4 Electronic configuration , electronic configuration of first 30 elements 1.5, Isotopes & Isobars, 1.6 Inert gases, Their characteristics ,electronic configuration 1.7 Molecule formation: valency, types of valency, electrovalency co valency. Its examples.Formation of Electrovalent compounds e.g. Nacl, $Cacl_2$ &$Mgcl_2$, formation of Covalent Compounds examples H_2O, Cl_2, Co_2,	**08**	**10**
02	**Electrochemistry** 2.1 Definition & differentiation of Atom, Ion. 2.2 Ionisation & Electrolytic dissociation, Arrhenius Theory of Ionisation, Degree of Ionisation & factors affecting degree of ionization. 2.3 Introduction of Conductors, Insulators, Dielectrics, Electrolyte, NonElectrolyte, 2.4 Electrolysis, Electrolytic Cell, Electrodes. Mechanism of Electrolysis 2.5 Electrochemical Series for Cations & Anions, 2.6 Electrolysis of CuSO4 Solution by using Cu Electrode & Platinum Electrode 2.7 Faraday's first & second law of Electrolysis & numerical problems on it Applications of Electrolysis such as Electroplating & Electrorefining 2.8 Electrochemical Cells & Batteries , Types of cell Primary & secondary cell construction Working & Applications of Dry cell & Lead – Acid Storage	**06**	**12**

03	**METALLURGY** 3.1 Definition of Metallurgy, Mineral, Ore, Gangue, Flux & Slag, Occurrence of Metals, 3.2 Mechanical Properties of metals such as Hardness, Toughness, Ductility, Malleability, Tensile strength, 3.3 Stages of Extraction of Metals from its Ores in detail i.e. Crushing, Concentration, methods of concentration (physical and chemical) 3.4 Reduction of iron in blast furnace with chemical reactions, Reactions in zone of reduction and zone of absorption, 3.5 Alloys Definition of Alloy, Purposes of Making alloy. 3.6 Methods of Preparation of alloy such as fusion method & compression method 3.7 Classification of Alloys ,ferrous alloys & Non Ferrous alloys, their examples. 3.8 Composition, Properties & Applications of Alnico, Duralumin, Dutch Metal, German Silver / Nickel Silver, Gun Metal, Monel metal, Wood's Metal	**08**	**14**
04	**Corrosion of metals and its protection** 4.1 corrosion Definition of corrosion, Types of corrosion 4.2 Atmospheric corrosion or dry Corrosion, corrosion due to oxygen , different film formation , 4.3 Immersed Corrosion or Electrochemical Corrosion, oxygen absorption Mechanism , Hydrogen evolution mechanism 4.4 Protection of Metals from corrosion. Purification of Metals from corrosion, Alloy Formation, Cathode Protection Appling Protective Coatings like metal coating by Galvanising, Tinning, Electroplating.	**06**	**08**
05	**WATER** 5.1 Sources of water, impurities in water, 5.2 Hard water & soft water, types of hardness, causes of hardness, 5.3 Effects of hard water in boiler, scale & sludge formation in boiler its effects on boiler, 5.4 Effects of hard water in diff. industries and domestic purposes, 5.5 Softening of hard water by soda lime process, permutite process, ion exchange process, 5.6 Potable water & its condition for potability, 5.7 Different methods of purification of water,Examples	**07**	**10**

	chlorination,sterlisation		
06	**Non Metallic Materials** 6.1 Plastics Definition of Plastic, Formation of Plastic by Addition Polymerisation with example such as Polyethylene & PVC 6.2 Condensation Polymerisation with suitable example such as Bakelite plastic. 6.3Types of Plastics, Thermo softening & Thermosetting Plastic & difference between them 6.4 Compounding of Plastics – Resins, Fillers, binders ,Plasticizers, Accelerators, Pigments etc. .Engineering properties of plastic and its related uses. 6.5 Rubber Natural Rubber, Its Processing, Drawbacks of Natural Rubber, 6.6 Vulcanisation of Rubber with Chemical Reaction. 6.7 Synthetic Rubber its examples Buna –S & Buna –N rubber, Distinction Between Natural & synthetic rubber. 6.8 Properties of rubber such as Elasticity ,Tack, resistant to abrasion, Rebound capacity. 6.9 Engineering Applications of rubber based on their properties. 6.10 Thermal Insulating Materials Definition & Characteristics of Thermal insulators. Preparation of glasswool, Properties & Applications of Thermocole , glass wool, cork, & asbestos.	**07**	**18**
07	**Lubricants-** 7.1 Definition of lubricant, lubrication, 7.2 functions of lubricants ,need of lubrication 7.3 Classification of lubricants with examples, 7.4 Mechanism of Lubrication by Fluid Film, Boundary&Extreme Pressure, 7.5 Physical Characteristics of Lubricants Such as Viscosity, Viscosity Index, Oiliness, Volatility, Flash & Fire Point, Cloud & Pour Point. 7.6 Chemical Characteristics such as Acid Value , Neutralization Number, Emulsification, Saponification Value, Selection of proper Lubricants for Various Types of Machines.	**06**	**08**
	TOTAL	**48**	**80**

List of practicals (ANY 10 SHOULD BE PERFORM)

01) Orbital configuration of different elements (at least 10 elements)
02) To verify Faraday's first Law of electrolysis.
03) To determine neutralization point of acetic acid (weak acid) and ammonium hydroxide (Weak base). calculate the normality and strength of acetic acid.

04) To determine the equivalent point of precipitation titration of $BaCl_2$ with H_2SO_4 using Conductivity Meter. To find the normality and strength of $BaCl_2$
05) To find the normality & strength in grams per liter of the given solution (NaOH) with the help of standard hydrochloric acid.
06) To determine pH value of given solutions, water samples, by using pH paper, universal indicator and pH meter.
07) To determine the normality & strength of given hydrochloric acid solution by titrating it against standard potassium hydroxide solution.
08) To determine percentage of iron from steel by titration method.
09) To determine the hardness of potable water and boiler feeding water.
10) To determine the chloride content potable water and boiler feeding water.
11) Preparation of phenol formaldehyde plastic.
12) To determine the acid value of oil sample by neutralization method.
13) Qualitative analysis of given salt solutions, i.e. to determine one acidic and one basic radical from given salt solution. (At least 05 salt solutions.)

TEXT BOOKS:

S.No.	Name of Book	Author	Publication
1.	chemistryof engineering materials	S.S.Narkhede	Nirali publication
2.	chemistry of engineering materials	Shane patil	Tech-Max Publications
3	chemistry of engineering materials	Jawale	Mc vranda publication. Inc.
4	Basic chemistry	Dr.D.D.Jadhav	Tech-Max Publications

REFERENCE BOOKS:

S.No.	Name of Book	Author	Publication
1.	Engineering Chemistry	Jain & Jain	Dhanpat Rai and Sons Co.
2.	Engineering Chemistry	R.S. S. S. Dara	S.N. S. S. Chand Publication
3.	Environmental Chemistry & PollutionControl	S. S. Dara	S.Chand Publication

5G105 – WORKSHOP PRACTICE (WP)

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	00		PT	TEE	TW	PR	OR	Total
PR	03	Max. Marks	--	--	50	--	--	50
TOTAL	03	Duration	--	--	--	--	--	--

RATIONALE:

The knowledge of different basic tools and different processes such as smithy, forging, carpentry, welding, plumbing, fitting etc. is the basic requirement of the diploma technician. These are the basic & fundamental operations encountered in workshop. At this level it is essential to impart the practical feel of these basic operations & processes to the students. With this intention this course is being introduced.

COMPETENCY STATEMENTS:

1. To understand use of different hand tools and workshop processes.
2. To perform basic workshop processes such as smithy, forging, carpentry, welding, plumbing, fitting.

COURSE CONTENTS:

TERM WORK:

1) Smithy & Forging: - One job involving cutting, bending, drawing down/ up operations.
2) Carpentry: - One Job involving Different types of carpentry joints (min. two joints) used in furniture, wooden items with the use of teak wood, combination of wood & steel frames, plywood, sun mica.
3) Welding: - One job welded joint involving operations such as Lap, Butt welding with the help of Arc Welding machine
4) Fitting & Filling: - Fitting and filing one job involving filing, chamfering, drilling, tapping etc. operations
5) Plumbing: - One practical job on pipe fitting and threading

Job diary, drawing of different types of tools , operations are to be submitted by each candidate.

TEXT BOOK:

SR No	Title and Edition	Author	Publisher
1	Workshop technology Vol. 1	B.S. Raghuwanshi	
2	Workshop technology Vol. 1	S.K. Hajra Choudhary	
3	Production technology	R.K. Jain.	

5G106: ENGINEERING GRAPHICS (EG)

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	02		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	--	--	50	50	--	100
TOTAL	04	Duration	--	--	--	2.00	--	--

RATIONALE:

Engineering drawing (Graphics) is the language of engineers. Often it is required to imagine the different objects from various directions, sound knowledge of engineering graphics will help the engineer to represent various objects and read various drawings used in workshop, industry and in various manufacturing processes.

COMPETENCY STATEMENT:

To understand the basic principles of Engineering Drawing

COURSE CONTENTS:

Topic No.	Content	Hours	Marks
1	**Introduction** 1.1 Drawing Instruments and their uses 1.2 Letters and numbers (single stroke vertical) for main title, sub-title and normal use 1.3 Different types of lines, Convention of lines and their applications. 1.4 Scale (reduced, enlarged & full size), Plain scale and Diagonal scale. 1.5 Sheet sizes and layout, Geometrical constructions 1.6 Dimensioning, its methods, parallel and chain dimensioning, radius and diameter dimensioning, leader and its use, dimension with text	**04**	
2	**Simple Drawing Practices** 2.1 Drawing of different circles with thin, thick, center line use, dividing circle into number of equal parts, dividing line into equal parts 2.2 Drawing pentagon, hexagon and rhombus, drawing correct arrows to dimension lines, drawing tangent to circle from given point	**04**	
3	**Engineering Curves** 3.1 To draw ellipse by – • Arcs of circle method • Concentric circle method	**08**	

	• Oblong method 3.2 To draw parabola by – • Directrix focus method • Rectangle method 3.3 To draw hyperbola by – • Transverse axis & focus method. • Passing through a given point. (Rectangular hyperbola) 3.4 To draw involute of square, hexagon and circle. 3.5 To draw cycloid, epicycloid, hypocycloid.		
4	**Orthographic Projections** 4.1 Converting pictorial view into orthographic views (First angle method of Projection), 4.2 Sectional orthographic projection of simple objects	**08**	
5	**Isometric Projections** 5.1 Isometric projection of simple objects 5.2 Isometric projection of objects having circular holes	**08**	
	TOTAL	**32**	

LIST OF PRACTICAL/EXPERIMENTS:

A3 size sketch book should be used by the students. It is necessary to draw all the sheet problems in sketch book first and then redrawn on the sheets

1. Home assignment in Sketch book on lines, lettering, numbers and geometrical constructions which includes additional drawings given in chapter 1 & 2 **(No Sheet)**
2. Two sheets on Engineering curves, (Minimum 6 curves).
3. One sheet on Orthographic Projection, (Minimum 2 objects) by first angle method
4. One sheet on Isometric projection of simple object (Minimum 2 objects).

PRACTICAL EXAMINATION:

At the end of term practical examination of 50 marks of 2 Hours duration is compulsory to all students. External and Internal Examiners should set and assess the Question paper jointly as per following guidelines

a) Engineering curves (Solve any one out of two given) 12 marks
b) Geometrical construction & scales (Solve any one out of two given) 08 marks
c) Orthographic Projections (One Problem) 15 marks
d) Isometric projections (One Problem) 15 marks

TEXT BOOKS:

Sr. No	Title and Edition	Author	Publisher
1	Engineering Drawings	N. D. Bhatt	Charotar Publishing House
2	Engineering Drawings	Sidheshwar, Shastri	Tata Mc Graw Hill
3	Engineering Drawing	R.V.Mali	Vrinda Publication

5G107:- BASICS OF COMPUTER SCIENCE

COURSE STRUCTURE:

Teaching scheme		**Evaluation scheme**						
TH	1		PT	TEE	TW	PR	OR	TOTAL
PR	2	MAX MARKS			50	50		100
TOTAL	03	DURATION						

COMPETENCY STATEMENT (S):

- To understand working & use of Computer for day-to-day use.
- To use computer for word processing, accounting related applications
- To prepare professional presentations.
- To understand and use Internet.

RATIONALE:

With rapid development of Technology and competitive economy, computers play very important role in the diversified fields such as CAD, CAM, power generation, image processing, telecommunication modeling and simulation etc.

The built in characteristics of computers have made them inevitable in different applications areas. So it is essential for a Diploma Technician to have a knowledge regarding computers and develop a skill to handle different software's available. It is always essential for a technician to update their knowledge to cope up with the fast development in software's. Considering this in view and duties to be performed by Diploma Technician in professional life, following curriculum is suggested.

OBJECTIVES:

At the end of the course student should able to,

- Understand working of computers
- Get knowledge of various components of computers.
- Understand concept & functions of Operating System.
- Perform file management operations using My computer & Windows Explorer
- Print the letter using MS Word
- Perform worksheet operations using MS Excel
- To prepare professional presentations using MS PowerPoint
- Use Internet for Create E-mail id, receive & send E-mail with attachment
- Search for the information on Internet.

Topic no	Contents	HRS	MARKS
01	**Fundamentals** 1.1 Uses, Types of computer, Block Diagram showing components of computer, Input devices, output devices, CPU, Primary Memory, Secondary memory., processor and its speed, RAM, Monitor, Display card, Hard Disk, Floppy drives, CD drive. 1.2 Sound card, etc. (Use of each) Hard ware and software, Types of software. 1.3 Concept of Operating Definition, functions and examples of operating system (like DOS, WINDOWS, Linux,) used on different types of computers.	**02**	
02	**Dos & Windows (H-03)** 2.1 **DOS:** Bios, Power on self-test, Dos & its functions. Concept of file & directory, rules for file &directory names, Types of files-system files, data files, Program files, text files, Config.sys, Autoexec.bat, Batch files. File attributes, Wild cards. 2.2 **DOS commands:** Internal Commands: DATE, TIME, CLS, DIR, COPY, DEL, REN, CD, MD, RD, PROMPT, PATH, External Commands: FORMAT, CHKDSK, DISKCOPY 2.3 **WINDOW 98/2000/XP** **Introduction** : 2.3.1 Starting Windows, Desktop, Icons, Task bar, Short cuts, the start Button, arranging Windows, Shutting down windows. 2.3.2 Windows Explorer: Creating, renaming, deleting Folders/ file. 2.3.3 Copying, moving, deleting, renaming files, Using Send to, Search files and folders, Recycle bin 2.3.4 Windows Setting: Date format, adding printer. 2.3.5 Windows Accessories: Calculator, Notepad, paint, word pad.	**03**	
03	**Ms-Word** Introduction to word processing, Introduction to MS word. Opening, Saving, closing a file. Page setup: Changing Margins, layout, and paper size. Formatting Text: Tables: Insert table, enter and edit data into table. Printing: Print preview, selecting printer, and print options	**03**	
04	**Ms-Excel** 4.1 Introduction to electronic spreadsheet. Introduction to MS Excel.	**03**	

	4.2 Components of MS Excel window like Title bar, Menu bar, Formula Bar, Status bar, Worksheet area, Sheet Tabs, Columns, rows. Hiding and viewing Toolbars like Standard and formatting tool bars. Entering data, copying, moving, Editing cell entries use of auto fill Saving, closing and opening file. 4.3 Page setup: Changing Margins, layout, and paper size. Enter formula, copy formula using fill handle Inserting functions. Use of functions like SUM, AVERAGE, MIN, IF, COUNT, LOG, SIN, COS, ROUND, SQRT, PI etc. 4.4 Formatting data: Change number format, alignment, borders, font, size etc. Use auto Format, Restructuring worksheet: Inserting and deleting the columns and rows. 4.5 Changing column width, row height. Charts (Graphs): 4.6 Types of charts, creating and modifying charts, printing Charts.		
05	**PowerPoint :** Overview, Using design template and auto content wizard, creating presentation, slides and its types, slide operations, modifying & running presentation, adding & editing. objects, creating tables, charts & Diagram, save & print option, custom presentation, applying transition & animation effects.	**02**	
06	**Internet :** 6.1 Introduction: Uses of Internet, Resources required using Internet. 6.2 Internet Service Provider: Need & Duties of ISP, Connecting to Internet, Domain &addresses, 6.3 Internet Browsers, Search engines, Email, Chat,	**03**	

LIST OF PRACTICALS:
(If required specify minimum number of practical to be conducted from the following)

1. List and identify the peripheral devices of a PC. Connect the keyboard, mouse, printer, monitor, and scanner to a computer. Get the information about the manufacturers and prices of various components of a PC.

2. Dos: Use various Internal & External commands of DOS.

3. Windows

• Start and shutdown of windows. Starting different applications. Using applications like calculator, paint, word

• Observe various features of windows like menus, push buttons, drop down list, check boxes, option buttons etc.

• Perform file management operations such copying, deleting, renaming, creating folders, and renaming folders using My computer, Windows Explorer, searching files and folders.

• Change windows format such as wall paper, date & time format, Installing printer, installing & removing programs by using add /remove programs, change display properties

4. Microsoft Word

• Prepare a sample bio data
• Write an application for job
• Prepare a timetable in tabular format.

5. Microsoft Excel

• Create a sample result sheet of your class.
• Create salary sheet for Employees (Apply Excel formulae/ functions to solve problems.)
• Draw a chart (line, bar, pie etc) based on the data tabulated.

6. Internet

• Creation of email account
• Send E-mail, Receive E-Mail. (Use attachment)
• Management of email account.
• Searching information on internet

7. PowerPoint

• Creating PowerPoint presentation, running presentation.
• Applying design template, background, transition effects, animation to slide.
• Preparing custom presentations and using pack and go features.

REFERENCES:

Sr. No	Title of Book	Author and Publication
1	DOS made simple	Subhas Mehta Galgotia Publications
2	Fundamentals of Computers	P.K.Sihna BPB Publication
3	Teach Yourself Windows 98	Greg Perry Techmedia
4	Teach Yourself Windows 98	Cassel & Hart Techmedia
5	Windows 98 Bible	Alen Simpson BPB Publication
6	MS Office 2000	Ed Bott Woody Ceonhard Prentice Hall India
7	Microsoft Office	Ron Mansfield BPB Publications
8	Teach Yourself MS Office 97	Greg Perry Techmedia
9	DOS made easy	Herbert Schildt McGraw Hill
10	MS windows XP	Galgotiya Publications

5R201- ENGINEERING DRAWING (ED)

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	02		PT	TEE	TW	PR	OR	Total
PR	04	Max. Marks			25	50		75
TOTAL	06	Duration			--	--	--	--

RATIONALE:

Engineering Drawing is the language of engineers and technicians. Always the engineers come across different types of drawings. It is therefore very important to understand the fundamentals and basic concepts involved in drawing.

COMPETENCY STATEMENT (S):

To prepare and interpret the production drawings as per I.S. code.

COURSE CONTENTS:

Topic No.	Content	Hours	Marks
1	**Orthographic and sectional views** Using **First Angle** Projection Method only 1.1 Review of orthographic projections 1.2 Conversion of pictorial view into orthographic 1.3 Sectional orthographic views	**06**	
2	**Isometric Projections** 2.1 Introduction 2.2 Isometric scale and its use 2.3Conversion of orthographic views into isometric view / projection (Including rectangular, cylindrical objects, representation of slots on sloping as well as plane surfaces)	**06**	
3	**Projections of Lines and Planes** Use of **first angle method** of projections 3.1 Projection of points 3.2 Projection of Lines inclined to **one** reference plane only 3.3 Projection of Planes inclined to **one** reference plane only	**08**	
4	**Projection of solids** Projection of following solids with their axes inclined to one reference plane only.(Use of first angle method of projections). 4.1Prism and pyramids: Triangular, Square, Pentagonal and Hexagonal types 4.2 Cylinder 4.3 Cones	**06**	

5	**Section of solids** Use **First angle** projection method only and Axis of solid inclined to **one** reference plane and parallel to other reference planes 5.1 Sectional views of solids such as prism, pyramid, cone and cylinder	**03**	
6	**Missing Views** 6.1 Draw missing view from the given Orthographic views - simple components using **First Angle** Projection Method only	**03**	
	TOTAL	**32**	

LIST OF EXPERIMENTS:

A3 size sketch book should be used by the students. It is necessary to draw all the sheet problems in sketch book first and then redrawn on the sheets

1. One sheet on Orthographic projections (2 problems)
2. One sheet on Sectional Orthographic projections (2 problems)
3. One sheet on Isometric projection (2 problems)
4. One sheet on projection of lines & planes (2+2 problems)
5. One sheet on projection of solids (2 problems)
6. One sheet on projection of sections of solids. (2 problems)

PRACTICAL EXAMINATION:

At the end of term practical examination of 50 marks of 2 Hours duration is compulsory to all students. External and Internal Examiners should set and assess the Question paper jointly as per following guidelines

- Orthographic/Sectional orthographic (One Problem) 14 marks
- Isometric projection with slots and holes (One Problem) 14 marks
- Lines and planes (One Problem out of two given) 10 marks
- Solid/section of solids/missing view (One Problem) 12 marks

AUTO-CAD Work:

In a few practical hours students should be made conversant with auto cad 2D and 3D regular solid drawings. Simple drawings should be demonstrated to the class with use of LCD projector

1. **One sheet** on Missing Views should be redrawn by using AUTO-CAD and its Print out A4 size should be attached in sketch book by all students.

TEXT BOOKS:

SR No	Title and Edition	Author	Publisher
1	Elementary Engineering Drawing	N.D.Bhatt ,	Charotar Publishing House
2	Engineering Drawing	Mali , Chaudhari,	Vrinda Publication
3	Engineering Drawing	Sidheswar Shastri ,	Tata Mc Graw Hill

5A202- AUTOMOBILE SYSTEMS-I

COURSE STRUCTURE:

Teaching Scheme		Evaluation scheme						
TH	03		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks	20	80	25	--	25	150
TOTAL	05	Duration	1.00	3.00	--	--	--	--

RATIONALE:

This subject is core technology subject for Automobile Engineering Course. This subject is part of automobile system concerning transmission of power. The knowledge of this subject is required in the subjects like Automobile component design, vehicle maintenance and vehicle testing. Basic principles and conceptual knowledge of this subject is useful for improving the performance of vehicles.

COMPETENCY STATEMENT(S):

1. Understand the vehicle layouts, chassis frame & location of various systems.
2. Understand principle, construction and working of clutch, gearboxes, propeller shafts, universal joints, slip joints & final drive in the transmission system.
3. To know advances in automobile transmission systems.

COURSE CONTENTS:

Chapter	Name of the Topic	Hours	Marks
01	**Vehicle layout and Chassis frame:** 1.1 Vehicle layout & its types—2 Wheel Drive- Front Engine Front Wheel Drive, Rear Engine Rear Wheel Drive, Front Engine Rear Wheel Drive & 4 Wheel Drive. 1.2 Chassis components-location & functions 1.3 Various loads acting on chassis frame. 1.4 Type of frames, frames construction, and material-	**08**	**12**

02	**Clutches** 2.1 Principle and necessity of Clutch. 2.2 Various types of clutches used in Automobiles – single plate, multiplate clutches - dry & wet clutches, centrifugal clutch, Semi-centrifugal clutch, diaphragm clutch. 2.3 Materials used for clutch lining. 2.4 Fluid coupling- principle, construction and working.	**08**	**12**
03	**Gear Boxes** 3.1 Principle and necessity of Gear Box. 3.2 various types of gear boxes used in automobiles such as sliding mesh, constant mesh, synchromesh type, vario - drive, transfer case. 3.3 Gear shift mechanism. 3.4 Overdrive 3.5 Torque Converter- principle, construction and working	**10**	**16**
04	**Propeller shafts, universal joints & slip joints** 4.1 Necessity and function of Propeller Shaft. 4.2 Constant velocity Joints- Inboard & outboard Joints- Rzeppa Joint, Tripod Joint. 4.3 Universal joint and slip joint. 4.4 Hotchkiss drive and torque tube drive.	**06**	**12**
05	**Final drive** 5.1 Principle, Necessity and function of final drive and differential. 5.2 Working of differential ,non slip differential & differential lock 5.3 Types of rear axles such as semi - floating, three quarter Floating and full floating type.	**06**	**12**
06	**Wheels and Tyres** 6.1 Types of wheels, rims and tyres. 6.2 Tyre materials, construction. 6.3 Tyre inflation and its effect. Tyre nomenclature, wheel specification 6.4.Tyre rotation	**06**	**10**
07	**Advances in automobile transmission components** 7.1 Concept of automatic transmission 7.2 Speed variator 7.3 Tubeless tyre,radial ply tire	**04**	**06**
	Total	**48**	**80**

TERM WORK: It shall consist of journal, based on the following experiments

Experiments:

1. Observer & Draw various vehicle layouts for- two wheelers, three wheeler and four wheelers.
2 Open a multi-plate clutch used in two wheelers, observe the operating Linkages and sketch the system.
3 To study the synchromesh gear box by assembling & dissembling
4 Open & observe universal joints such as Hooks universal joint.
5 Open the differential, sketch the unit with bearing locations.
6 Demonstration of any one type of rear axle
7 Open any two types of tyres, wheels and rims, observe and sketch.
8 Collect the information on following topics from Internet/Magazine/company manuals/etc
A) Study transmission system of cars/2W/4W models launched in last three years
b) Automatic transmission system
9 Visit to four-wheeler, two-wheeler garage/service station. Observe & study the transmission systems. Prepare a report

Reference Books:

Sr. No.	Title& Edition	Author	Publisher
01	Automobile Engineering Vol.I	Kirpal Singh	Standard Publication
02	Automobile Engineering	R.B. Gupta	Satya Prakashan New Delhi
03	Automobile Mechanics	Crouse / Anglin.	TATA McGraw – HILL
04	Automobile Engineering Vol. II	Anil Chikkara	Satya Prakashan New Delhi
05	The Automobile	Harbans Singth Royat	S. Chand Publication
06	Motor automotive technology	Anthony Schwaller	Delmar Publisher Inc.
07	Automotive service	Tim Gills	Delmar Publisher Inc.
08	Automotive Mechanics	S. Srinivisan	TATA McGraw – HILL
09	Automotive Technology	H M SETHI	TATA McGraw– HILL

5A203- AUTOMOBILE MANUFACTURING PROCESSES (AMP)

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	03		PT	TEE	TW	PR	OR	Total
PR	03	Max.Marks	20	80	50	50	----	200
TOTAL	06	Duration	01	03	--	--	--	04

RATIONALE:

Automobile Manufacturing Processes is a core technological subject in Automobile Engineering Course. With advent of technology there are many advances in manufacturing processes and equipments. The knowledge of these advances is essential for a technician engaged in engineering organizations. He should also be proficient in writing CNC programmes and use it in manufacturing industry. This subject is intended to develop these abilities

COMPETENCY STATEMENT(S):

"To understand and apply the Automobile manufacturing processes in practice."

OBJECTIVES:

The student will be able to:

- Know the forging process and it's use in manufacturing automobile parts.
- Know the different press tools and their operations.
- Understand different welding process used in industry.
- Selection and applications of different surface cleaning and coating process.
- Know the different methods of surface finishing.
- Know about CNC machines and to write CNC programming.

Topic no.	Name of the Topic	Hours	Marks
1	**Forging** 1.1 Forgeable materials and forgeability. 1.2 Advantages and limitations of forging process. 1.3 Classification of forging processes. 1.4 Forging by open and close dies. 1.5 Forging sequences for connecting rods, crankshafts, Camshafts, spanners and gears.	**06**	**10**

2	**Press and press work** 2.1 Materials used in press work. 2.2 Classification of presses. 2.3 Major parts of mechanical press and their functions . 2.4 Drive mechanisms used on presses. 2.5 Parts of standard die set. 2.6 Operations which can be performed on presses like Punching, piercing, blanking, forming, drawing. Press components used in automobiles.	**06**	**11**
3	**Welding processes** 3.1 Classification of welding process. 3.2 Working principle of Gas welding and types of flames. 3.3 Arc welding process like metal arc, TIG. MIG. 3.4 Resistance welding (spot, projection, seam, butt) 3.5 Aluminum and Cast iron welding. 3.6 Brazing and soldering. 3.7 Introduction to Plasma arc welding. Specific applications pertaining to auto industry.	**08**	**12**
4	**Processes For Plastics** 4.1 Broad classification of plastics, common properties of plastics, thermosetting, thermo plastics. 4.2 Plastics processing methods – Compression moulding, transfer moulding, injection moulding, extrusion, calendaring. Blow moulding 4.3 Advantages and disadvantages of plastics, joining of plastics.	**04**	**06**
5	**Metal Turning** 5.1 Introduction to center lathe, simple turning process, taper turning, screw cutting, 5.2 Center lathe accessories, attachments, specification of lathe, 5.3 Capstan and turret lathes, automats, tooling set-ups,different attachments and accessories, tool layout.	**06**	**10**
06	**Mechanics Of Metal Cutting** 6.1 Tool geometry and tool signature, single point cutting tools 6.2 Chip formation, continuous chip, dis-continuouschip,Built-up edge, 6.3 Chip breaker, cutting tool materials, cutting fluids, 6.4 Single point, multi-edge cutting tools, twist drills.	**06**	**11**

7	**Surface Treatment and finishing processes** 7.1 Selection and use of surface treatment and finishing process. 7.2 Surface cleaning processes: blasting, tumbling, alkaline, acid and electrolytic cleaning. 7.3 Surface coating processes : electroplating, galvanizing, Metal Spraying, painting. 7.4 Surface finishing processes : Lapping, honing, Super finishing, buffing, burnishing. (Applications from auto industry to be given).	**06**	**10**
8	**Introduction to CNC machines** 8.1 NC and CNC machines. 8.2 Classifications of CNC machines. 8.3 Advantages and disadvantages of CNC machines. 8.4 Working principle of CNC machines. 8.5 Principle of Computer aided part programming. 8.6 Part programming – Do loop, Subroutine, Canned Cycle.Simple programme for turning,chamfering	**06**	**10**
	Total	**48**	**80**

EXPERIMENTS:

1. One composite job involving milling machine operations such as key way cutting, gear cutting by indexing, etc. for the batch of 4 to 6 students.

2. Assignment on any one of the following types of press working dies.
a. Progressive die
b. compound die
c. Combination die.
Draw the sketches of the die components.
3. One resistance welding job to show the working principle of resistance welding

4. One simple part programming job on CNC machine.

5. At least one industrial visit be arranged to show the different Milling machines, grinding machines, CNC machines, forging operations, Surface treatment and surface finishing processes.

6. Visit to press shop to observe various operations, and report on the industrial visit as a part of term work.

REFERENCES:

Sr No	Title of Book	Author and Publication
1	Elements of Workshop Technology. Vol. -I and II	S. K. Hajra Choudhury. A. K. Hajra Choudhury. Media Promoters and Publishers Pvt. Ltd. Mumbai.
2	Workshop Technology Vol. -I and II.	. H. S. Bawa Tata McGraw-Hill Publishing Co. Ltd. New Delhi.
3	Workshop Technology Part-I, II and III	Dr. W. A. J. Chapman ELBS and Edward Arnold (Publishers) Ltd., London.
4	Manufacturing Processes	B. H. Amstead, Phillip Ostwald, Myronl Begeman. John Wiley and Sons
5	CNC machines programming and applications.	Aditan, Pabla, Willey Estarn Ltd.
6	H.M.T. Production Technology	H.M.T

5Q201-APPLIED MECHANICS

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks	20	80	50	--	--	150
TOTAL	06	Duration	1.00	3.00	--	--	--	--

RATIONALE: -

Civil engineering technician should be able to analyse behavior of components of structure under various types of loads, which will enable him to design the same. This course provides basic knowledge of principles, laws and theory for analysis.

COMPETENCY STATEMENTS:

The student shall be able to :

1. Verify the laws, theorems of mechanics.
2. To check for equilibrium for a force system.
3. Apply principles, laws and theorems to analyze components under static and dynamic loads.
4. Understand use & application 0f simple lifting machines.

COURSE CONTENTS:-

Sr. No.	Name of the Chapter / topic / Content (Follow S.I. units)	Hours	Marks
1.	**Fundamental Concepts** 1.1 Definitions of Mechanics**,** Applied Mechanics, statics, dynamics, kinematics, kinetics, space, time, mass, particle, rigid body.Scalar & vector quantities with examples, Newtons laws. 1.2 Concept of force, definition, S.I.unit, representation of force as a vector, Bow's notation. Types of force(pull/tensile, push/ compressive)Law of transmissibility of force.	**04**	**02**
2.	**Resolution of a force** 2.1 Concept of system of forces: Coplanar, Non coplanar, collinear, concurrent, non-concurrent, parallel(like & unlike), general. 2.2 Resolution of a force, Resolution of a force into two components at any angle & at right angle ie. Orthogonal components.	**04**	**06**
3.	**Composition of forces** 3.1 Definition of composition of force, definition of resultant, Law of parallelogram of forces & Law of polygon of forces (No problems on Law of polygon of forces) 3.2 Resultant of collinear & concurrent force system	**10**	**14**

	3.3 Concept of Moment of a force, magnitude, lever arm, types & sign convention, unit. Law of moment, Principal of moment/Verignon's theorem. Couple, characteristics of couple with example. 3.4 Resultant of parallel force system & non concurrent non parallel force system.		
4.	**Equilibrium** 4.1 Definition of equilibrium and equilibrant, properties of Equilibrant, relation between resultant & equilibrant. 4.2 Conditions of equilibrium for collinear, concurrent, parallel & non concurrent non parallel force system. 4.3 Concept of free boby , free body diagrams, Lami's Theorem & its applications such as cables. Problems with two unknowns only.	**06**	**10**
5.	**Beam reactions** 5.1 Definition of beam, types of beam: cantilevers, simply supported, over hanging, continuous, fixed beams, , types of supports: simple, fixed, hinged & roller, types of loads, point load, uniformly distributed load, uniformly varying load. 5.2 Support reaction of beams. Problems for reactions of simply supported, over hanging beams under different loading such as vertical and inclined concentrated loads, uniformly distributed load and combination of both. 5.3 Problems for reactions of simply supported beams with hinged & roller support under concentrated loads (vertical & inclined), uniformly distributed load and combination of both.	**06**	**08**
6.	**Friction** 6.1 Concept of friction, Definition of friction. Types of friction (static, dynamic, rolling, sliding), laws of friction, Defination of co-efficient of friction, angle of friction, angle of repose & relation between these. Advantages & disadvantages of friction. 6.2 Equilibrium of bodies on level plane, force (pull & push) applied horizontally & inclined. 6.3 Equilibrium of bodies on inclined plane, force applied Parallel to plane only. 6.4 Ladder friction. (with one surface smooth)	**10**	**12**
7.	**Centroid and center of gravity** 7.1 Definition of centroid, Centroid of triangle, square, rectangle, circle, semicircle, quarter circle. 7.2 Determination of centroid of Composite areas consisting of not more than above three standard areas. 7.3 Definition of Center of gravity, C.G. of simple regular solids, cube, cylinder, cone, sphere, hemisphere. 7.4 Determination of C.G. of solid objects made up of any two these regular solids.	**10**	**12**

8.	**Moment of Inertia** 8.1 Definition of M.I., radius of gyrations, parallel axis theorem & perpendicular axes theorem, Methods to calculate MI. 8.2 Formulas for M.I. of square, rectangle, triangle, circle, semicircle, quarter circle & hallow square, rectangle, circular, laminas.(Derivation shall not be asked in the examination) 8.3 Determination of MI of sections such as I, channel, T, and angle section about centroidal & other axes & composite sections such as I section with plates & sections with combinations of not more than three standard figures.	**10**	**12**
9.	**Simple Lifting Machines** 9.1 Definition of simple machine, load, effort, mechanical advantages, velocity ratio, input of a machine, output of a machine, efficiency, relation between MA, VR & efficiency. Ideal machine, ideal effort, ideal load, friction in machine, effort lost in friction, load lost in friction. 9.2 Law of machine, maximum mechanical advantages, maximum efficiency of machine, reversibility of machine, condition for reversibility of machine (no derivation), self locking machine (No numerical problems)	**04**	**04**
	TOTAL	**64**	**80**

TERM WORK: -

It shall consist of manual/journal, based on the following experiments, to develop the ability of students to integrate the knowledge and skills by application to the field problems.

Experiments: - Manual/Journal shall consist of following experiments :

1) To verify the law of polygon of forces.
2) To verify the law of moments.
3) To verify Lami's theorem.
4) To find beam reaction using beam reaction apparatus.
5) To verify the laws of friction with two different materials.
6) Determination of coefficient of friction & angle of repose for any two different surfaces.
7) Two assignments on graphical determination of R for parallel force system.(One for R & one for equilibrant)
8) Two assignments on graphical determination of R for non concurrent non parallel force system with verification of analytical calculations.
9) Simple machines: Comparison between various types of machines, to find M.A., V.R., efficiency , law of machine from graph, study nature of graph for P_i & P_f for any three following machines:
    a. Worm & worm wheel./ Differential axle and wheel
    b. Single / double purchase crab.
    c. Simple screw jack.
    d. Two sheave / three sheave pulley block.
    e. Worm geared pulley block/Differential pulley block

TEXT BOOKS:

Sr no.	Title	Author	Publisher
01	Fundamental of Applied Mechanics	Dhade, Jamdar & Walawalkar	Pune Vidhyarthi Gruh, Pune.
02	Applied Mechanics	R. S. Khurmi	Dhanpat Rai & Sones, Delhi.
03	Applied Mechanics	S. Ramamruthum	Dhanpat Rai & Sones, Delhi.
04	Engineering Mechanics	K. L. Kumar	Tata McGraw HillCo., Delhi.
05	Applied Mechanics	I.B. Prasad	Khanna Publications, Delhi.

REFERENCE BOOKS:

Sr no.	Title	Author	Publisher
01	Engineering Mechanics	Beer & Johnston	Tata McGraw Hill Co., Delhi.
02	Engineering Mechanics	Timoshenko & Young	Tata McGraw Hill Co., Delhi.
03	Engineering Mechanics	F. L. Singer	Harper International Edition.

5A205- HEAT ENGINEERING

COURSE STRUCTURE:

Teaching Scheme		**Evaluation scheme**						
TH	03		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks	20	80	25	--	25	150
TOTAL	05	Duration	1.00	3.00	--	--	--	--

RATIONALE:

Heat Power Engineering is a core engineering subject. Heat energy is the basis for most of the power producing and power absorbing devices. In order to understand the principles and working of these devices it is essential to understand the basic laws, concepts of thermodynamics ,gas laws, properties of steam, generation of steam with modern boilers, steam condensers and turbines. As modern diesel engine vehicles are turbocharged, students should also understand the working principles and constructions of air compressors, gas turbines and jet engines. Due to energy crunch of petroleum products worldwide hunt for alternative energy sources is being done for the last three decades. Hence students should also have comparative brief idea about various conventional energy sources, calorific values, carbon value and evaporative power of fuels, alternative energy sources. Heat transfer forms basis of different components like condensers, radiators, cooling fins, etc. Hence student should have capability to calculate the necessary parameters.

Objectives: Students will be able to:

1. learn to correlate the theoretical knowledge with practical aspects of systems of work producing and work absorbing devices like boilers, condensers, steam turbines, air compressors, gas turbines, etc.
2. understand the various sources of energy and ways to harness it.
3. understand the chemistry of combustion of fuels, estimation of calorific value, mass of air required for complete combustion of fuels.
4. understand the basic concepts of heat transfer and it's application in various appliances.
5. identify/observe/locate/ operate various parts of instruments / equipments carefully and follow test procedures.
6. observe the behavior of devices with the change in parameters and make changes if necessary.

COURSE CONTENTS:

Topic no.	Content	Hours	Marks
01	**Fundamental concepts of thermodynamics and various thermodynamic processes:** 1.1 Basic concepts of - i) system ii) surrounding iii) Universe iv) open system v) closed system vi) Isolated system vii) steady flow energy equation viii) internal energy ix) enthalpy x) entropy. 1.2 Zeroth, first and second law of thermodynamics, General gas equation, Characteristics of gas constant, Mol of gas, Universal gas constant, specific heats of ideal gases. 1.3 Thermodynamic processes of ideal gases. Isobaric, Isochoric, Isothermal, Adiabatic and polytropic with representation on P-V and T-S diagram, work done, change in internal energy, change in enthalpy and relation between P,V & T (Derivations only for adiabatic process) 1.4 Air cycles: - P-V and T-S diagram and equations for air standard efficiency of Otto, Diesel & Dual combustion cycle.	**10**	**16**
02	**Properties of steam and steam power:** 2.1 Formation of steam, various phases like wet steam, dry saturated Steam, superheated steam. 2.2 Dryness fraction, degree of superheat, sensible heat, Latent heat, calculation of enthalpy of wet, dry saturated & superheated steam using steam table. 2.3 Study of boilers like three pass packaged type boiler, Water Tube & Fire Tube Boiler.Boiler terms. 2.4 Steam condenser: Principle, Function, locations in steam power plant. Surface condenser & its Applications. 2.5 Steam Turbines: Classification of turbines, construction and working of Impulse and Reaction turbine.	**10**	**16**
03	**Air Compressors:** 3.1 Various uses of compressed air and classification of compressors. 3.2 Air compressor terminology like i) Free air delivered ii) Capacity of compressor iii) Piston displacement iv) I.P., B.P. v) Volumetric efficiency vi) Isothermal efficiency vii) Overall Isothermal or Compressor efficiency 3.3 Construction and working of single stage and two stage reciprocating air Compressors with P.V diagram. Necessity of multistaging and intercooling. 3.4 Construction & working of rotary compressors i) Centrifugal compressor ii) Axial flow compressor iii) Screw compressor	**08**	**12**

04	**Gas Turbines:** 4.1 Brayton cycle- P. V. diagram and thermal efficiency 4.2 Classification of gas turbines. 4.3 Construction and working of gas turbines i) open cycle ii)closed cycle gas turbines, P.V. & T.S diagrams. 4.4 Turbojet & turboprop engine.	**04**	**08**
05	**Sources of Energy & Power plants:** 5.1 Classification of various conventional and non-conventional sources of energy. 5.2 Construction and working of power plants based on conventional energy sources : i) Thermal power plant ii) Diesel power plant iii) Gas turbine power plant. 5.3 Parameters of site selection	**06**	**10**
06	**Heat transfer:** 6.1 Modes of heat transfer--conduction, convection and radiation. 6.2 Conduction - Fourier's law , thermal conductivity, conduction through cylinders, thermal resistance, composite walls, combined conduction and convection. 6.3 Thermal radiation, absorptivity, transmissivity, reflectivity, emissivity, black and gray bodies, Stefan-Boltzman law, Heat transfer by radiation. 6.4 Heat transfer in condenser and radiator.	**06**	**10**
07	**Fuels and Combustion :** 7.1 Types of fuels – definition, classification, calorific value of fuels. 7.2 Ultimate analysis and proximate analysis of solid fuels. 7.3 Liquid fuels- Comparative information about composition, specific gravity and gross calorific values of liquid fuel. 7.4 Gaseous fuels- natural gas, LPG, CNG, and other artificially prepared gaseous fuels	**04**	**08**
	Total	**48**	**80**

Practical:

Skills to be developed:

Intellectual Skills:

a. Observe & calculate thermal efficiency at constant pressure heating.
b. To understand working of steam turbine.
c. To refer relevant act & list its salient features.
d. To calculate efficiency of solar water heating system.

Motor Skills :

a. To observe & draw boiler mountings.
b. To start reciprocating air compressor & to take measurements.
c. To follow given procedure to conduct trial on reciprocating air compressor.

List of Practical:

1) Determine thermal efficiency of constant pressure heating.

(Heating in open container and in pressure cooker)

2) Study of boiler mounting- a) safety valve and b) Bourdon's pressure gauge. Boiler accessories-a) economizer b) super-heater (construction and working should be studied with the help of models.)
   (for study of safety valves, practical experiments like replacing dead weight safety valve on ordinary pressure cooker with lever safety valve can be carried out.)
3) Study and provisions of Indian boiler act with reference to duties of boiler inspector, registration process, transfer of boilers etc.
4) To conduct trial on reciprocating air compressor.
5) Dismantling and assembling of one reciprocating,screw or rotary compressor.
6) Study of gas turbines used in turbocharger.
7) Study of functioning of domestic solar water heater and Biodiesel plant.
8) Determination of calorific value of solid or liquid fuel using Bomb calorimeter.

Learning Resources:
Books:

Sr. No.	Author	Name of Book	Publication
01	R. S. Khurmi & J. K. Gupta	A Text book of Thermal Engineering	S. Chand & Co. Ltd.
02	Patel and Karamchandani	Elements of Heat Engines (Vol. I, II & III)	Acharya Book Depot.
03	A. S. Rao	Thermal Engineering	Satya Prakashan
04	B. K. Sarkar	Thermal engineering	Tata McGraw Hill
05	Jones & Dugan	Engineering Thermodynamics	Prentice Hall of India
06	Yunus Cegel & Mike Boles	Thermodynamics	Tata McGraw Hill
07	Jesse S.Doolittle & Francis J Hale	Thermodynamics for Engineers.	John Willey & Sons
08	S. Domkundwar, Dr C.P. Kothandaraman & A.V. Domkundwar	A course in Thermal Engineering	Dhanpat Rai & Co.(P) Ltd, New Delhi

5R206-DEVELOPMENT OF LIFE SKILLS

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	--		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks	--	--	25	--	25	50
TOTAL	02	Duration	--	--	--	--	--	--

RATIONALE:

Over a period of time, it has been observed that effectiveness and utility of diploma engineers at work place can be enhanced by imparting generic skills right from entry to the diploma education. The generic skills are lifelong skills which should be improved continuously during the period of education. The generic or life skills are necessary for diploma engineers for their professional career in future. These skills can be inculcated in diploma engineers by a combination of necessary theoretical inputs supplemented by practical assignments and practical exercises.The required theoretical content is divided into four logical units

(I) Information search
(II) Communication skills
(III) Self development
(IV) Task – Management

In the present course, main intention is to enhance the life skills via varied types of practical assignments and practical exercises. Basic approach is to give necessary theoretical inputs in short followed by the practice.

Course is designed by keeping self in focus with a clear objective of developing Generic Skills, to enhance the capabilities in the fields of searching, assimilating and using information on job. Developing self and managing given tasks, finally to present himself as a technocrat.

It is an effort to develop student to be successful in finding a practical and reaction solution to any problem he comes across. It covers more or less all aspects of life skills. The development of subject is progressively ascending parallel to development of study in polytechnic.

COURSE CONTENTS:

It is expected that the teacher should give theoretical inputs to students about following contents in 8-9 lectures. He should emphasize the importance of each content in practical assignments and practical exercises to be carried out in practical work. Overview of below contents is expected to be delivered to the students. Importance of these aspects is to be emphasized for practical assignments.

Sr. No.	Content to be covered	Hours
1	**Information Search** Information source –Primary, secondary, tertiary Print and non - print , documentary, Electronic Information center, Library , exhibition, Government Departments. Internet Information search – Process of searching, collection of data -questionnaire , taking Interview , observation method.	02
2	**Communication Skills & Presentation Skills** Techniques of communication skills, Body language **,**Dress like the audience **,**Posture, Gestures, Eye contact and facial expression. Presentation Skill –Stage fright,Voice and language – Volume, Pitch, Inflection, Speed, Pause Pronunciation, Articulation, Language,Practice of speech. Group discussion and Interview technique,Use of aids –OHP, LCD projector, white board	02
3	**Self Analysis & Self Development** Understanding self— Attitude, aptitude, assertiveness, self esteem, Confidence buildings. Concept of motivation. Stress Management, Health Management, Time management, Emotion-Concept, types, controlling, emotional intelligence. Creativity-Concept, factors enhancing creativity,	03
4	**Task Management** Introduction, Task identification,Task planning ,organizing and execution, Closing the task, Problem Solving, Working in Teams, Leadership in teams, Handling frustrations in group.SWOT analysis	02

LIST OF ASSIGNMENTS:

The Term Work Will Consist Of Following Assignments. (Minimum 08 assignments)

1) **Information search:-** Visit your Institute's Library and enlist the books available on the topic given by your teacher. Systematically gather the information on the topic given by teacher along with refrences. Use of Internet also to be done in getting the information(Here group of five to six students should be given various technical topics for the information search.Students should be asked to collect Various Technical papers on related topics also)

2) **Topic Presentation:**- One recent topic related to technical advancement should be given to a group of five to six students. Group should search the necessary information from various sources and prepare a systemtic power point presentation. All such presentations should be delivered in front of class by groups. Presentations are to be evaluated by teacher.

3) **Individual Speech:** Topic will be given to the individual for a speech of 5 to 8 minutes.Here the individual speeches of students will be conducted and evaluated by group of students.

4) **Group Discussion:** Teacher should form group of six to eight students and give topics for group discussion. Group discussions should be carried out and evaluated by teacher

5) Visit to any one place like historical/office/farms/development sites etc and gather information through observation, print resources and interviewing the people and make a systematic record of same.

6) Prepare your individual time table for a week -

a) List down your daily activities.
b) Decide priorities to be given according to the urgency and importance of the activities.
c) Find out your time wasters and mention the corrective measures.

7) Find out the causes of your stress that leads tension or frustration .Provide the ways to avoid them or to reduce them. Systematically record the same.

8) SWOT analysis:- Analyse yourself with respect to your strength and weaknesses, opportunities and threats. Following points will be useful for doing SWOT.

a) Your past experiences,
b) Achievements,
c) Failures,
d) Feedback from others etc.

9) Undergo a test on reading skill/memory skill administered by your teacher.

10) Form a group of 5-10 students and do a work for social cause e.g. tree plantation, blood donation, environment protection, camps on awareness like importance of cleanliness in slump area, social activities
(One activity per group)

11) Conduct an interview of a personality and write a report on it.

12) Collect the technical information, Leaflets, Broachures on various products given by teacher.(Here products like MotorCycle, Cars, Trucks, Pumps,Cutting Tools, Computers etc to be given)

13) Arrange an exhibition, displaying flow-charts, posters, paper cutting, photographs etc on the topic given by your teacher

14) Collect information about various vehicle loan schemes,House loan schemes, Industry loan schemes from nationalized banks and make a record of it.

15) Prepare a typical loan repayment chart for a loan under following cases 1. Fixed rate of interest and 2. Reducing balance

16) Obtain information about BIS standard for a particular product.

NOTE:- THESE ARE THE **SUGGESTED ASSIGNMENT** FOR GUIDE LINES TO THE SUBJECT TEACHER. HOWEVER THE SUBJECT TEACHERS CAN SELECT ,DESIGN ANY ASSIGNMENT RELEVANT TO THE TOPIC, KEEPING IN MIND THE OBJECTIVES OF THIS SUBJECT.

Learning Resources:

Books:

Sr. No	Author	Title of the book	Publisher
1	Marshall Cooks	Adams Time management	Viva Books
2	E.H. Mc Grath , S.J.	Basic Managerial Skills for All	Pretice Hall of India, Pvt Ltd
3	Allen Pease	Body Language	Sudha Publications Pvt. Ltd.
4	Lowe and Phil	Creativity and problem solving	Kogan Page (I) P Ltd
5	Adair, J	Decision making & Problem Solving	Orient Longman
6	Bishop , Sue	Develop Your Assertiveness	Kogan Page India
7	Marion E Haynes	Make Every Minute Count	Kogan page India
8	Pearson Education Asia	Organizational Behavior	Tata McGraw Hill

5R207-PROFESSIONAL PRACTICES

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	--		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks			25	--		25
TOTAL	02	Duration			--	--	--	--

RATIONALE:

Most of the diploma holders join industries. Due to globalization and competition in the industrial and service sectors the selection for the job is based on campus interviews or competitive tests.

While selecting candidates a normal practice adopted is to see general confidence, ability to communicate and their attitude, in addition to basic technological concepts.

The purpose of introducing professional practices is to provide opportunity to students to undergo activities which will enable them to develop confidence. Industrial visits, expert lectures, seminars on technical topics and group discussion are planned in a semester so that there will be increased participation of students in learning process.

COMPETENCY STATEMENTS

Student will be able to:

1. Acquire information from different sources
2. Prepare notes for given topic
3. Present given topic in a seminar
4. Interact with peers to share thoughts
5. Prepare a report on industrial visit, expert lecture

SR No.	Activities	Practical Hours
1	**Industrial Visits** Structured industrial visits be arranged and report of the same shall be submitted by the individual student, to form a part of the term work. The industrial visits may be arranged in the following areas / industries : Sugar Factory / Dairy / Chemical Industry / Thermal Power Plant ./ Automobile Industry i) Machine shop having CNC machines. ii) ST workshop / Auto service station iii) City water supply pumping station iv) Manufacturing unit to observe finishing and super finishing processes.	**06**
2	**Lectures by Professional / Industrial Expert lectures to be organized from any two of the following areas:** Interview Techniques. Modern Boilers – Provisions in IBR Applications of Sensors and Transducers Alternate fuels – CNG / LPG , Biodiesel, Ethanol, hydrogen Piping technology	**03**
3	**Information Search :** **Information search can be done through manufacturer's catalogue, websites, magazines, books etc. and submit a report any one topic.** **Following topics are suggested :** i) Engine lubricants & additives ii) Automotive gaskets and sealants iii) Engine coolants and additives iv) Two and Four wheeler carburetor. v) Power steering vi) Filters vii) Different drives/Transmission systems in two wheelers. viii) Types of bearings – applications and suppliers. ix) Heat Exchangers x) Maintenance procedure for solar equipment. Tools holder on general purpose machines and drilling machines.	**05**
4	**Seminar :** Seminar topic shall be related to the subjects of fourth semester. Each student shall submit a report of at least 10 pages and deliver a seminar (Presentation time – 10 minutes)	**04**
5	**Case Study** A group of four students will prepare a write up on two case studies one each of an industry and an entrepreneur, analyse the case studies and draw inference.	**04**

6	**Event management-** Conduct an event like blood donation camp, poster/ paper presentation competition, industrial survey, RTO camp, other social activities, arranging expert lectures, conduct of interviews etc.	**05**
7	**Group Discussion : (Two topics)** **The students shall discuss in group of six to eight students and write a brief report on the same as a part of term work. The topic for group discussions may be selected by the faculty members. Some of the suggested topics are** i) Solar Vehicles / Electric Vehicles. ii) Auto Vehicles – Comparison. iii) Two stroke versus four stroke engines iv) Recycling of plastics and other waste material v) Attributes of product design vi) Creativity and innovativeness vii) Energy conservation in institutes viii) Value engineering ix) Revolution in communication technology x) Pneumatic tools and equipments xi) Wear mechanisms	**05**
	TOTAL	**32**

5R208- MECHANICAL TECHNOLOGY (MT)

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	02		PT	TEE	TW	PR	OR	Total
PR	03	Max.Marks	20	80	25	--	25	150
TOTAL	05	Duration	01	03	--	--	--	04

RATIONALE:

Diploma engineers are always involved in the application of engineering processes in the manufacturing areas. In view this it is essential that the diploma engineers should be well exposed to the fundamental processes called non chip forming processes like welding, cold working and hot working, press work, pattern making, foundry processes. Diploma engineer of any branch should be able to visualize these processes in the field.

COMPETENCY STATEMENTS:

3. To understand various non chip forming processes.
4. To understand the application of the above processes.

COURSE CONTENTS:

Topic No.	Content	Hours	Marks
1	**Hot and Cold working processes** 1.1Methods of Hot working, Pipe & tube production, forging, extrusion, piercing, hot spinning, 1.2Methods of cold working , cold rolling, shearing & blanking, wire drawing, spinning, embossing, stretch forging, squeezing, high pressure sheet metal forming.	**05**	**15**
2	**Press and Press work** 2.1 Introduction, types of presses, 2.2 Power press parts, power press driving mechanism, press size, press tools, 2.3 Methods of punch support, methods of die support, die accessories, types of dies and operations, press guard, 2.4 Types of press tools, press brake, press operations	**06**	**15**
3	**Welding** 3.1 classification of welding, 3.2 Study of welding methods – Arc welding, Gas welding, Resistance welding, Spot welding, butt welding, flash welding, seam welding, projection welding, thermit welding, inert gas arc welding, TIG welding, MIG welding, 3.3 Selection of welding methods for different materials	**06**	**15**

	such as cast steel, cast iron, carbon steel, stainless steel. Inspections,defects &remedies		
4	**Pattern Making** 4.1 Definition, Design consideration in pattern, pattern layout, pattern construction, 4.2 Pattern materials, selection of materials; Allowances, master pattern, function, types, core prints unserviceable parts as pattern; core boxes 4.3 Color code and preservation of pattern. Shrinkage / contraction Rule.	**05**	**12**
5	**Moulding** 5.1 Hand tools, and their uses, 5.2 Moulding machines and their types, 5.3 Moulding sand, characteristics, constituents of moulding sand, sand preparation & conditioning, sand testing equipments, core moulding, and solidification of metals. 5.4 Gravity die casting, slush casting, moulding procedure, gating risering, use of pads, exothermic material, use of chills, CO2 moulding, and chaplets.	**05**	**12**
6	**Foundry Engineering** 6.1 Introduction, furnaces used in foundry like coke fired, gas fired, cupola, 6.2 preparation of cupola, charging of cupola, jamming of cupola, Zone & reactions 6.3 defects in casting, causes & remedies, inspection of casting, hot metal handling equipments 6.4 special casting methods, permanent mould, hot chamber die casting m/c, cold chamber die casting m/c, centrifugal casting, true centrifugal, semi centrifugal, and centrifuging, investment casting, continuous casting.	**05**	**11**
		32	**80**

TERM WORK:

Every student is required to submit the term work as mentioned below-

1. Welding
   - 1.1 Fabrication job involving the operations of welded joints.
   - 1.2 Job involving spot welding.
2. Pattern Making
   Pattern with core prints and core box.
3. One job involving plain and step turning
4. Visits to industry involving operations like press work, hot & cold working, foundry and forging.
5. Journal based on shop tools, specifications, method of use & their maintenance, report of the industrial visits etc.

TEXT BOOK:

Sr.No	Title and Edition	Author	Publisher
1	Workshop technology Vol. 1	B.S. Raghuwanshi.	Dhanpat rai and sons
2	Workshop technology Vol. 1	S.K. Hajra Choudhary	publishing house
3	Production technology	R.K. Jain,	Khanna publishers

5G301-ENGLISH

Course Structure:

Teaching Scheme		Evaluation Scheme						
TH	02		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks	20	80	25	--		125
TOTAL	04	Duration	1	3	--	--	--	--

RATIONALE:

English is the only language used all over the world. It is necessary to gain command over English languge .English is also developed as a language of International, Trade& Commerce, Library, Link language.

To help students to:

•Become competent in English Grammar and its usage.

•Write and speak English confidently correctly.

•Gain command over English language.

•Learn the modern methods of English such as sending, receiving emails to be competent with International trends.

•To use proper pronunciations

COMPETENCY STATEMENTS:

• To develop Theoretical concepts and practical implementations of English language.

• To develop writing skills.

SR.No.	Name of Topic	Hours	Marks
1	**TEXT FROM BOOK** 1.1 Comprehension – Responding to the questions from text (Spectrum) 1.2 Vocabulary - Understanding meaning of new words from text 1.3 Identifying parts of speech from the text.	**16**	**30**
2	**Situational Grammar** 2.1 Tenses and Time 2.2 Yes/No, Wh-questions and Question Tags, Punctuation Marks 2.3 Reported Speech; Voice ;Degree 2.4 Articles ,Prepositions, Conjunction	**10**	**25**
3	**Craft of Writing** 3.1 Paragraph Writing-Definition, Types, Essentials. 3.2 E-mail 3.3 Resume	**04**	**15**
4	**Functional English** 4.1 Vocabulary building- (Synonyms Antonyms, Homophones) Sounds and syllable Sentence structures 4.2 Use of Contextual words in a given paragraph.	**02**	**10**

List of Assignments:

1) Building of Vocabulary

Words from the glossary given at the end of each chapter, to be used to make sentences.

2) Applied Grammar

Identify the various parts of speech and insert correct parts of speech in the sentences given by the teachers.

3) Punctuation

Punctuate 20 sentences given by the teachers.

4) Tenses

List 12 tenses and give two examples for each tense.

5) Dialogue Writing

Write at least two dialogues on different situations.
(Conversation between two friends, conversation between two politicians etc.)

6) Idioms and Phrases

Use of Idioms and Phrases in sentences. (20Examples)

7) Biography

Write a short biography on your favorite role model approximately. (250 – 300) Words with pictures

TEXT BOOKS:

S.No.	Name of Book	Author	Publication
1.	Spectrum-A Text Book on English	--	MSBTE

REFERENCE BOOKS:

S.No.	Name of Book	Author	Publication
1.	English grammar and Composition	R.C.JAIN	Macmillan

5G302- COMMUNICATION SKILLS

COURSE STRUCTURE:

Teaching scheme		Evaluation scheme						
TH	01		PT	TEE	TW	PR	OR	TOTAL
PR	02	MAX MARKS	--	--	50	--	25	75
TOTAL	03	DURATION	--	--				

RATIONALE:
Language skills pertaining to English have been already introduced previously. With a view to achieve some command over a language & to develop communication skills is the main objective of this subject.

COMPETANCEY STATEMENT:
The student will be able to:

1. To develop Listening, Speaking, Reading and Writing skills.
2. Ability to engage & interact effectively with others.
3. To enable an individual to express perfectly.
4. To use appropriate body language.
5. To obtain acceptance & provide assistance, direction & leadership.

COURSE CONTENTS:

Topic no	contents	HRS	MARKS
01	**Introduction to Communication** 1.1 Definition, Importance Communication cycle/process 1.2 The Elements of communication	**04**	
02	**Types of Communication** 2.1 Verbal-Nonverbal, Formal – Informal, Upward-Downward, Vertical-Horizontal-Diagonal Communication.	**02**	
03	**Principles of Effective Communication :** 3.1 Principles of effective communication 3.2Communication Barriers & how to overcome them	**04**	
04	**Non Verbal Communication** 4.1 Aspects of body language(gestures ,Postures etc.) 4.2 Pictorial Representation(tables,graphs, piechart etc.)	**02**	
05	**Formal Written Skills** 5.1 Office Drafting: Circular, notice & memo 5.2 Job Application 5.3 Business Correspondence: Inquiry , order letter & adjustment letter	**04**	
	TOTAL	**16**	

List of Experiments-

01 Communication Cycle (With the Help of Diagram) + any two communications Situations to be represented with the help of Communication Cycle. (Use Pictures)
02 Speech
03 conversation
04 Group discussion
05 Non-Verbal Communication:
Body Language: Five Illustrations of appropriate use of Body Language used on the part of student in formal and Informal setups. (Example- formal setup-classroom)

06 Seminar related on any topic.
07 Interview Techniques
08 Job Application & Effective Resume Writing

REFERENCE BOOKS:

S.No.	Name of Book	Author	Publication
1.	Text book of Communication skills	MSBTE	MSBTE
2.	Everyones guide to Effective Writing	Jayakaran	Apple
3	Developing Communication Skills	Krushnan Mohan,Meera Banarji	Macmillan
4	Professional Communication Skills	Pravi S R Bhatia	s. chand&co.

5R301- BASICS OF ELECTRICAL ENGINEERING AND ELECTRONICS

COURSE STRUCTURE:

Teaching scheme		Evaluation scheme						
TH	04		PT	TEE	TW	PR	OR	TOTAL
PR	02	MAX MARKS	20	80	50	--		150
TOTAL	06	DURATION	1	3				

RATIONALE:

The course aims to prepare the technicians to carry out the responsibilities related to electrical. A mechanical diploma holder employed in industry needs to operate and maintain industrial motors.

Today the industrial environment consists of systems with the combinations of , electrical and electronic controls. engineers always come across with these systems in operating sense. He is required to operate, maintain and run these systems. technicians should have fundamental knowledge of various electronic circuits, amplifiers, oscillators, digital fundamentals should be known to them. Considering the vital and inseparable place of this area this course is introduced.

COMPETENCY STATEMENT(S):

- To know various fundamentals of electrical engineering.
- To get familiar with electrical equipments
- To know various electrical machines
- To understand and operate various electronic circuits and devices.

OBJECTIVES

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

- Understand the working of various industrial motors
- Realize importance of electrical safety
- Describe construction, working and application of transformer.

COURSE CONTENTS:

Chapter	Name of Topic	Hrs	Marks
01	**Fundamentals** 1.1 Structure of atom ,concept of current , emf, pd 1.2 Resistance & its properties 1.3 Laws of resistances & resistivity 1.4 Factors affecting the resistance, Effect of temperature on resistance, RTC 1.5 Ohm's law 1.6 Series & parallel combination of resistances, Division of currents in parallel branches, simple numericals	**08**	**10**

	1.7 Kirchhoff's current and voltage law 1.8 Simple numerical based on ohm's law & Kirchoff's laws 1.9 Capacitance, permittivity, series & parallel connections of capacitors, simple numerical. 1.10 Ammeter, voltmeter, wattmeter, energy meter, power factor meter, Frequency meter, CT , PT and their uses.		
02	**Magnetism & Electromagnetism** 2.1 Concept of magnetic lines of forces, magnetic field. 2.2 Flux, flux density, magnetic field intensity, MMF, reluctance, permeability. 2.3 Magnetic hysteresis, hysteresis loop, hysteresis loss. 2.4 Eddy currents & Eddy current loss. 2.5 Methods to minimize hysteresis & Eddy current loss. 2.6 Electric and magnetic circuit similarities & dissimilarities 2.7 Faraday's laws of electromagnetic induction 2.8 Lenz's law 2.9 Fleming's right hand, Left hand rule, its application. 2.10 Self and mutual inductance, coefficient of coupling	**06**	**08**
03	**A.C. Circuits** 3.1 Generation of alternating voltage ,wave forms & phasor representation. 3.2 RMS & average values 3.3 Phase & phase difference 3.4 series R-L, R-C, R-L-C circuits, voltage, impedance, power triangle. 3.5 Parallel a.c. circuits. 3.6 Simple numerical based on above topic. 3.7 Advantages of three phase over single phase, Phase Sequence. 3.8 Star & Delta connections	**08**	**10**
04	**Electrical Machine Fundamentals** 4.1 Construction & classification of d.c. machines 4.2 Working principle of d.c. generator & motor 4.3 Characteristics of d.c. motor 4.4 Construction & classification of single phae transformer 4.5 Working principle, e.m.f. equation, transformation ratio. 4.6 O.C. & S.C test of transformer, efficiency and regulation 4.7 Simple numerical on transformer efficiency. 4.8 Construction & Classification of three phase induction motor 4.9 Speed & Slip 4.10 Construction , Working principle , uses of single phase induction motor 4.11 Applications of all above machines in industry.	**06**	**08**
05	**Electrical safety**	**04**	**04**

	5.1 Single line diagram of power system in industry 5.2 Safety precautions to avoid electric hazards. 5.3 Causes of electrical accidents, remedial action.		
	ELECTRONICS		
06	**Electronic Devices** 6.1Introduction to electronic devices, their symbols, principle of working and testing procedure – Diode, Zener diode, Power diode, Varactor diode, Bipolar Junction Transistor (BJT), Field Effect Transistor(FET) - JFET & MOSFET, Uni-junction 6.2 Transistor(UJT), power devices – DIAC,TRIAC, SCR, Photo devices-, LDR, Photo diode, Photo transistor, LED & LED display (7 segment), Liquid crystal display(LCD),	**07**	**08**
07	**Power supply** 7.1 Circuit diagram and operation- Half wave, full wave & bridge rectifier. 7.2 Filters – L, C, L-C, π filter 7.3 Concept of unregulated power supply, regulated power supply line & load regulation 7.4 Principle of operation 7.5 block diagram and application of shunt regulated power supply, series regulated power supply 7.6 3 pin IC regulated, IC 723 adjustable power supply.	**07**	**08**
08	**Transistor** 8.1 Transistor as a switch and amplifier 8.2 single stage transistor amplifier CB, CE and CC configuration and their applications, 8.3 Oscillator – Requirement of oscillator circuit, Barkhauson's criteria of oscillator, circuit diagram and its application 8.4 Phase shift oscillator, Hartley oscillator, Colpitts oscillator, Crystal oscillator.	**05**	**07**
09	**OP Amp** 9.1 Block diagram, configurations and use of op amp as - Inverting, Non-inverting, Summing 9.2 use of op amp as - Voltage to current converter, current to voltage converter, differentiator 9.3 use of op amp as - Comparator, Wien bridge oscillator, Schmitt's trigger, Instrument amplifier.	**05**	**06**
10	**IC 555** 10.1 Block diagram, Multi vibrator circuit diagram and working for Mono stable, Bi stable and Astable Multivibrator 10.2 Analog to Digital Converters , Digital to Analog converter 10.3 Block diagram and working of –Welding control circuits	**05**	**06**

	– sequential timer Temperature control circuits using SCR, FWR Speed control circuits Level control circuit using variable capacitor and potentiometer.		
11	**Sensors and conditioning circuits:** 11.1 Terminology, basic principles, principle and construction of different sensors 11.2 temperature sensors, pressure sensors, flow sensors, displacement sensors.	**03**	**05**
		64	**80**

LIST OF PRACTICALS:

ELECTRICAL (If required specify minimum number of practical to be conducted from the following)

1. To list the specifications of various electrical machines. (Workshop/ electrical laboratory, mechanical laboratory)
2. To draw single line diagram of electrical laboratory
3. To verify the Ohm;s law.
4. To study the effect of rise in temperature on resistance.
5. Starting and reversing of D.C shunt motor.
6. To determine the transformation ratio of single phase transformer.
7. To determine the regulation and efficiency of transformer by direct loading.
8. Starting and reversing 3- phase induction motor.
9. Safety precaution to be taken while performing maintenance of electrical system.
10. To verify the relations between V & I in a star & delta connection.

ELECTRONICS: (If required specify minimum number of practical to be conducted from the following)

11. To identify the electronic components of devices such as diodes, transistors, SCR, Diac, Triac.
12. To plot V-T characteristic of Zener Diode
13. To plot V-I characteristic of P-N junction diode.
14. Rectifier with filter
15. To Study inverting and non inverting amplifier.
16. To plot gain and frequency response of single stage amplification.
17 To measure the voltage of two I/P input summer circuit using operational amplifier.
18. multivibrator
19. To measure displacement using LVDT.
20. Sensors & Transducers

REFERENCES:

Sr. No	Title of Book	Author and Publication
1	A text book of electrical engineering	B.L.Theraja, S.Chand and Company
2	Electrical engineering	M.K.Chondekar, Pingala Prakashan
3	Applied electronics	R. S. Sedha, Prentice Hall
4	Instrumentation	Malvino , Tata McGraw Hill

5G304- ENVIRONMENTAL SCIENCE

COURSE STRUCTURE:

Teaching scheme		**Evaluation scheme**						
TH	02		PT	TEE	TW	PR	OR	TOTAL
PR	00	MAX MARKS			50	--		50
TOTAL	02	DURATION	--	--				

RATIONALE:
The course of environmental science aims at providing the knowledge of various recourses and pollutants, waste and preliminary treatment with re-cyclic aspect aspects.

Objectives:

The students will be able to;

- To understand the environment.
- To create the awareness.
- To know the recourses.
- To classify the types of waste.
- To classify the types of pollutants.
- Management of waste.

COURSE CONTENTS:

Topic no	**contents**	**HRS**
01	**Resources**: 1.1Engineering uses of natural and artificial resources such as water, Metals, wood, plastics, rubber and glass etc. 1.2 List various types of resources	**2**
02	**Environment:** 2.1 Meaning of environment, scientific aspects, burning topic on environment science such as global warming, climate change, deforestation.aquatic life and tsunami effects etc.. 2.2 Activity web searching of burning topic on environmental hazard,poster competition/exhibition/slogan etc	**4**
03	**Waste** 3.1 Different types of wastes, causes and effects of wastes on plants, animals and human life. 3.2 Listing causes and effect and risks of any one waste	**4**
04	**Pollution** 4.1 Meaning of pollution and its types(air,water,sound) causes and its effects.	**6**

	4.2 Pollution norms,rules and bye laws 4.3 Group discussion and conclusion	
05	**Mechanical waste** 5.1Identification of mechanical waste 5.2 Effects & risk of waste 5.3 Recycling and waste management. 5.4 Application & uses 5.5 Market survey of any one type of waste.	**7**
06	**Treatments** 6.1 concept and need of treatment 6.2 Standards of pollution control board/industry for its disposal 6.3 Arrange visit to effluent treatment plant & prepare report.	**5**
07	**Environmental Management** 7.1 Meaning of environmental Management 7.2 Management of any one type of waste. 7.3 Expert lecturer on a)Duties & citizen and role of government b)Environmental management assessment	**4**

NOTE: The term work will consist of the assignment work given by the subject teacher on the above topic contents.

REFERENCES:

Sr. No	Title of Book	Author and Publication
1	Air pollution	M.N. Rao and H.V.N. Rao Tata McGraw Hill
2	Automotive Mechanics	William H. Course, Tata McGraw Hill
3	Internal Combustion Engines	K.K. Ramlingam, Scitech
4	Water Supply and Sanitary Engineering	G.S. Bilgi Dhanpat Rai and Sons.
5	Elements of Environment Science and Engineering	P. Meenakshi, Prentice-Hall
6	A basic course in environmental studies	S.Deswal and A. Deswal, Dhanpat Rai and Sons.
7	Introduction to Environmental Engineering	P. Aarne Vesilind and Susan M. Morgan Thomson

5G305-INDUSTRIAL MANAGEMENT

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	03		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks	20	80	25	--	25	150
TOTAL	05	Duration	01	03	--	--	--	--

RATIONALE:

The diploma pass out is middle management cadre in the industrial organizational set up. A proper insight and understanding of Business Processes is therefore essential for all Polytechnic students. Management is a subject which deals with basics of Managerial science required to understand the processes in Industrial & Commercial environment. This will enable the to become familiar and to understand various Business processes, structures, their functioning and the role technicians will have to perform.

OBJECTIVE:

After completion of the curricula, the pass outs will able to:
1. Familiarize environment in the world of work
2. Appreciate the importance of management process in Business.
3. Identify various components of management.
4. Understand the role & responsibilities of a Technician in an Organization.
5. Appreciate the rules and regulations pertaining to work ethics and Social Responsibilities.

COURSE CONTENT:

Topic No	Name of Topic	Hours	Marks
01	**Overview Of Business** 1.1. Types of Business • Service • Manufacturing • Trade 1.2 Globalization • Introduction 1.3 Intellectual Property Rights (I.P.R.) Advantages & disadvantages with respective to India	**(03)** 01 01 01	**06**
02	**Evolution of Scientific Management** 2.1 Evolution of Management • Concept and definition of management • Levels of management • Administration & management • Scientific management by F.W.Taylor 2.2 Principles of Management (14 principles of Henry Fayol) 2.3 Functions of Management • Planning • Organizing • Directing • Controlling 2.4 Organizational Management • Introduction to Organization, • Types of organization: Line, Line & staff, Functional Project • Centralized & Decentralized, Authority & responsibility Span of Control 2.4 Forms of ownership • Proprietorship, Partnership, Joint stock, Co-operative Society, Govt. Sector	**(07)** 01 01 01 02 02	**10**
3	**Human Resource Management** 3.1 Personnel Management: Definition and Functions 3.2 Staffing • Introduction to HR Planning • Recruitment Procedure 3.3 Personnel • Training & Development • Types of training • Skill Enhancement 3.4 Leadership & Motivation • Maslow's Theory of Motivation • Front Line Supervisor	**(09)** 01 01 02	**15**

	• Group Dynamics. 3.5 Safety Management • Causes of accident • Safety precautions • Industrial hygiene 3.6 Introduction to Factory Acts • ESI Act • Workmen Compensation Act • Industrial Dispute Act. (Introductory approach only)	02 02 01	
4	**Financial Management** 4.1 Objectives & Functions, 4.2. Capital Generation & Management • Types of Capitals • Sources of raising Capital 4.3 Budgets and accounts • Types of Budgets • Production Budget (including Variance Report) • Labour Budget • Introduction to Profit & Loss Account (only concepts) ; 4.4 Introduction to • Excise Tax • Service Tax • Income Tax • MOD-VAT • Custom Duty (Introductory approach only)	**(09)** 01 03 03 02	**12**
5	**Materials Management** 5.1 Inventory Management -Meaning & Objectives. ABC Analysis Economic Order Quantity, Introduction & Graphical Representation. 5.2 Purchase Procedure, Objects of Purchasing, Steps in Purchasing 5.4 Modern Techniques of Material Management • Introductory treatment to JIT / SAP / ERP. (Introductory approach only)	**(06)** 03 02 01	**10**
6	**Marketing Management** 6.1 Introduction The Market, types of market, marketing process Selling vs. marketing, stress on customer centric approach. 6.2 Marketing Segmentation: benefits, marketing information system, Objectives of Marketing research, 6.3 Primary and Secondary data, Survey method, Uses of survey method, Types of survey, observation approach,	**(08)** 01 02 02	**12**

	panel research, experimental research, scope for marketing research in India. 6.4 Sales Promotion only concept**,** importance of advertisement in marketing, Media selection, channels of distribution, 6.5 Emergence of global marketing, international marketing environment, Multinational companies, procedure of export. (Introductory approach only)	02 01	
7	**Project Management** 7.1 Project Management: Introduction ,CPM & PERT Technique Concept of Break Even Analysis (only introductory), Progress tracking with the help of bar charts. 7.2 Quality Management Definition and concept of Quality , concept of Quality , Quality Circle, Quality Assurance, TQM, Kaizen, 5 'S', & 6 Sigma. (only introductory). (Introductory approach only)	**(6)** 03 03	**15**
	TOTAL	**48**	**80**

List of Practical:

The practical in management may consist of following task,

1.0 Case studies.
2.0 Guided Presentation.
3.0 Management Games.
4.0 Surveys.
5.0 Data collection, Presentation and Interpretation.
6.0 Role play/Group Discussions.

1.0 Case Study :
The case study approach may be applied to following subtopics of the curriculum.
The concern teacher may select similar suitable topics for case study.
(Any Two case studies and its presentation)

- Types of Business
- Intellectual Property Rights (I.P.R.)
- Forms of ownership
- Training & Development
- Leadership & Motivation
- Group Dynamics
- Industrial hygiene
- Sources of raising Capital
- Budgets and accounts
- MOD-VAT
- Modern Techniques of Material Management
- Marketing Segmentation

- Sales Promotion
- Quality Management

2.0 Guided Presentation (Any two)

- Centralized & Decentralized, Authority & responsibility
  Span of Control
- Skill Enhancement
- Safety Management
- Budgets
- JIT / SAP / ERP
- Advertisement in marketing,
- Media selection
- Global marketing
- Quality Management.
- Progress tracking

3.0 Management Games (Any two games from following areas or like wise)

- Human Resource Management
- Marketing Management
- Materials Management
- Project Management
- Lateral Thinking

4.0 Surveys (Any one survey form following areas or like wise)

- Training & Development
- Causes of accident
- Industrial Dispute
- Sources of raising Capital
- Inventory Management
- Customer centric approach by various business houses.
- Sales Promotion
- Product Mix
- Media selection
- Role of Multinational companies
- Impact of Quality Management parameters on project.

5.0 Data collection, Presentation and Interpretation
(Any one form following areas or like wise)

- Training & Development
- Capital Generation & Management
- Inventory Management
- Sales Promotion
- Media selection
- International marketing environment
- Channels of distribution
- Project Management
- Quality Management Parameters.

6.0 Role play/Group discussion

(Any one from following areas or likewise)

- Training
- Recruitment procedure
- Inventory management
- Market identification and sales promotion
- Project management team building

REFERENCES :

Sr. No	Title of Book	Author and Publication
1	Industrial Organization and Management	O.P.Khanna, Dhanpat Rai and Sons
2	Industrial Organization and Management	Banga and Sharma, Khanna Publications
3	Modern Business Organization & Management	S.A.Sherlekar & V.A. Sherlekar, Himalaya Publications
4	The process of Management	W.H.Newman,Prentice-hall of india pvt ltd,new delhi

5G311 to 5G328-NON EXAM

Course Structure:

Teaching Scheme		Evaluation Scheme						
TH	0		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks						
TOTAL	02	Duration						

ANY ONE OF THE FOLLOWING COURSES

COURSE CODE	COURSE TITLE
5G311	Personality Development
5G312	EDP(Civil Engg)
5G313	Hobby Electronics
5G314	Spoken English
5G315	German
5G316	French
5G317	Yoga
5G318	Music-Instrumental
5G319	Two wheeler Maintenance
5G320	EDP(Electrical Engineering)
5G321	Electrical Maintenance
5G322	Electronics Maintenance
5G323	Computer Maintenance
5G324	Japanese
5G325	Music-vocal
5G326	Aerobics
5G327	Indian classical dance
5G328	Sewing Machine Maintenance

5G311 to 5G328-NON EXAM

Course Structure:

Teaching Scheme		Evaluation Scheme						
TH	0		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks						
TOTAL	02	Duration						

ANY ONE OF THE FOLLOWING COURSES

COURSE CODE	COURSE TITLE
5G311	Personality Development
5G312	EDP(Civil Engg)
5G313	Hobby Electronics
5G314	Spoken English
5G315	German
5G316	French
5G317	Yoga
5G318	Music-Instrumental
5G319	Two wheeler Maintenance
5G320	EDP(Electrical Engineering)
5G321	Electrical Maintenance
5G322	Electronics Maintenance
5G323	Computer Maintenance
5G324	Japanese
5G325	Music-vocal
5G326	Aerobics
5G327	Indian classical dance
5G328	Sewing Machine Maintenance

5G303- ENTREPRENEURSHIP DEVELOPMENT

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	02		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks			25	--	25	50
TOTAL	04	Duration			--	--	--	--

RATIONALE:

The post liberalization industrial and economic scenario in India makes it imperative that a more dynamic and pragmatic approach be adopted to create new, first generation entrepreneurs on a large scale.

This would help in tackling the problem of unemployment and contribute to the creation of new entrepreneurs. Using knowledge & advanced technology as their strategic tools those who can take on the increased competition in the domestic as well as global markets are innovators and entrepreneurs in true sense. This can be achieved only if more and more people are motivated and convinced to choose entrepreneurship as a career and put their energies and resources to a productive use.

The student community also needs to explore the emerging opportunities. It is therefore necessary to inculcate the entrepreneurial values during their educational tenure. This will help the younger generation in changing their attitude and take the challenging growth oriented tasks instead of waiting for white- collar jobs.

This subject will help in developing the awareness and interest in entrepreneurship and create employment for others.

Objectives:

Students will be able to

1) Appreciate the importance of entrepreneurship.
2) Identify entrepreneurship opportunity.
3) Get primary information to start any business.
4) Acquire entrepreneurial values and attitude.
5) Use the information to prepare project report for business venture.

6) Develop awareness about enterprise management.

Course Contents:

Topic No	Name of Topic	Hours
01	**Basic Concepts** 1.1. Concept, Classification & Characteristics of Entrepreneur. Creativity and Risk taking, Concept of Creativity & Qualities of Creative person. Risk Situation, Types of risk & risk takers. 1.2 Business Idea Methods and techniques to generate business idea 1.3 Transforming Ideas in to opportunities transformation involves Assessment of idea & Feasibility of opportunity, SWOT Analysis.	**5**
02	**Information And Support Systems** 2.1 Information Needed and Their Sources. Information related to project, Information related to support system, Information related to Procedures and formalities. 2.2 Support Systems: • Small Scale Business Planning, Requirements. • Govt. & Institutional Agencies, Formalities • Statutory Requirements and Agencies. • Government Support and subsidies to entrepreneur.	**5**
3	**Market Assessment** 3.1 Marketing -Concept and Importance 3.2 Market Identification, Survey Key components (Market Segmentation) 3.3 Market Assessment	**5**
4	**Business Finance & Accounts** 4.1 **Business Finance** • Cost of Project • Sources of Finance • Assessment of working capital • Product costing • Profitability • Break Even Analysis • Financial Ratios and Significance 4.2 **Business Account** Accounting Principles, Methodology • Book Keeping • Financial Statements • Concept of Audit, • Trial Balance • Balance Sheet	**6**

5	**Business Plan & Project Report** 5.1 Business plan steps involved from concept to commissioning Activity Recourses, Time, Cost 5.2 **Project Report** 1) Meaning and Importance 2) Components of project report/profile (Give list) 5.3 **Project Appraisal** 1) Meaning and definition 2) Technical, Economic feasibility 3) Cost benefit Analysis	**6**
6	**Enterprise Management And Modern Trends** 6.1 Enterprise Management: - 1) Essential roles of Entrepreneur in managing enterprise 2) Product Cycle: Concept And Importance 3) Probable Causes Of Sickness 4) Quality Assurance, Importance of Quality, Importance of testing 5) Industrial zones and SEZ. 6.2 E-Commerce ,Concept and process 6.3 Global Entrepreneur: role and opportunities.	**5**
	Total	**32**

Practical:

The practical task may be divided in following heads

1. Literature survey – MSFC/IDBI/MSSIDC/CIDBI/MSME/DIC/ ROLE OF DIFFERENT COMMERCIAL BANKS etc.
2. Administration of ready made tools like questionnaires, opinionnaire, Interview schedule for product identification purpose (decision making process).
3. Development of “Business Ideas”.
4. Visit to MCED/MITCON- gong through the product related library.
5. Preparation of Preliminary / Detailed project report in the formats recommended by MCED/MITCON.
6. At least one case study of successful entrepreneur..

Text Books

Sr. No	Title of Book	Author and Publication
1	Entrepreneurship Development	TTTI, Bhopal.
2	The Seven Business Crisis& How to Beat them	V.G.Patel
3	A handbook of New Entrepreneurs	P.C.Jain ,Dhanpat Rai and Sons
4	Entrepreneurship development	E.Gorden, K. Natrajan.
5	New Initiatives in Enterprenuership Education And training	Gautam Jain, Debmuni Gupta
6	www.ediindia.org.	
7	Entrepreneurship Theory and Practice	J.S.Saini,B.S.Rathore
8	Enterpreneurship Development and management	A.K.Singh, Laxmi Publications
9	The Beermat Enterpreneur	Southon, Pearson Education limited

5R401- FLUID POWER

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	03		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks	20	80	25	--	25	150
TOTAL	05	Duration	01	03	--	--	--	--

RATIONALE:

Oil Hydraulic systems & pneumatic systems are widely used in all fields of engineering as clean source of motive power. Low cost automation systems with the use of pneumatics have become popular as manufacturing aids.

Diploma engineers come across such systems in all segments of industries.

Hence the subject will give the students basic skills and knowledge, which will be directly needed in the industrial environment.

COMPETENCY STATEMENT:

- To know the various properties of fluid.
- To understand the flow through pipes and losses in relation to practical applications.
- To understand working of different types of turbines & pumps.
- To know the different components of hydraulic & pneumatic circuits.
- To understand working of different components and their use in circuits.
- To prepare different circuits using above components

OBJECTIVES:

The student will be able to.

- Understand the basic fluid mechanics and principles governing them.
- Identify various components of hydraulic & pneumatic systems.
- Know the working principle of various components used for hydraulic & pneumatic systems.
- Select appropriate components required for simple hydraulic and pneumatic circuits.
- List probable causes of faults or defects in the components of hydraulic & pneumatic circuits.

Course Contents:

Topic No	Name of Topic	Hours	Marks
01	**Basic Concepts** 1.1.Mass density, weight density, specific volume, specific gravity, Viscosity - dynamic and kinematics, Newton's law of viscosity 1.2 Pressure, units, pressure head, Pascal's law, positive and negative pressure. Manometers- simple, U-tube, simple differential	4	4
2	**Fundamentals Of Fluid Flow** 2.1 Types of flows, concept of discharge, continuity equation, 2.2 Bernoulli's equation, assumptions, application of equation in pipes & nozzles. 2.3 Applications- venturimeter, pitot tube, simple numerical	4	8
3	**Flow through pipes** 3.1 Laws of fluid friction, Reynolds number, Major losses, Darcy-Weisbatch equation, Chezy's formula, simple numerical. 3.2 Minor losses - entry, exit, accessories such as sudden enlargement, contraction, bends, valves, elbows, numerical. 3.3 Hydraulic Gradient Line (HGL), Total Energy Line (TEL) , pipes in series, equivalent pipe, parallel pipes, 3.4 Power transmission through pipes, max. efficiency of transmission Water hammer in pipes - causes, effects and remedial measures.	5	10
4	**Turbo machinery** 4.1 Pumps: Construction and working of centrifugal, reciprocating, jet and submersible Pump, multistage pumps, cavitations, air vessels.Priming of pumps. 4.2 Turbines:Hydraulic power plant layout, classification of turbines, construction and working of Impulse, reaction and axial flow turbine. Governing of turbines. Selection of turbines.	7	12
5	**Introduction to oil hydraulic systems** 5.1 Practical applications of hydraulic systems. 5.2 General layout of oil hydraulic systems. 5.3 Merits and limitations of oil hydraulic system	3	3
6	**Components of Hydraulic systems** 6.1 Pumps – construction and working of Vane pump, gear pump, Gerotor pump, screw pump, piston pump only. 6.2 Valves – Construction, working and symbols of Pressure control valves – pressure relief valve, pressure reducing, pressure unloading, Direction control valves – Poppet valve, spool valve, 3/2, 4/2	6	10

	D.C. valves, Sequence valves. Flow control valves – pressure compensated, non pressure compensated flow control valve. 6.3 Actuators- Construction, working and symbols of Rotary Actuators - Hydraulic motors. Linear Actuators – Cylinders - single acting, double acting. 6.4 Accessories – Pipes, Hoses, fittings, Oil filters, Seals and gaskets, Accumulators. (Types, construction, working principle and symbols of all components)		
7	**Hydraulic Circuits** 7.1 Meter in, Meter out circuits 7.2 Bleed off circuit 7.3 Sequencing circuit 7.4 Hydraulic circuits for Milling machine, Shaper machine, Motion synchronization circuit.	**6**	**10**
8	**Introduction to pneumatic Systems** 8.1 Applications of pneumatic system 8.2 General layout of pneumatic system 8.3 Merits and limitations of pneumatic systems	**2**	**3**
9	**Components of pneumatic system** 9.1 Compressor – Reciprocating & Rotary compressors. Control Valves – Pressure regulating 9.2 valves, Flow Control valves, Direction Control Valves. 9.3 Actuators –Rotary - Air motors, Types, construction, working principle 9.4 Linear- Cylinders- Types, construction & working principle 9.5 Accessories – Pipes, Hoses, Fittings, FRL unit (Types, construction, working principle and symbols of all components)	**5**	**10**
10	**Pneumatic Circuits** 10.1 Speed control circuits. 10.2 Sequencing circuits 10.3 Roller operated 10.4 Stroke control circuit, 10.5 Time delay circuit, its application in vacuum handling, 10.6 Dual control, 10.7 Intermediate stopping of piston, 10.8 Mechanical press.	**6**	**10**
	TOTAL	**48**	**80**

LIST OF PRACTICALS/EXPERIMENTS:
(Minimum twelve experiments from the following)

1. To find out mass density, weight density, and specific gravity of liquids and Compare them.
2. To study different types of manometers and gauges used in the laboratories.
3. Calculation of pressure with the help of manometers.
4. Calculation of actual discharge.
5. Study of layout for a hydroelectric power station.
6. Study and demonstrating working of Pumps and turbines.
7. To measure the flow by using venturimeter.
8. To determine loss of head per unit length of different materials.
9. To determine minor losses of head in pipe joints.
10. To find efficiency of a centrifugal pump.
11. To find efficiency of a reciprocating pump.
12. To study different types of turbines.
13. To study different elements of hydraulic and pneumatic systems and their symbols.
14. To study and develop circuits (four) on hydraulic trainer.
15. To study and develop circuits (four) on pneumatic trainer.

REFERENCES:

Sr. No	Title of Book	Author and Publication
1	Fluid mechanics and hydraulic machinery	Modi & Seth, Standard book house Delhi
2	Fluid mechanics and hydraulic machinery	R. K. Bansal, Laxmi publications (P) limited
3	Hydraulics	R.S. Khurmi, S.Chand and Company
4	Hydraulics	Jagdish Lal , Metropolitan Book Company Pvt Limited
5	Industrial Hydraulics	Pippenger and Hicks, McGraw Hills Book Company
6	Pneumatics and Hydraulics	Harry L. Stewart , D.B.Taraporewala and Sons And companu
7	Hydraulics & Pneumatics	Andrew Parr ,Jaico Publishing house
8	Pneumatic systems	S.R. Mujumdar, Tata MC Graw Hills

5R402: MACHINE DRAWING (MD)

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	02		PT	TEE	TW	PR	OR	Total
PR	04	Max. Marks	20	80	50	--	25	175
TOTAL	06	Duration	1.00	4.00	--	--	--	--

RATIONALE:

Machine Drawing is the language of engineers and technicians. A mechanical engineering technician has to work in different situations like supervision of production, maintenance of machines, inspection work, prepare drawing of objects etc. He has to interpret the parts drawings and assembly drawings.

COMPETENCY STATEMENT (S):

To prepare and interpret the production drawings as per I.S. code.

COURSE OBJECTIVES:

Student should able to,

1. Understand the curves of interpenetration of solids
2. Understand development of surfaces
3. Use proper welding and machining symbol.
4. Use proper limits,
5. Use IS Conventions.
6. Read the given drawing.
7. Prepare assembly drawing from given components drawing.
8. Prepare production drawing.

CONTENTS:

Topic No.	Content	Hours	Marks
1.	**Development of surface of solids:** 1.1 Development of lateral surface of following rectangular solids like Cone Cylinder Pyramids and Prisms 1.2Development of funnel, Chimney, pipe bends and composite solids	**06**	**08**
2.	**Curves of Interpretation** Curves of Interpretation of the surface of solids in following cases – 2.1 Cylinder with cylinder when- i)Axes at 90^0 and intersecting. ii)Axes at 90^0 and offset. 2.2 Cylinder with cone when – i)Axis of cylinder is parallel to H.P. and V.P. and perpendicular and intersecting the axis of cone. 2.3 Prism with Prism	**06**	**12**

	i)Axes at 90^0 and intersecting. ii)Axes at 90^0 and offset		
3.	**Limits, Fits and Tolerances** 3.1 Characteristics of surface roughness- Indication of machining symbol showing direction of lay, roughness grades, machining allowances, manufacturing methods. 3.2 Introduction to ISO system of tolerance, dimensional tolerances, elements of interchangeable system, hole & shaft based system, limits, fits & allowances. Types and selection of fit. Calculations of tolerances 3.3 Geometrical tolerances, tolerances of form and position and its geometric representation. 3.4 Direction of Lays	**04**	**08**
4.	**Assembly to Details** Detailed part drawings of the following with all necessary requirements specified on drawings 4.1 Oldham, Flexible coupling and Universal coupling 4.2 Tool Post, Tail stock ,Foot step bearing 4.3 Screw Jack, Plummer Block, Steam stop valve	**06**	**18**
5.	**Details to Assembly** Assembly drawings of the following with all necessary requirements specified on drawings 5.1 Oldham and Universal coupling 5.2 Flexible coupling, Tool Post, Tail stock 5.3 Foot step bearing, Screw Jack, Plummer Block 5.4 V-belt pulley with shaft, Drill jig	**06**	**18**
6.	**Conventional Representation** 6.1 Welded Joints – Representation of the welds and preparation of working drawing showing the sizes of weld lengths, flash finish with supplementary symbols etc. 6.2 Conventions used in machine drawing for representing – Long and Short break in pipes, rods, shafts. Ball and roller bearing, springs, gears, cocks and valve 6.3 C.I., M.S., Brass, Bronze, Aluminum, Rubber materials. 6.4 Various types of sections like revolved, offset, full, half removed, partial local and broken sections 6.5 Standard conventions representing following –Pipe fitting on elbows, bends, plugs, lay out nipple, couplings, red sockets	**02**	**08**
7	**Free hand Sketches** Industrial drawings are to be used for reading and sketching 7.1 Different types of threads and thread profile, bolts, nuts, etc. 7.2 Keys of the following types – Sunk key, taper key, woodruff key, cone key, 7.3 Couplings – Flange, Muff, Flexible, Oldham Joints – Cotter, Knuckle	**02**	**08**

	7.4 Pulleys – Flat belt, V-belt, fast & loose types I.C. engine piston, connecting rod, gland and stuffing box, 7.5 Journal bearing,Pedestal bearing, Plummer block bearing and foot step bearing.		
		32	**80**

LIST OF PRACTICALS:

A3 size sketch book should be used by the students. It is necessary to draw all the sheet problems in sketch book first and then redrawn on the sheets

1. One sheet on development of surfaces (2 problems)
2. One sheet on curves of interpenetration (2 problems)
3. One sheet on Assembly to details
4. One sheet on Details to assembly
5. One sheet on production drawing (Selecting most common from the following). Hexagonal Nut, Hexagonal Bolt, Spur Gear, V-Belt Pulley, Flywheel, Show on the sheet – Tolerance, Surface finish, Part No. Machining Sequence.
6. Sketch book work on conventional specification like Long and Short break in pipes, rods, shafts. C.I., M.S., Brass, Bronze, Aluminum, Rubber materials. Ball and roller bearing, cocks and valve, revolved, offset, half removed, partial local and broken sections. **(No sheet)**
7. Sketch book work on Free hand sketching on keys, couplings, joints bolts etc. **(No sheet)**
8. AUTO-CAD work : Revision of all 2D cad tools should be taught to students in one practical session and then **One sheet** on Assembly to details (i.e. Sheet no. 3) should be redrawn by using CAD. Print out A4 size should be attached in sketch book by all students.

REFERENCES:

Sr. No	**Title and Edition**	**Author**	**Publisher**
1	Machine Drawing	N. D. Bhatt	Charotar Publishing House
2	Machine Drawing	Mali & Choudhary	Vrinda Piblications
3	Engineering Drawing	Sidheshwar and shastri,	Tata Mc Graw Hill

5R403-PROJECT

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	00		PT	TEE	TW	PR	OR	Total
PR	04	Max.Marks	--	--	100	--	50	150
TOTAL	04	Duration	--	--	--	--	--	--

RATIONALE:

In practice the diploma technicians come across problems of varied nature. He/she will have to solve the problems involving drawings, designs, manufacturing, installation, testing and maintenance of machines. In order to cultivate the systematic methodology for problem solving using acquired technical knowledge & skills, this subject is introduced.

This subject will also help to enhance the generic skills & professional skills.

COMPETENCY STATEMENT (S):

- Design the related machine components & mechanism.
- Convert innovative or creative idea into reality.
- Understand & interpret drawings & mechanisms
- Select the viable, feasible & optimum alternative from different alternatives.
- Us of skills learnt in workshop practical.
- Assemble parts or components to form machine or mechanisms.
- Classify & analyze the information collected.
- Implement the solution of problem effectively.

NOTES:

1) Project group size: Maximum 6 students
2) Project report will be of minimum 40 pages unless otherwise specified.
3) Project diary should be maintained by each student.

CONTENTS:

A batch of maximum 6 students will select a problem and then plan, organize & execute the project work of solving the problem in a specified duration. Student is expected to apply the knowledge & skills acquired. Batch may select any one problem / project work from following categories.

a) Fabrication of small machine / devices/ test rigs/ material handling devices/ jig & fixtures/ demonstration models, etc. Report involving aspects of drawing, process sheets, costing, Installation, commissioning & testing should be prepared and submitted.

b) Design & fabrication of mechanisms, machines, Devices, etc. Report involving aspects of designing & fabricating should be prepared & submitted .

c) Development of computer program for designing and /or drawing of machine components, Simulation of movement & operation, 3D modeling, pick & place robots etc.

d) Industry sponsored projects- project related with solving the problems identified by industry should be selected. One person / engineer from industry is expected to work as co- guide along with guide from institution.

e) Literature survey based projects: - Project related with collection tabulation, classification, analysis & presentation of the information. Topic selected must be related with latest technological developments in mechanical or mechatronics field, and should not be a part of diploma curriculum. Report should be of min 60 pages.
f) Investigative projects- Project related with investigations of causes for change in performance or structure of machine or component under different constraints through experimentation and data analysis.
g) Maintenance based projects: - The institute may have some machine/ equipment/ system, which are lying idle due to lack of maintenance. Students may select the specific machines/equipment/system. Overhaul it, repair it and bring it to working condition. The systematic procedure for maintenance to be followed and the report of the activity be submitted.

h) Industrial engineering based project: Project based on work study, method study, methods improvement, leading to productivity improvement, data collection, data analysis and data interpretation be undertaken.
i) Low cost automation projects: Project based on hydraulic/pneumatic circuits resulting into low cost automated equipment useful in the identified areas.
j) Innovative/ Creative projects – Projects related with design, develop & implementation of new concept for some identified useful activity using PLC, robotics, non-conventional energy sources, CIM, mechatronics, etc.
k) Environmental management systems projects: Projects related with pollution control, Solid waste management, liquid waste management, Industrial hygiene, etc, Working model or case study should be undertaken.

l) Market research/ survey based projects: Projected related with identification of extent of demand, sales forecasting, Comparative study of marketing strategies, Comparative study of channels of distribution, Impact of variables on sales volume, etc. The project involves extensive survey & market research activities information to be collected through various mechanisms/tools & report is prepared.
m) Project based on use of appropriate technology particularly benefiting rural society or economically weaker section.
n) Project can be selected other than the area specified above. Project should provide viable and feasible solution to the problem identified. Report should be of min 50 pages.

Teaching Methodology:

1. Conducting literature Survey.
2. Discussion within batch
3. Discussion with guide

REFERENCES:

Sr. No	Title of Book	Author and Publication
1	Project Management and team work	Karl Smith Tata McGraw Hill
2	Project Management	Cliffored gray & Erik Lasson Tata McGraw Hill

JOURNALS/ MAGAZINES

1) Popular mechanics
2) Machine Design
3) Mechanical Engineering (ASME)
4) Automotive Mechanics
5) Innovative ACR
6) Invention intelligence

5R404: SEMINAR

Teaching Scheme		Evaluation Scheme						
TH	--		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks	--	--	50	--	50	100
TOTAL	02	Duration	--	--	--	--	--	--

RATIONALE:

It is found that the students are lacking in the communication and presentations. To improve this ability this course is introduced.

COMPETENCY STATEMENT (S):

- To improve communication skills
- To prepare professional presentations.
- To understand advance technologies.

OBJECTIVES:

At the end of the course student should able to-

- Acquire information from different sources
- Prepare notes for given topic
- Present given topic in a seminar
- Interact with peers to share thoughts
- Prepare a report on industrial visit, expert lecture

CONTENTS:

Seminar on any advanced technical topic to be presented by individual student in a batch of 20 students. A separate topic be selected by an individual student.

Information search can be done through manufacturer's catalogue, websites, magazines, books etc. and submit a report any one topic.

Following topics are suggested:

- Engine lubricants & additives
- Automotive gaskets and sealants
- Engine coolants and additives
- Two and Four wheeler carburetor.
- Power steering
- Filters
- Different drives/Transmission systems in two wheelers.
- Types of bearings – applications and suppliers.
- Heat Exchangers
- Maintenance procedure for solar equipment.
- Electronic fuel injection systems.
- Exhaust gas analysis.
- Vehicle testing.
- Transducer application in automobiles.
- Environmental pollution & control.
- Quality systems

- Industrial safety
- Aircraft technology
- Ship Technology
- Alternative fuels
- Alternative energy sources
- Refrigeration & Air conditioning
- Types of bearing
- Automobile saftey

NOTE:Above topics are given for reference,Teacher may give other topics related to Automobile engineering

5A405-AUTO ELECTRICAL AND ELECTRONICS SYSTEMS

COURSE STRUCTURE:

Teaching Scheme		**Evaluation scheme**						
TH	03		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks	20	80	25	--	25	150
TOTAL	05	Duration	1.00	3.00	--	--	--	--

RATIONALE:

Automobile engineer must have knowledge of electrical and electronic systems in vehicle because proper function of automobile depends on some important parts of electrical and electronic system. Nowadays use of microprocessor rapidly goes on increasing .The main aim of this subject is to impart the basic knowledge of electrical and electronic circuits as well as microprocessor in modern vehicles.

COMPETANCY STATEMENT:

1. Diagnose and repair the defects in the circuits, to protect circuits & understand working of electromagnetic gauges as well as electrical accessories.
2. Understand the purpose, construction, rating, testing of battery & major reasons of battery failure.
3. Identify components, operation and testing of starting as well as charging system.
4. Understand the basic need, components, and operations of ignition system.
5. Understand lighting system & accessories.
6. Troubleshoot various complaints in electrical & electronics system.

COURSE CONTENTS:

Topic No	Content	Hours	Marks
01	**Electrical & Electronic Components** 1.1 Purpose and operation of electrical components like switches, relays, solenoids, buzzers, and resistors. 1.2 Purpose of circuit protection devices like fuses, maxi fuses, circuit breakers (Manual and automatic resetting types.) and fusible links 1.3 Working of Electromagnetic gauges like temp Gauges, fuel gauge, engine oil pressure gauge. 1.4 Working of electrical accessories like wind shield wiper, wind screen washer, blower motor, heater plug power window, electric horn 1.5 Features of scan tester	**08**	**14**
02	**Battery** 2.1 Lead acid battery – construction & working 2.2 Low maintenance & Maintenance free battery 2.3 Battery ratings and specifications. 2.4 Battery trouble & Battery maintenance 2.5 Battery charging 2.6 Jump starting-Procedure and precautions. 2.7 Alkaline battery 2.8 Battery testing – Battery terminal test, Leakage test, Specific Gravity. Test, Capacity test.	**08**	**14**
03	**Starting And Charging System** 3.1 Construction and working of starting system. Types of starter drive (Bendix and overrunning clutch types only) construction and working. 3.2 Testing of starting system – Quick testing, Current draw test, Insulated circuit resistance test, Ground circuit test, No crank test, free speed test. 3.3 Construction & operation of alternator. 3.4 Operation of charge indicator light circuit	**07**	**10**

4	**Ignition Systems** 4.1 Necessity of ignition system. 4.2 construction and working of battery ignition system. 4.3 Magneto ignition system- construction and working of CDI system. 4.4 Components of ignition system:- Ignition coil types, Distributor, spark plug, cords, and condenser 4.5 Electronic (or solid state) ignition system with distributor- circuit diagram and working. 4.6 Triggering of Primary circuit – Inductive, Hall Effect and Optical method. 4.7 Distributor less/ computer controlled coil ignition system operation. 4.8 Spark advance mechanisms	**08**	**14**
05	**lighting accessories** 5.1 Automotive bulb 5.2 Operation of automatic headlight dimming**.** 5.3 Use and working of fiber optics & its diagnosis 5.4 Light switch, brake stop light switch 5.5 Direction indicators-Flashing light indicator 5.6 Operation of automatic on/off headlight with time delay	**06**	**10**
06	**Diagnosis of electronic components & Systems** 6.1 Sensor testing: - Oxygen sensor, Engine coolant sensor, Intake air temp. Sensor, Throttle position sensor, Manifold absolute pressure sensor. 6.2 Onboard diagnosis (OBD):- 6.2.1 Purpose of (onboard diagnostic second generation) OBD II, flash codes of Malfunction indicator light. 6.2.2 OBD II terminology:- Drive cycle, Trip, Warm up cycle (Definitions only) 6.3 Troubles of electronic gauges like. Gauge reads low constantly, Gauge reads high constantly, Inaccurate Gauge reading.	**06**	**10**
07	**Safety Devices** 7.1 Center locking 7.2 Anti theft system 7.3 ECU immobilizer system 7.4 child lock 7.5 Fog lamps 7.6 Some dos & don’ts for safety	**05**	**08**
	Total	**48**	**80**

TERM WORK: It shall consist of journal, based on the following experiments

Experiments:

1 To study cut section of lead acid automotive battery.
2 Alternator-component identification and output test, Regulated Voltage Output Test charging circuit resistance test.
3 Starter Motor –component identification, starter current draw test and voltage drop test.
4 Adjustment of ignition timing of a multi cylinder engine with strobe (neon light)
5 To dismantle & assemble distributor of battery ignition system.
6 Location and identification of sensors. Stand alone diagnosis.
7 Assignments - On Board Diagnosis.
8 collect the following information from internet/manuals/magazines/etc
a) Prepare a detail report of electronic systems used in any modern four wheelers
b) Ignition system used in any two wheelers

REFERENCE BOOKS:

Sr.No	Title &edition	Author	Publisher
01	Automobile Engineering Vol. I and Vol. II	Kirpal Singh	Standard Publication
02	Automobile Engineering	K. K. Jain and R.B. Asthana	Tata McGraw hill
03	Automobile Engineering	R.B. Gupta,	Satya Prakashan New Delhi
04	Automotive Mechanics	W.H.Crouse&Anglin	Tata McGraw hill
05	Automotive Electricity, Electronics & Computer Controls	Barry Hollenbeck	Delmar Publishers
06	Automotive Technology: A System Approach	Jack Erjavec, Robert Scharff	Delmar Publisher Inc
07	Automotive Electrical Equipment	P. L. Kohli	Tata McGraw-Hill
08	Automotive electronic systems	Trevor Mellard	ELBS

5R406-THEORY OF MACHINES

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	03		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	--	25	150
TOTAL	05	Duration	1.00	3.00	--	--	--	--

RATIONALE:

Fundamental knowledge of various mechanisms and machines help in understanding the working of mechanical devices. This curriculum primarily aims at focusing the basic concepts of mechanisms of machine parts. Analysis of forces and motion of machine parts helps the designer to design more effectively.

Knowledge of working of flywheel and governor give the basic idea of storing energy in flywheel and controlling speed of the engine.

Study of the machine part like cam relates its application in the various machineries.

COMPETENCY STATEMENT (S):

- To understand working & application of simple mechanisms.
- To compute velocity and acceleration of various links in mechanism.
- To understand working of governors, flywheel, bearing and cam.

COURSE CONTENTS:

Topic No.	Content	Hours	Marks
1	**Simple mechanisms** 1.1Introduction, Kinematic link, Types of links. Concept of Machine and Structure, Difference between machine and structure. Kinematic pairs and types. Types of constrained motions 1.2 Concept of Kinematic chain, mechanism and Inversion, Inversions of Four bar chain: Beam engine, coupling rod, Watt's indicator mechanism 1.3 Inversions of Single Slider crank chain: Pendulum pump, oscillating cylinder, Rotary internal combustion engine, Quick return mechanism 1.4 Inversions of Double slider crank chain: Elliptical trammel, Oldham's coupling	08	12
2	**Velocity and Acceleration Diagrams** 2.1 Relative Velocity method Velocity and acceleration of a point on a link, concept of linear and angular velocity, centripetal and tangential acceleration, angular acceleration 2.2 Drawing of velocity and acceleration diagrams for simple	10	18

	mechanisms by relative velocity method 2.3 Instantaneous centre of Rotation (ICR) method: Concept of ICR, Types of Instantaneous centers, Kennedy's theorem, circle diagram to locate Instantaneous centers, finding of velocity of various points by ICR method for Slider crank mechanism and four bar mechanism 2.4 Klein's construction for velocity and acceleration of piston in slider crank mechanism Problems on drawing of velocity & acceleration diagrams		
3	**Cams and Followers** 3.1Definition of cam and follower, types of cams and follower, cam terminology 3.2 Motions of follower , simple harmonic, uniform velocity, uniform acceleration & retardation, their displacement , velocity, acceleration diagram 3.3 Introduction to circular arc and tangent cam 3.4 Drawing the profiles of cam for given follower and type of motion with offset and without offset. Problems on drawing of cam profile.	08	12
4	**Power Transmission** 4.1 Need of power transmission, classification of drives, relative merits and demerits of Belt drives vs Gear drives 4.2 Belt drives, types of belts, concept of velocity ratio, length of belt, ratio of tensions, initial tension, centrifugal tension, law of belt, comparison of V-belt and flat belt, concept of timing belt 4.3 Power transmitted by belt drive, condition for maximum power transmission 4.4 Gears: Gear terminology, types of gears, Gear ratio, spur, helical, bevel, spiral, herringbone, rack and pinion types, and law of gearing 4.5 Gear trains: Simple, compound and epicyclic gear trains, their velocity ratios Simple numerical on power transmission and gear trains	10	15
5	**Friction in Bearings** 5.1 Types of friction, coefficient of friction 5.2 friction of pivot and color bearing, conical bearing with their theories of uniform pressure and uniform wear condition, derivations Simple numerical on uniform pressure and uniform wear condition	04	09

6	**Flywheel and Governor** 6.1 Flywheels: Functions of Flywheel, concept of turning moment (T-□) diagram for four stroke internal combustion engine, multi cylinder engine, 6.2 Fluctuation of energy, coefficient of fluctuation of energy, fluctuation of speed and importance of flywheel in engine and machines 6.3 Governors: Function of governor, types of governors as centripetal and inertia 6.4 Governor terminology, comparison with flywheel 6.5 Forces on reciprocating parts of engine, piston effort, crank pin effort, crank effort, thrust on bearing, etc.	04	08
7	**Balancing and Vibrations** 7.1 Concept of balancing, balancing of single rotating mass.Need of balancing,process of balancing 7.2 Concept and terminology used in vibration, causes of vibrations in machines, their harmful effects and remedies	04	06
		48	80

LIST OF PRACTICALS / EXPERIMENTS:

1. Study of Shaper's quick return mechanism and finding of ratio of angle of cutting stroke to the angle of return stroke for quick return mechanism with the help of model
2. Study of one each inversion of four bar and single slider crank and double slider crank mechanism with the help of their working models
3. Drawing the Velocity and acceleration diagrams by relative velocity method for simple mechanisms (Two problems)
4. Drawing the velocity diagram by Instantaneous center method of four bar mechanism
5. Klein's constructions for velocity and acceleration for slider crank mechanism
6. Drawing profile of cam having knife edge follower and with different type of motions (01 problem without offset and 01 problem with offset)
7. Drawing profile of cam having roller follower and with different type of motions (01 problem without offset and 01 problem with offset)
8. Determine the radius of rotation of fly-ball for different speed of governor and draw a graph between radius of rotation versus speed
9. Study of bicycle free wheel sprocket mechanism with the help of working model
10. Determination of Gear ratio by using any gear box and velocity ratio for any belt drive in the lab

REFERENCES:

Sr. No	Title and Edition	Author	Publisher
1	Theory of machines	Khurmi	S Chand and company
2	Theory of machines	Ballani	Khanna Publishers
3	Theory of machines	Jagdishlal and Shah	
4	Theory of machines	Rattan	Tata McGraw Hill
5	Theory of machines	B.L.Singhal	Nirali Publications

5R407 – 3 D MODELING (3DM)

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	01		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	--	--	50	--	50	100
TOTAL	03	Duration	--	--	--	--	--	--

RATIONALE:

With rapid development of Technology and competitive economy, computers play very important role in the diversified fields such as CAD, CAM, CIM and simulation etc.

It is essential for a Diploma Technician to have a knowledge regarding the latest drafting software used in the industries and to achieve skill in operating different software's available such as Pro-E, Catia, Solid Work, and Edge Cam etc. It is always essential for a technician to update their knowledge to cope up with the fast development in software's. Considering this in view and duties to be performed by Diploma Technician in professional life, curriculum for three Dimensional modeling is suggested.

Solid Works and Pro Engineer are the most widely used software in industries.

COMPETENCY STATEMENTS:

1. To understand working of 3-D Environment
2. To understand concept of Sketching
3. To understand and do Part modeling
4. To apply the Features Extrude, Cut, Revolve, Rib
5. To apply the Features Sweep, Loft, Pattern
6. To make assembly of the parts designed
7. To draw and plot views of the parts/assemblies prepared.

COURSE CONTENTS:

Topic No.	Content	Hours	Marks
1	**Introduction to Pro-Engineer GUI** 1.1 Tool bars: Standard Toolbar, Sketch Toolbar, Relationship Toolbar, View Toolbar, Drawing Toolbar, Feature Toolbar and Annotation Toolbar. 1.2 Feature Manger Design Tree: Design Manager, Property Manager, and Configuration Manager. Selection Method: Selection from Design Tree, Graphic Area.	02	-
2	**Sketching** 2.1 Sketch Plane, grid, units, edit and modify sketch.	03	-

	2.2 Sketch relations: Adding and changing geometric relations 2.3 Dimensioning: Vertical, horizontal, aligned, angular, circular sketches. 2.4 Reference Geometry: Creating axis, creating reference planes		
3	**Part Modeling** 3.1 Creating Features such as extrude, Cut Extrude, Holes, Revolve, Shell, Loft, Sweep, 3.2 Modifying a feature using daft, Fillet, Chamfer, and Hole Wizard. 3.3 Creating Feature Pattern: Circular Pattern, Rectangular Pattern, Through Sketch	**03**	-
4	**Editing and modifying part model** 4.1 Feature Manager Design Tree, Editing a Feature definition, 4.2 Editing sketch of the part model, Move and copy Features, 4.3 Suppress, Rollback, 4.4 Part colour, Mass properties.	**03**	-
5	**Assembly** 5.1 Assembly Toolbar, Feature Manager design tree conventions, 5.2 Mate components, align, concentric, parallel. Calling part model into assembly from library	**03**	-
6	**Drawing** 6.1 Creating Drawings: standard templates, Sheet setup, 6.2 Adding drawing views: standard three views, Sectional views, auxiliary views, detailed views. 6.3 Annotations: adding dimensions, notes, centre marks, Bill of Material, 6.4 Page Setup, Print selection, print preview, and Print Solid-Works document	**02**	-
	TOTAL	**16**	

TERM WORK:

Understand the 3-D environment.

1. Drawing the sketches of the machine parts (Min. 08)
2. Creating parts using features extrude, cut, rib. (Min. 8)
3. Creating parts using revolve, chamfer, fillet, sweep, loft, draft. (Min. 04)
4. Part modeling using reference axis and planes, editing and modifying the parts, patterns circular and rectangular.(Min. 04)
5. Creating assemblies of the parts designed. (Min. 04)
6. Creating drawing views of the parts and the assemblies. (Min. 04)
7. Plotting the Drawings with dimension and annotations. (Min. 02)

TEXT BOOK:

Sr.No	Title and Edition	Author	Publisher
1	3 D Modeling using Solid Works	-	Lab Manual Developed by G. P. Aurangabad
2	Pro Engineer Tools and Tutorials	-	Pro Engineer Resource center

REFERENCE BOOK:

Sr.No	Title and Edition	Author	Publisher
1	3 D modeling by Pro Engineer wildfire 4	Roger Toogood	Schroff Developement corp.
2	Design Modeling with Pro Engineer	-	Schroff Developement corp.

5A408- VEHICLE MAINTENANCE

COURSE STRUCTURE:

Teaching Scheme		Evaluation scheme						
TH	02		PT	TEE	TW	PR	OR	Total
PR	03	Max.Marks	--	--	50	--	25	75
TOTAL	05	Duration	--	--	--	--	--	--

RATIONALE:

Vehicle maintenance is a technology subject. Perquisites for this subject are automobile engines, advance automobile engines, automobile transmission systems and automobile systems which are covered adequately in previous semesters.

Vehicle, engine and system components have definite life for which they give better performance. So, to get the best performance from the engine and systems, it is required to be maintained at regular intervals.

The proper maintenance of the components results in good fuel economy, least environmental pollution and reliability.

To do above task, an automobile engineer should have adequate knowledge of maintenance and maintenance methods.

COMPETANCY STATEMENT:

The student will be able to:

1. Understand use of tools and equipments.
2. Draw layout of Automobile workshop.
3. Compare and understand types of maintenance systems.
4. Critique whether to repair or replace.
5. Execute dismantling of assemblies.
6. Check the parts for proper functioning.
7. Execute various adjustments to be done for proper functioning.
8. Execute tuning of assemblies.

COURSE CONTENTS:

Topic No.	Content	Hours
1	**Maintenance management and record Keeping** 1.1 Necessity of maintenance 1.2 Types of maintenance and their applications 2.2.1 Preventive maintenance system. 2.2.2 Scheduled maintenance system 2.2.3 Break down maintenance system 1.3 General servicing procedure. For two wheeler & four wheeler Decision to repair or replace. 1.4 Workshop records- history sheet, work order, activity file	**04**
2	**Auto Workshop Layout & Equipments** 2.1 General safety precautions. 2.2 Functions of General shop equipments and tools -wheel balancer, wheel aligner, crankshaft aligner and straightner, engine analyzer, arbor press, drill press, battery charger & tester, tire changer, car washer, lift, FIP calibration machine, head light aligner, valve grinder, honing machine, cylinder boring machine, bearing puller, spark plug tester,growler,cylinder bore gauge 2.3 List of tools & equipments required for two wheeler & four wheeler	**04**
3	**Engine Maintenance** Part A: 3.1 Troubles, Causes & remedies in engine, fuel system, cooling system, lubrication system & MPFI Engine. 3.2 Checking and Servicing of following engine components: cylinder head, cylinder block, cylinder liners, piston, piston ring, crank-shaft, connecting rod, valves. 3.3 Tuning of engine Part B: 3.4 Fuel feed system service carburetor dismantling, cleaning and tuning, injector cleaning and testing, FIP phasing and calibration, MPFI -injector testing and cleaning. Sensor testing 3.5 Lubrication system service. – change oil filter, check oil pump, and diagnose causes for excessive oil consumption, external oil leakage, and low oil pressure in an automobile engine.	**06**
4	**Transmission system** Adjustment of clutch. 4.1 Troubles, Causes and remedies of clutch. 4.2 Troubles, Causes and remedies of gearbox	**04**
5	**Brakes** 5.1 Inspection and repair of master cylinder, wheel cylinder, brake drum, and brake disc, brake linings and brake pads. 5.2 Adjustment of hydraulic brakes – shoe clearance, brake pedal free	**04**

	travel, pedal to wall clearance, parking brake adjustment. 5.3 Troubles, Causes and remedies in brake system.	
6	**Wheel,tyres & suspension** 6.1 Troubles, Causes and remedies of suspension system. Lubrication of leaf springs 6.2 Procedure of wheel alignment (after chassis height adjustment) by wheel alignment gauges and procedure of wheel balancing. Troubles, Causes and remedies of steering system. 6.3 Care of wheels and tires.	**04**
7	**Frame & body repair** 7.1 Frame repairs (cracks, loose rivets, and skewness in frames) and alignments. 7.2 Body repairs- denting, denting tools and equipments 7.3 Repainting procedure, patch work. 7.4 Painting defects	**03**
8	**Precautions & some Dos & Don'ts** 8.1 Instructions regarding inspection & maintenance-drive belt,engine oil & filter,gear oil,engine coolant,spark plugs,air cleaner,clutch padel,tyres,battery 8.2 Instructions for-power window,immobilizer key,seat belt,jacking the vehicle for tyre changing,parking brake 8.3 Instructions for safe driving,body work care,vehicle cleaning	**03**
	Total	**32**

TERM WORK: It shall consist of journal, based on the following experiments

Experiments:

1 Visit to car washing center. Study necessary equipments & activites.Prepare a report
2 Dismantle available engine, clean, inspect & repair engine components. Assemble the engine
3 Dismantle the two wheeler carburetor, clean inspect & repair components, Tune the carburetor
4 Overhauling of clutch & gear box-repair, replacement of components & reassembly
5 Adjustment of mechanical and hydraulic brakes and renewal of brake liners, repairing of master cylinder, wheel cylinder, brake chamber, break bleeding.
6 Repair & maintenance of cooling system components
7 Repair & maintenance of car air conditioners.
8 Visit to Wheel alignment & wheel balancing center & study setting of different steering geometry parameters. Understand wheel balancing procedure. Prepare a report
9 Visit to 2 wheeler & 4 wheeler service center/workshop
Draw layout, list equipments& tools, procedures, records, warranty claims
10 Collect information on following topics from internet/vehicle manuals/etc
A) Maintenance of MPFI engine
B) Prepare PPT on different tools & equipments for automobile maintenance
C) Developments in body repairs & paintings

Reference Books:

Sr. No.	Title & edition	Author	Publisher
01	Automotive Service	Tim Gills	Delmar Publisher Inc.
02	Automobile Mechanics	Crouse / Angling.	TATA McGraw – HILL
03	Automobile Engineering Vol. III Auto Marketing and Workshop Techniques	Anil Chikara	Satya Prakashan, New Delhi
04	Automobile Engineering Vol. IV Body repair techniques	Anil Chikara	Satya Prakashan, New Delhi
05	Automobile Engineering Vol. V Paint techniques	Anil Chikara	Satya Prakashan, New Delhi
06	Automobile Engineering Vol. I	Dr. Kirpal Singh	Standard Publishers.
07	Motor Automotive Technology	Anthony Schwaller	Delmar Publisher Inc.
08	Heavy Duty Truck System	Ian Norman, Robert Scharff, John Corinchoke	Delmar Publisher Inc.
09	Santro & Accent Basic training Book	--	Hyundai Motors India Ltd.
10	Service Manuals of all Euro –III & IV vehicles.	--	Maruti motors India Ltd.
11	Automotive Mechanics	S.Srinivasan	Tata McGraw Hill.

5A409- ADVANCED AUTOMOBILE ENGINES

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	03		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks	20	80	25	--	25	150
TOTAL	05	Duration	1.00	3.00	--	--	--	--

RATIONALE:

This is a technology subject. This subject forms basis for Sixth Semester Subject of Vehicle Maintenance and Garage Practice. In the era of globalization and open economy, many Indian and foreign manufacturers are producing high technology vehicles. This subject enables a candidate to understand advanced engine technologies. With shortage of conventional petroleum fuels, all alternative fuels and sources of energy are becoming increasingly popular, and significant. This course will enable a candidate to understand the alternative energy sources and fuels of future.

Understanding advanced engine technology will enable an engineer to test and service such engines. Advanced auto technology engines include certain features like MPFI, CRDI, and hybrid drives. This course will enable candidates to diagnose engine condition including On-board diagnosis and stand-alone diagnosis.

COMPETENCY STATEMENTS:

To understand the various components of the automobile and their working principals
To understand the drive cycle for measurement of pollutants

COURSE CONTENTS:

Topic No.	Content	Hours	Marks
1	**Engine Selection** 1.1 Comparison of SI and CI engines on the basis Thermal efficiency and fuel consumption 1.2 Comparison of SI and CI engines on the basis of thermodynamic and operating variables. 1.3 Comparison of performance characteristics. S.I. and C.I. Engine application- with purpose of selection. Note: - assignment on comparative study of engine specification and it rating on basis of various parameters	**05**	**09**
2	**Fuels and Alternative Energy Options for Auto Engines** 2.1 Different types of fuels, calorific value 2.2 Properties of S.I. Engine fuel	**08**	**15**

	2.3 Properties of C.I. Engine fuel 2.4 Fuel additives and their effects 2.5 LPG as SI engine fuel. 2.6 Alcohol as gasoline fuel blends. 2.7 Alcohol as CI engine fuel. 2.8 Natural gas as a Transport fuel. 2.9 Electric cars and hybrid vehicles.		
3	**Theory of Combustion** 3.1 Ignition limits 3.2 Stages of combustion in SI engine 3.3 Effect of engine variables on Ignition lag. Effects of engine variables on flame propagation 3.4 Abnormal combustion- Detonation, pre-ignition, surface ignition, Effects of detonation. 3.5 Control of detonation. 3.6 SI engine combustion Chambers 3.7 Stages of combustion in CI engine 3.8 Air Fuel ratio in Diesel engines 3.9 Delay period and variables affecting delay period. 3.10 Diesel knock and its control.CI engine combustion chambers	**09**	**15**
4	**Computer Controlled Fuel-Injection System** **PART A** 4.1 Throttle body injection (TBI) system, comparison with carbureted engine fuel supply system. 4.2 Multi-Point fuel Injection system (MPFI)/ Port fuel injection (PFI) system. Types of injection- sequential, grouped and simultaneous injections. Comparison of MPFI and TBI systems. 4.3 Electronic control module (ECM) control functions. 4.4 Inputs and outputs of electronic control module (ECM). 4.5 Output control functions- Fuel Injection control, Spark advance control, idle speed control, Exhaust gas recirculation control and other controls **PART B** 4.6 Construction and working of fuel Injector and fuel pump. 4.7 Electronically controlled diesel Injection pump. 4.7.1 Electronic control system 4.7.2 Fuel system 4.7.3 Glow plug circuits 4.7.4 Injection pump timing 4.7.5 Electronic Injection advance. Common rail direct injection system	**08** **09**	**14** **13**
5	**Fuel Economy, Air pollution and Emission Control** 5.1 Fuel Economy standards. 5.2 Methods of improving fuel economy. 5.3 Pollutants from gasoline engines.	**09**	**14**

	5.4 Effect of engine maintenance on exhaust emission 5.5 Gasoline engine emission control, Catalytic Converters. 5.6 Diesel emission, Diesel smoke and control 5.7 Exhaust-Gas recirculation (EGR) - EGR Valve and control 5.8 Early fuel evaporation system 5.9 Positive crankcase ventilation (PCV) system 5.10 Electric assist choke system 5.11 Evaporation emission control system 5.12 Euro Norms and Bharat stage Norms. Equipment for checking Exhaust emission from vehicles. 5.13 Comparison of diesel and gasoline emissio		
		48	**80**

PRACTICALS:

1. Cylinder Head Observation and Combustion Chamber Identification:
   Remove the cylinder head of an engine. Observe the combustion chamber, location of valves, spark plug or Injector.
2. Study of Decarbonization of combustion chamber. Clean and refit.
   Use any four engines: - a) Bullet, b) Luna, c) Multi cylinder Petrol Engine, d) Multi-cylinder Diesel engine, e) Scooter Engine.
   Interpret the type of combustion chamber. Sketch them and describe the construction.
   State the characteristics of the combustion chamber.
   Check the valve-valve seats for leakage. Check the condition of Spark Plug or fuel injector. Check the glow plug operation.

3 Valve Clearance Adjustment and Valve Timing Investigation:
- Perform Tappet setting of a single cylinder four-stroke engine.
- Perform Tappet setting of a multi cylinder engine.
- Construct the Port timing diagram of a two- stroke engine.
- Construct the Valve timing diagram of a four-stroke engine.

4. Electronic Fuel Injection System Diagnoses:
   Diagnose Electronic fuel Injection system with diagnostic tester/ engine scanner.
   Perform On-Board diagnosis.
- Read trouble code at engine check Light/Malfunction Indicator light.
- Use Engine scanning tool for diagnosis
- Locate various Components of Electronic fuel injection system.
- Identify components of EFI system.
- Perform stand –alone diagnosis using a Multi-meter and test lamp.

5Exhaust Gas Analysis:
Perform Exhaust gas analysis of an engine exhaust using 4-gas analyzer:
- Diagnose engine condition from exhaust gas analysis.
- Follow test cycle –modes of operation.

TEXT BOOK:

Sr. No	Title and Edition	Author	Publisher
1.	Motor Automotive Technology	Anthony Schwaller	Delmar Publisher Inc.
2.	Automotive Service	Tim Gills.	Delmar Publisher Inc.
3.	A Course in Internal Combustion engine	M.L Mathur, R.P.Sharma,	Dhanpat Rai Publication
4.	Automobile Engg. Vol.-2	Dr. Kirpal Singh.	Standard Publishers.
5.	Automobile Engineering Vol.1	Anil Chikara,	Satya Prakashan, New Delhi
6.	Automobile Mechanics	Crouse / Anglin.	TATA McGRAW – HILL
7.	Internal Combustion Engines	V.Ganeshan.	TATA McGRAW – HILL

REFERENCE BOOK:

Sr. No	Title and Edition	Author	Publisher
1.	Santro & Accent Basic training Book	Identified Experts,	Hyundai Motors India Ltd.
2.	Service Manuals of all Euro –II vehicles.	Identified Experts,	Maruti motors India Ltd.

5A410- AUTOMOBILE SYSTEMS II

COURSE STRUCTURE:

Teaching Scheme		Evaluation scheme						
TH	03		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks	20	80	25	--	25	150
TOTAL	05	Duration	1.00	3.00	--	--	--	--

RATIONALE:

This subject is Core Technology subject for Automobile Engineering course. This subject is part of Automobile systems concerning control of vehicles. Knowledge of this subject is required in the subjects like Automobile Component Design, Vehicle maintenance, vehicle testing. Conceptual knowledge of this subject is useful for understanding and improving the performance of Automobile system.

COMPETENCY STATEMENT(S):

1. Understand construction, working and functions of Automobile control systems such as steering, braking and suspension.
2. To know developments in body engineering, control systems and safety equipment.

COURSE CONTENTS:

Topic No.	Content	Hours	Marks
01	**Front Axle and Steering :** 1.1 Types of front axle - Dead axle, live axle, type of stub axle arrangements- Elliot, reverse Elliot, lamoine, reverse lamoine. 1.2 Steering geometry – Caster, camber, king pin inclination, toe in– toe out, Correct Steering angle. 1.3 Under steering and over steering, Turning radius & its effect. 1.4 Construction, working & application of Steering gear box – rack and pinion type, recirculating ball type, worm & roller type. 1.5 Steering linkages & special steering column. 1.6 Hydraulic power steering.	**10**	**16**

Topic No.	Content	Hours	Marks
02	**Brakes:** 2.1 Classification of brakes 2.2 Principle, construction and working of -disc brakes, drum brake. 2.3 Construction and working of the following-- Mechanical braking system, Hydraulic Braking system, Air braking system, Hydraulic operated air assisted braking system. 2.4 Properties of brake fluids 2.5 Parking brake.	10	16
03	**Suspension Systems :** 3.1 Types of suspension systems - Rigid & independent suspension 3.2 Types of Independent suspension system-McPherson strut, wishbone type. 3.3 Semi-elliptical Leaf spring, coil spring , torsion bar arrangement 3.4 Telescopic hydraulic shock absorber 3.5 Air Suspension System. 3.6 Anti roll bar, stabilizer bar.	08	14
04	**Automobile body:** 4.1 Types of bodies 4.2 Materials used in body construction 4.3 Automotive paints & primers 4.4 Protective and anti corrosive treatments, painting procedure	08	12
05	**Car Heating Ventilation & Air Conditioning System(HVAC):** 5.1 Ventilation system 5.2 Heating system 5.3 Basic principle-vapour compression cycle, layout & operation of HVAC 5.4 Type of refrigerant used in car air conditioning & their properties 5.5 Temperature control system, humidity control.	06	12
06	**Advances in automobiles & safety features** 6.1 Electric power steering 6.2 Concept of anti lock braking system 6.3 Gas filled shock absorber 6.4 Safety features such as air bags, exhaust brake, collapsible steering	06	10
	Total	48	80

TERM WORK: It shall consist of journal, based on the following experiments

Experiments:

1. Open the steering gearbox, observe the components and steering linkages, sketch and assemble.
2. Observe and draw layout of hydraulic braking system. Open master cylinder, wheel cylinder, and brake drum. Observe and sketch the components.
3. Observe and study the air braking system of the vehicle
4. Open, observe and sketch leaf spring and assemble.
5. Dismantle telescopic shock absorber, observe and sketch its components.
6. Observe and draw the layout of air suspension system.
7. Visit to body repair & painting industry. prepare a detailed report
8. Study air conditioning of a car. Locate the components, measure temp at various places.
9. Visit to service station of a four wheeler

REFERENCE BOOKS:

Sr. No.	Title and edition	Author	Publisher
1	Automobile Engineering Vol.I	Kirpal Singh	Standard Publication
2	Automobile Engineering Vol. II	Anil Chikara	Satya Prakashan New Delhi
3	Automobile Engineering	R.B. Gupta	Satya Prakashan New Delhi
4	Automobile Mechanics	Crouse / Anglin.	TATA McGRAW – HILL
5	Motor Automotive Technology	Anthony Schwaller	Delmar Publisher Inc.
6	Automotive Service	Tim Gills	Delmar Publisher Inc.
7	Automotive Mechanics	S. Srinivisan	TATA McGRAW – HILL

5R411- MECHANICAL ENGINEERING MATERIALS

COURSE STRUCTURE:

Teaching Scheme		**Evaluation scheme**						
TH	03		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks	20	80	25	--	25	150
TOTAL	05	Duration	1.00	3.00	--	--	--	--

RATIONALE:

Mechanical Engineering Materials is a core technology subject in Mechanical Engineering Discipline. A Mechanical Engineering diploma holder deals with various materials required for cutting tools, Dies, Gears, Bearings and many other applications. Knowledge of selection of proper tool materials, heat treatments for specific materials, ferrous and non- ferrous materials and their alloys for various engineering application, as well as insulating, refractory and plastic materials as per the requirements is essential.

COMPETENCY STATEMENT(S):

Select the proper materials for the different engineering applications considering their structure-property-application relationships.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
1.	**Engineering Materials and their Properties** 1.1 Classification of engg material as amorphous & crystalline, ferrous & non ferrous 1.2Introduction to non metallic materials like polymers,rubber,plastic,ceramics,abrasive,adhesive & insulating materials such as cork,asbestos,composite material 1.3 Unit cell & space lattice with particular reference to iron 1.4 Properties of metals such as elasticity,toughness,tensile strength,ductility,hardness etc	**04**	**06**
2.	**Equilibrium diagrams** 2.1 Definition of phase, pure metal, alloy 2.2 Solid solution-Substitutional & interstitial 2.3 Solidification of pure metal & alloy with the help of cooling curves 2.4 Equilibrium diagram for isomorphous,eutectic,peritectic & eutectoid systems	**04**	**06**

3.	**Iron-carbon diagram & steels, cast iron** 3.1 Iron carbon diagram-Study of various phases, three reactions of iron carbon diagram i.e. eutectic, eutectoid & peritectic, critical temperature on iron carbon diagram. 3.2 Concept of steel & cast-iron on diagram as hypereutectoid steel, eutectoid steel, hypereutectoid steel, hypoeutectic cast iron eutectic cast iron, hypereutectic cast iron 3.3 Classification of plain carbon steel as low, medium and high carbon steel	**06**	**10**
4.	**Heat Treatment of Steels** 4.1 Transformation in steel on heating-Conversion of pearlite to austenite,TTT curves for steels, transformation of austenite to pearlite,bainite & martensite.critical cooling rate, continuous cooling rates & isothermal cooling 4.2 Hardening-purpose, hardening temp range, conventional hardening,martempering,structure of martensite & properties 4.3 Tempering-low temperature, medium temperature, high temperature tempering processes, purpose of each 4.4 Annealing- Purpose of annealing, processes like full annealing, isothermal annealing, spherodising annealing. Annealing temperature range 4.5 Normalizing-Purpose of normalizing, normalizing process, normalizing temperature range 4.6 Subzero treatment-Purpose of subzero treatment, retained austenite &its effect 4.7 Surface hardening-Necessity of surface hardening of steels, surface hardening methods such as flame hardening, induction hardening with application. Case hardening methods such as carburizing,nitriding,cyaniding	**12**	**18**
5.	**Alloy steels** 5.1 Effect of alloying element on Iron-carbon diagram,TTT diagram 5.2 Properties & uses of common alloying elements, effect on properties of steel 5.3 Examples of alloy steels- free cutting steels, stainless steel & its types, tool steels, heat treatment of tool steel, spring steel, properties & application	**05**	**10**
6.	**Specification of steels & cast iron** 6.1 Indian standard and American standard(AISI), British specifications(only En1,En8,En24,En31,En42) 6.2 selection steels for various components like- Wood cutting saw, hack saw blade,drills,milling cutter, cold blanking die, hot forging die, cold drawing die, jaw crusher plates, bulldozer plates, household utensils, dental instruments, leaf spring,gears,ball bearing, camshaft & crankshaft	**04**	**06**

7	**Cast irons** 7.1 Classification of cast iron 7.2 Structure, properties & application of white & grey cast iron 7.3 Production of malleable, nodular cast iron 7.4 Structure, properties & application of Malleable & Nodular cast iron	**04**	**08**
8	**Manufacturing of steels** 8.1Classification of methods for Manufacturing of steels(only introduction) 8.2 Manufacturing of steel by Induction furnace method	**03**	**04**
9	**Non ferrous metals/alloys** 9.1 Properties & application of copper & copper alloys such as brass, tin bronze 9.2 Aluminum & aluminum alloys(LM series only) 9.3 Bearing material	**04**	**08**
10	**Powder Metallurgy** 10.1 Description of powder metallurgy process-powder making,blending,compacting,sintering,infiltration & impregnation 10.2 Advantages & limitations of powder metallurgy 10.3 Application of powder metallurgy	**02**	**04**
	Total	**48**	**80**

TERM WORK:
It shall consist of journal, based on the following experiments

List of Practical:

1. Demonstration of metallurgical microscope and study of electron microscope.
2. Preparation of specimen.
3. Study of iron-carbon diagram and TTT diagram.
4. Demonstration of Muffle furnace & study of electric arc furnace
5. Study of temperature measuring devices like pyrometers, thermocouples,
6. Jomny and quench test.
7. Study of micro structures of following,

   Pure iron, 0.2, 0.4, 0.8 & 1.2 carbon steels. White, gray, malleable, nodular, cast irons and hardened steels
8. End color coding of steels.
9. Collect following data on commonly used steels & cast-iron

   a) Size availability b)Prices c)Recommended heat treatment d)Applications

10. Collect following information from internet/magazines/manuals/cataloges
    i) Aerospace material
    ii) Ship building material
    iii) Engg application of non ferrous material
11. Visit to metallurgical industry/lab to study different testing procedure such as hardness measurement, spectro analysis, and preparation of mounting for micro structural observation, Specimen preparation, study different furnaces & heat treatment

REFERENCE BOOKS:

SN	Title & edition	Author	Publication
01	A Text Book of Material Science and Metallurgy	O.P.Khanna	Dhanpat Rai and Sons [1999]
02	Material Science And Metallurgy	Dr.V.D. Kodgire	Everest Publishing House [1990]
03	Material Science and Engineering	R.K.Rajput	S.K.Katari and Sons [2002 reprint 2003]
04	Material Science and Processes	S.K.Hazra and Choudhari	Indian Book Distribution Co. [1982]
05	Engineering Materials Properties and Selection	Kenneth G. Budinski and Micheal K. Budinski	Pearson Education, New Delhi
06	ASME Material Manuals	ASME	
07	Introduction to Physical metallurgy	Sidney H. Avner	Tata Mc Graw Hill edition (2^{nd})

5Q202- STRENGTH OF MATERIALS (SOM)

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	03		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks	20	80	25	--	25	150
TOTAL	05	Duration	1.00	3.00	--	--	--	--

RATIONALE:

Civil engineer should be able to analyze behavior of materials and structures under various types of loads. This course enables to understand different types of forces and corresponding effects on materials and structural elements under various types of loads so that suitable material of suitable strength can be selected for the structural components.

COMPETENCY STATEMENTS:

1. To study development of different types of stresses and strains in structural elements due to various types of actions viz. tension, compression, shearing, bending, twisting, temperature change etc.
2. To investigate the strength of structural elements of different materials under various types of loadings.
3. Testing of materials used in civil engineering structures to find their properties, behavior and failure patterns under different loading condition conforming to BIS standards.

COURSE CONTENTS:-

	Name of the Chapter / topic (Follow S.I. units)	**Hours**	**Marks**
1.	**Simple Stress & Strain** **1.1.** Definition of stress, strain, Hooke's law, Modulus of elasticity, Classification of stresses, strains, sign conventions. Lateral strain, Poisson's ratio **1.2.** Stress-strain curve for mild steel and HYSD bar, Yield stress/ Proof stress, Ultimate stress, Breaking stress and Percentage elongation. **1.3.** Bars of uniform and stepped cross sections under axial load, Composite sections under axial load, modular ratio, equivalent area.	**05**	**08**
2.	**Shear stress and shear strain** **2.1.** Concept of shear load, shear stress, shear strain, modulus of rigidity **2.2.** State of simple shear, complementary shear stress, punching shear **2.3.** Relation between modulus of elasticity, modulus of rigidity (No derivation of formula)	**05**	**06**

3.	**Volumetric strain** **3.1.** Concept of biaxial stresses, triaxial stresses **3.2.** Volumetric strain, formula for volumetric strain and change in volume due to uni-axial, biaxial and tri-axial stresses, bulk modulus, relation between modulus of elasticity and bulk modulus (No derivation of formula) **3.3.** Relation between modulus of elasticity, modulus of rigidity and bulk modulus(No derivation of formula)	**06**	**08**
4.	**Temperature Stresses and strains** **4.1.** Free deformation of a simple bar due to temperature variation, thermal coefficient **4.2.** Development of temperature stress **4.3.** Temperature stresses in bars of uniform section - deformation prevented partially and fully	**03**	**06**
5.	**Shear Force and Bending Moment in beams** **5.1.** Types of beams, types of loading, types of supports **5.2.** Concept of shear force and bending moment, sign conventions. **5.3.** Point of contraflexure **5.4.** Relation between bending moment, shear force and rate of loading **5.5.** Shear force and bending moment diagrams for cantilever beam, simply supported beam, simply supported beam with overhang(s) subjected to point loads, uniformly distributed loads and couple	**08**	**14**
6.	**Shear stresses in beams** **6.1.** Shear stress equation with meaning of terms in equation, shear stress distribution for solid rectangular and solid circular sections. **6.2.** Relation between max. shear stress and average shear stress for rectangular and circular solid sections	**03**	**06**
7.	**Bending Stresses in Beams** **7.1.** Bending of different types of beams(elastic curves) and development of bending stresses and their nature, neutral axis. **7.2.** Theory of simple bending, assumptions in theory of simple bending, flexural formula with meaning of all terms, section modulus, bending stress distribution diagram, moment of resistance. **7.3.** Application of theory of bending to symmetrical and unsymmetrical cross sections of beam viz. rectangular, hollow rectangular,circular,hollow circular, I- section, T-section, angle section, channel section	**06**	**10**
8.	**Direct & Bending Stresses** **8.1.** Concept of direct load & eccentric load **8.2.** Tension & short compression members subjected to eccentric load with eccentricity about one principle axis only,	**07**	**12**

	maximum and minimum stress, resultant stress distribution diagrams **8.3.** Rectangular section subjected to load eccentric about one/both axes **8.4.** Condition for no tension, middle third rule, core of the section and limit of eccentricities for rectangular and circular sections **8.5.** Determination of resultant stresses for dam with upstream face vertical. Conditions of stability of dam section.		
9.	**Torsion** **9.1.** Theory of pure torsion-assumptions **9.2.** Torsion equation, moment of resistance, polar modules **9.3.** Shear stress distribution across solid and hollow circular shaft. **9.4.** Strength of circular shafts & hollow circular shafts, No problems on comparison of circular & hollow circular shafts in terms of weight, strength **9.5.** Power transmitted by shaft	**05**	**10**
	TOTAL	**48**	**80**

TERM WORK: -

It shall consist of journal, based on the following experiments
Experiments: - Journal shall consist of any 10 experiments form the following list.

1) Tension test on mild steel specimen - to calculate weight per meter length, yield stress, ultimate stress and percentage elongation to check suitability of material as per BIS requirement
2) Tension test on deformed steel (tor steel) - to calculate weight per meter length, proof stress, ultimate stress and percentage elongation to check suitability of material as per BIS requirement.
3) Compression test on timber- to find the crushing strength along the grain and across the grain/ compression test on Metals
4) Flexural test on timber beam - to plot load deflection curve, to calculate the maximum bending stress at elastic limit, to calculate modulus of elasticity
5) Flexural test on roofing tiles and flooring tiles – to check their suitability as per BIS requirement
6) Field tests and Compression test on bricks - to calculate crushing strength and to classify the bricks as per BIS standards
7) Abrasion test on flooring tiles.
8) Water absorption test on bricks, roofing tiles and flooring tiles.
9) Shear test on any two metals
10) Cold bent test on mild steel and deformed steel.
11) Brinell hardness / Rockwell hardness test
12) Izod impact and Charpy impact test.
13) Torsion Test on mild steel and cast iron.

TEXT BOOKS:

S.No.	Name of Book	Author	Publication
1.	Strength of Materials	Ramamrutham	Dhanpatrai publishing Co.
2.	Strength of Materials	R.S. Khurmi	S. Chand & Co., N. Delhi
3.	Strength of Materials	Sunil Deo	

REFERENCE BOOKS:

S.No.	Name of Book	Author	Publication
1.	Strength of Materials	Powpov	
2.	Strength of Materials	S.S. Ratan	Tata McGraw hill
	Strength of Materials	Alfred P. Poorman	Mc Graw Hill Book Co. Inc.
3.	Mechanics of Materials	Ferninand P. Beer, E.Russel Johnson	Mc Graw Hill Book Co. Inc.

5R412-INDUSTRIAL VISIT

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	00		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks			50	--	--	50
TOTAL	02	Duration			--	--	--	--

COMPETENCY STATEMENT (S):

- To expose students to industry and industry environment
- To inculcate ability of developing observation of various practices adopted in industry.
- To Practically observe the manufacturing processes.
- To get acquainted with the advanced technologies in industries.
- To cope up with latest knowledge in the industries.
- To observe and record details of industry as regards layout, organizational structure, manufacturing processes, equipment details and layouts, and quality practices followed in industry.
- To systematically write a detailed report about visit.
  The purpose of introducing industrial visits is to provide opportunity to students to observe the practical manufacturing environment prevailing in industries, which will enable them to correlate the theoretical concepts

RATIONALE:

from curriculum to practical realities.

Due to globalization and rapid technical advancements, the technologies followed in industries are rapidly changing. There are significant changes in the manufacturing processes adopted along with new concepts of quality enhancements. By industrial visits students will get a chance to observe these advancements.

OBJECTIVES:

At the end of the course student should be able to-

- Acquire information from different sources.
- Prepare structured format of industrial visit concerned to industry to which the visit is arranged
- Interact with peers to share thoughts.
- Prepare a report on industrial visit.

IMPORTANT NOTE:

Industrial visits of short and long duration can be arranged by the faculty as per convenience and need of the present days. It is expected that the students will be exposed to industrial atmosphere. This may comprise of a total of all short and long duration visits.

It is expected that the faculty should design a structured visit format depending on the production of the industry to be visited before the visit is undergone and should distribute to all the students.

The task of report writing and evaluation is expected to be completed in 16 hours duration.

CONTENTS:

1. **Structured Visits** **(H-02)**
   Structured industrial visits be arranged to any of the following:

i) Nearby Petrol Pump. (Fuel, oil, product specifications)
ii) Automobile Service Station (Observation of Components / aggregates)
iii) Engineering Workshop (Layout, Machines)
iv) Dairy Plant / Water Treatment Plant
v) Manufacturing organizations for observing various manufacturing processes including heat treatment
vi) Material testing laboratories in industries or reputed organizations
vii) Auto workshop / Garage
viii) Plastic material processing unit
ix) ST workshop / City transport workshop
x) Manufacturing unit to observe finishing and super finishing processes.
xi) City water supply pumping station.
xii) Sugar Factory / Dairy / Chemical Industry / Thermal Power Plant.
xiii) Machine shop having CNC machines.
xiv) ST workshop / Auto service station.
xv) Automobile manufacturing / auto component manufacturing units to observe the working of SPM.
xvi) Refrigeration and air conditioning manufacturing / servicing units / industries / workshops.
xvii) Automobile service stations for four wheelers.
xviii) Co-ordinate measuring machine to observe its construction working specifications and applications.
xix) Auto Engine Testing unit to gather details regarding the testing procedures/parameters etc.
xx) Wheel Balancing unit for light and/or heavy motor vehicles.
xxi) Food processing unit.
xxii) Textile industry machinery manufacturing / servicing units.
xxiii) Hydro electric and Thermal power plants.
xxiv) Automotive Research Association of India, Pune , Central Iinstitute of Road Transport, Pune, Vehicle Research and Development establishment , Ahmednagar.
xxv) Engine testing; exhaust gas analysis and vehicle testing.
xxvi) PWD workshop.
xxvii) Safety museum at Central Labour Institute, Saion, Mumbai.
xxviii) Material Handling System, quality control charts / production record / layout flow systems / Facilities / Hydraulic & pneumatic systems / Working of Boilers and steam engineering applications.

xxix) Auto / Electronic equipment manufacturing industry.
xxx) Cement / Sugar / Chemical / Textile / Steel rolling mills / extrusion industries.
xxxi) Material handling in mines or ports.
Earth Moving Equipment Maintenance Shop.

2. Report Writing (H-01)

The students should collect the structured visit format from the faculty. The report shall be submitted by individual student in structured format given by the faculty after the industrial visits. This report will form a part of the term work.

Teaching Methodology:

1. Preparing for the industrial visits.
2. Acquiring permissions from the organization.
3. Conducting the industrial visits.
4. Report writing.

5A414- PRODUCTION ENGINEERING

COURSE STRUCTURE:

Teaching scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	TOTAL
PR	02	Max. Marks	20	80	25	--	25	150
TOTAL	06	Duration	1.00	3.00				

RATIONALE:-

In changing industrial scenario the importance of productivity is becoming more and more critical. A diploma engineer working at lower level management in industries, they play a vital role in above aspects. Developing a positive attitude in employees towards the productivity is crux of industrial engineer.

A supervisor can achieve highest level of productivity by using proper workplace layout, proper methods of processing. At the same time principles of motion economy reduces stress and fatigue in workers.

COMPETENCY STATEMENT:-

1. To gain expertise in specialized aspects of industrial engineering system.
2. To design workplace using 5S principles, conduct method study,
3. able to apply motion economy principles, able to apply techniques of work measurement,
4. able to convince the workers the importance of work study in improving productivity.

:

COURSE CONTENTS:

Topic No	Content	Hours	Marks
1	**BASIC CONCEPTS OF PRODUCTIVITY:-** 1.1 Definition, productivity measurement at national, industrial and enterprise level, 1.2 benefits of higher productivity, 1.3 various productivity measurement approaches such as total productivity , total factor productivity ,return on investment 1.4 Productivity of materials, productivity of land, buildings, machines and manpower, factors contributing to productivity improvement	**07**	**06**
2	**TECHNIQUES FOR PRODUCTIVITY MEASUREMENT:-** 2.1 Work content and ineffective time, 2.2 improving productivity by reducing work content, 2.3 improving productivity by reducing ineffective time, 2.4 roles of management, supervisor, worker in work study. 2.5 Essential qualities of work study engineer.	**07**	**06**

3	**METHOD STUDY:-** 3.1 Definition, 3.2 objectives, 3.3 procedure of method study, 3.4 process chart symbols, 3.5 flow process chart, 3.6 travel chart, 3.7 Multiple activity chart, 3.8 string diagram. 3.9 Questioning technique 3.10 primary questions, secondary questions. 3.11 Consider courses of action, define new method implement the new method 3.12 follow up the development by routine checks	**10**	**12**
4	**MOTION STUDY:-** 4.1 Principles of motion economy, 4.2 use of human body , 4.3 arrangement of work place , 4.4 Introduction to 5s , 4.5 Design of tools and equipment. 4.6 SIMO chart, 4.7 Therbligs, 4.8 Memo motion study, 4.9 Micro motion study.	**08**	**12**
5	**WORK MEASUREMENT:-** 5.1 Purpose, 5.2Techniques of work measurement such as Work sampling , 5.3 PTS (predetermined time standards) , 5.4 Standard data	**06**	**11**
6	**TIME STUDY:-** 6.1 Definition, Objectives 6.2 Time study equipment- stop watch, time study board, time study forms. 6.3 Selecting the job, 6.4 Selecting the worker, 6.5 Determining basic time, work allowances, standard time, Numericals	**06**	**11**
7	**LOCATING AND CLAMPING METHODS:** 7.1 Introduction. 7.2Basic principles of location 7.3 Locating from plane surface 7.4 Locating from circular surface. 7.5 Locating from irregular surface. 7.6 Locating methods and devices. 7.7 Basic principles of clamping. 7.8 Clamping devices.	**08**	**10**

8	**INTRODUCTION TO FIXTURES:** 8.1 Introduction, 8.2 types of fixtures- vice fixtures, 8.3lathe fixtures- chucks, face plate fixtures, magnetic and vacuum chucks. 8.4Milling fixtures- single piece milling, string milling, reciprocal milling, progressive milling , index milling, rotary milling.	**06**	**06**
9	**INTRODUCTION TO DRILL JIGS:** 9.1 Introduction, definition, 9.2Types of drill jigs- leaf jigs, box and tumble jig, template jigs, plate jig , Universal or pump jigs, 9.3 drill bushings.	**06**	**06**
	Total	**64**	**80**

PRACTICALS:

1. Collecting information about productivity on Internet, from NPC(National Productivity council).
2. .Case study on increasing productivity of a small work place.
3. Conducting method study for particular operation and alternative method should be suggested.
4. Conducting time study on operator.
5. To study advanced manufacturing techniques- kaizen, Poke Yoke.
6. Above practical should be conducted in respective industries so that students get acquainted with emerging trends in Industrial Engineering.
7. Submit 2D drawing of any one type of drill jig.
8. Submit 2D drawing of any one type of fixture.
9. Submit 2D drawing of different types of locating devices.
10. Submit 2D drawing of different types type of clamping devices.
11. Use of software for calculation of total time.

REFERENCE BOOKS:

Sr. No	**Title of Book**	**Author**	**Publication**
1	Introduction to Work-study	ILO,	Oxford publication
2	Work study	M.S.Mahajan	Vrinda prakashan
3	Industrial organization and supervisory management	O.P. Khanna,	Dhanpat Rai and Sons
4	Tool Design	Donaldson	Tata MCGraw Hill Publication Company limited

5A415-SPECIAL PURPOSE VEHICLES

COURSE STRUCTURE:

Teaching scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	TOTAL
PR	02	Max. Marks	20	80	25	--	25	150
TOTAL	06	Duration	1.00	3.00	--	--	--	--

RATIONALE:

In the fast developing economy of India, the infrastructure development is at its peak. Earth moving machines are integral part of infrastructure development activity. India being largest market of Tractor in the world, it is necessary for automobile engineer to have full knowledge of tractor or agricultural machinery.
Hence these two categories of off-highway vehicles are primarily included in special purpose vehicles. This course in Automobile Engineering will make student to understand and apply the knowledge about various system and subsystems for servicing of these vehicles.

COMPETENCY STATEMENTS:

1 Know importance of earth moving machines and agricultural machines in India.
2 Identify various systems and subsystems of earth moving machines and agricultural machines
3 Explain working and construction of various systems and subsystems in earth moving machines and agricultural machines
4 Carry out preventive maintenance of earth moving machines and agricultural machines.

COURSE CONTENTS:

Topic No.	Content	Hours	Marks
01	**Earth Moving Machines – Introduction** 1.1 General layout,Application & Classification of earth moving machines.Comparison of tyred & crawler tractor 1.2 General Specifications of a typical earth moving machine. 1.3 Comparison between general automobile & earth moving machine on following parameters: • Traveling Speed • Working conditions • Power output & power variations	**14**	**12**

	• Controls • Torque & torque variations. • Steering • Suspension • Fuel & fuel consumption • Hydraulics • Power take offs • Clutch • Brakes • Driving license • RTO registration 1.4 Implications of earth moving machines on economy & infrastructure development: • Next five year plan • Role of earth moving machine in road laying, bridge construction, building construction, tunnel, mining & in disaster management.		
02	**Tractor Dozer** 2.1 Tractor dozer- types, layout, power train & bucket swing Applications i.e. ripping, blasting Vs ripping. 2.2 Rippers – types i.e. hinge & parallelogram, their application & comparison. 2.3 Ripper tip selection. 2.4 Dozing & Underwater application. 2.5 Dozer blade – types i.e. straight dozer, angle dozer, S' blade, 'U' blade, 'C' blade, 'A' blade, and their applications. 2.6 Track shoe construction & working. 2.7 Under carriage maintenance. 2.8 Safety precautions for Dozer operations	**08**	**14**
03	**Dragline (Rope Operated Excavator)** 3.1 Applications of dragline i.e. excavating channels, ditches, trenches, underwater soil, stripping overburden, shallow grading, general excavation, loading into hoppers, loading hauling units, sloping & grading.(simple sketches only) 3.2 Clamshell **-** application, capacity, bucket, construction & size 3.3 Hoe and Cranes - their working & Application.	**08**	**12**
04	**Loaders & Excavators:** 4.1 Crawler loader – working & attachments i.e. standard bucket, bulk handling bucket, fork lift attachment, crane attachment Stability & safety of crawler loader operations. 4.2 Wheeled loader –types i.e. back hoe & front hoe, working, capacity & output. 4.3 Hydraulic Excavator: Application, block diagram,	**12**	**14**

	types of buckets & their applications e.g. 3 in 1 bucket, ejector bucket, square hole bucket, ditch digging bucket, clay bucket and hydraulic grab. 4.4 Scraper**:** Block diagram, types – Towed & self-propeller, 4.5 Motor Grader – Block diagram, constructions, application, stability & safety, capacity & outputs		
05	**Tractor:** 5.1 Comparison of tractor with an automobile 5.2 Indian tractor industry 5.3 General Layout of a tractor 5.4 Power train & transmission layout of a tractor 5.5 Tractor Power take off its working & construction 5.6 Tractor tyres construction & selection 5.7 Counterweight & its importance 5.8 Types of implements in tractors, its uses & its effect on performance of a tractor 5.9 Power tiller- Comparison with tractors, Various attachments & its applications	**12**	**16**
06	**Forklift Truck , tipper & road roller** 6.1 Forklift Truck- Types, layout, lifting mechanism, counterweight & steering mechanism. Safety in operation. 6.2 Tipper – Types, construction & working tipping mechanism & maintenance. Safety in operation of tipper.	**10**	**12**
	Total	**64**	**80**

List of Practical/ Assignments:

1. Visit to service center of Tractor or Dozer or Excavator or Fork lift or Road roller. Write report on various mechanisms used, service procedure adopted, cost of equipment and other financial aspects.
2. Visit to a mine/ construction site to observe various operations of Earth Moving Machines. Write a report on the visit.
3. Assignment on specifications and features like hydraulic circuit, control systems of any one earth moving machine,
4. Assignment on specifications and capacities of any one dozer. Draw the sketches of various dozer blades stating their applications.
5. Assignment on applications of any one Rope operated excavator/ fork lift.
6. Assignment on working of crawler loader and its attachments/ road roller types and operations.

Teaching Methodology:

- Lecture method without media.
- Lecture method-using media.
- Demonstration using LCD projector.

Teaching Resources: Overhead projector, LCD projector.

REFERENCES:

Sr. No	Title of Book	Author and Publication
1	Art of earth moving	Jagman Singh
2	Tractors and automobile.	Radichev
3	Tractors and their power units	Burge
4	Earth moving plant	Trucker
5	C. D.s: on various Topics of Automobile Engineering	SAE Publisher

5A416- VEHICLE AERODYNAMICS & DESIGN (VAD)

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	--	25	150
TOTAL	06	Duration	01	03	--	--	--	--

RATIONALE:

Use of aerodynamic shape in automobile are essential to increase fuel efficiency and allowing driving high speed with minimum air drag. The prerequisite subject like- auto systems, auto chassis, transmission etc. have been studied earlier. This subject is application of prerequisite knowledge involving vehicle stability & vehicle dynamics. Design of vehicles needs the knowledge of aerodynamics. The vehicle performance depends upon aerodynamics principles used which highlights importance of this subject. The knowledge of this subject can be used in vehicle body-work and rework.

COMPETENCY STATEMENTS:

1. To understand concepts of aerodynamics
2. To calculate various forces & moments acting on moving vehicles
3. To know the stability of vehicle on slope & turns.
4. To get concepts of vehicle model testing in wind tunnel for estimating drag coefficients.
5. To estimate tractive effort required to propel the vehicle & parameters which decide vehicle performance.
6. To apply the knowledge in vehicle body work and rework.

COURSE CONTENTS:

Topic No.	Content	Hours	Marks
1.	**Aerodynamics:** 1.1Introduction of aerodynamics: Historical examples & future trends 1.2Classification&practicalobjectivesof aerodynamics 1.3Fundamental aerodynamic variables like Pressure, Density, Temperature and Flow Velocity. 1.4 Aerodynamic forces & moments like Relative Wind, Free Stream, Lift, and Drag. 1.5 Concept of airfoil and air dam.	**10**	**16**
2.	**PART A : Ergonomic consideration** 2.1 Concept of Visibility 2.2 Concept of Blind spot 2.3 Driver seat design requirement	**15**	**20**

	2.4 Passenger seat design requirement 2.5 Child seat design requirement 2.6 Aerodynamic properties **PART B : Aerodynamics properties of basic shape** 2.7 Lift & pitching. 2.8 Side forces & yaw moment. 2.9 Rolling moment.		
3.	**Fundamentals of Aerodynamic Drag** **Part A** 3.1 Types of car bodies. 3.2 Flow field around the car -Air flow pattern, Pressure distribution 3.3 Local origins of flow field - Front end, windshield wiper, A-pillar, Roof, Rear end 3.4 Water and dirt accumulation on the body – Safety, water flow, Dirt Deposits **Part B** 3.5 Wind tunnels: 3.5.1 Concept (no analytical treatment) 3.5.2 Construction 3.5.3 Existing wind tunnels:- Large, Small full scale wind tunnel, Wind tunnel for scalemodel,Climatic tunnel, Climatic wind chamber 3.6 Wind noise: 3.6.1 Wind noise sources: - Leak noise, Cavity noise, Wind- rush noise; 3.6.2 Design features of A-pillar, Outside rear view, mirror, Wind shield wipers, Radio antenna, Roof racks, Doors.	**15**	**20**
4.	**Directional Stability** 4.1 Aerodynamic stability 4.2 Driving behavior in cross wind 4.3 Driving with trailer 4.4 Stability of vehicle on slope (derivation & numerical problems) 4.5 Stability of vehicle on turns (derivation & numerical problems)	**12**	**12**
5.	**Vehicle Performance (numerical problems)** 5.1Various resistances faced by vehicle (air, rolling, gradient) 5.2 Power required to propel the vehicle 5.3 Maximum Drawbar pull 5.4 Tractive efforts, Traction, 5.5 Relation between vehicle & engine speed. 5.6 Acceleration and gradeability.	**12**	**12**
		64	**80**

TERM WORK:

1. Study of ergonomics of human body & hence the design of driver's and passenger's seat.
2. Comparison of visibility of different vehicles. Prepare a report.
3. Procedure for measurement of various aerodynamic forces and moments.
4. Study of wind tunnel and procedure for wind load distribution on various body structures.
5. Case study of an accidental vehicle, which took place due to improper body rework /body building.
6. Procedure of measurement of air drag in wind tunnel.
7. Prepare aerodynamic shape with the help of Graphics Software.
8. Simple sketches of modern passenger car, truck, bus etc with suitable design showing importance of Aerodynamics.
9. Simple sketches of airflow patterns on various types of vehicle.

TEXT BOOK:

Sr.No	Title and Edition	Author	Publisher
1.	Automotive mechanics	Joseph Heitner	--
2.	Automotive mechanics	William H. Crouze	--
3.	Automotive Eng. Fundamentals	Richard stone, Jeffrey k. Ball,	SAE International

REFERENCE BOOK:

Sr.No	Title and Edition	Author	Publisher
1.	Fundamentals of aerodynamics	John. D Anderson,	McGraw-Hill Books Company, International student Edition
2.	Aerodynamics of road vehicles from fluid mechanics to vehicle	Wolf-Heinrich	Hucho, SAE International
3.	Aerodynamics of road vehicles from fluid mechanics to vehicle	Butlerworths, by Wolf-Heinrich	Hucho, SAE International
4.	Vehicle body layout and analysis	John Fenton,	Hutchinson, London

5A417– CAD-CAM AND AUTOMATION (CCA)

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks	20	80	25	--	25	150
TOTAL	06	Duration	01	03	--	--	--	--

RATIONALE:

The need of today's manufacturing industrial world is based on best quality & precision oriented shorter manufacturing cycle time .To satisfy this need the use of CAD/CAM & automation is inevitable. To satisfy industrial need, diploma engineer should be able to understand the concept of automation and use of CAD/CAM technology. The prerequisites of this subject have been introduced in earlier subjects such as engineering graphics, engineering drawing & mechanical engineering drawing.

COMPETENCY STATEMENTS:

1. To understand the fundamentals & use CAD.
2. To conceptualize drafting and modeling in CAD.
3. To plan CNC part programming and prepare part program.
4. To operate CNC machine.
5. To understand the concept of automation and FMS

COURSE CONTENTS:

Topic No.	Content	Hours	Marks
1.	**Introduction to CAD/CAM** 1.1 Computers in industrial manufacturing. Product Cycle, 1.2 CAD/CAM, CAD/CAM hardware and basic structure, CPU, Memory, I/O devices, Storage devices and system configuration	**04**	**06**
2.	**Geometric Modelling** 2.1 Requirement of geometric modelling, Types of geometric models. 2.2 Geometric construction method-sweep, 2.3 solid modelling- Primitives & Boolean operations, Free formed surfaces (Classification of surface only) (No numerical treatment)	**08**	**12**
3.	**Introduction to computer numerical Control** 3.1 Introduction - NC, CNC, DNC, AC 3.2 Advantages, disadvantages and Application of CNC. 3.3 Classification of CNC system, depending on feedback control and	**12**	**12**

	3.4 Motion control system - point to point, straight line, Continuous path (Contouring). 3.5 The coordinate system in CNC, Axis identification of lathe and milling 3.6 Constructional details of CNC machine.		
4.	**Part programming** 4.1 Fundamentals of part programming, 4.2 Types of part programming, Manual part programming and computer aided part programming (APT). 4.3 NC–Words, Programming format, simple part programming 4.4 Use of canned cycles, subroutines and do loops.	**10**	**20**
5.	**Industrial Robotics** 5.1 Introduction, physical configuration, basic robot motions, 5.2 Technical features such as - work volume, precision and speed of movement, weight carrying capacity, drive system, End effectors, robot sensors. 5.3 Application – Material transfer, machine loading, welding, spray coating, processing operation, assembly, inspection.	**16**	**16**
6.	**Automation** 6.1 Basic elements of automated system, advanced automation functions, 6.2 Various levels of automation and comparison 6.3 Flexible manufacturing system, Introduction, FMS equipment, FMS application, 6.4 Introduction to CIM	**14**	**14**
		64	**80**

TERM WORK:

1. Two assignments on simple part programming.
2. Four assignments on cad-cam 2D
3. Two assignment on cad-cam 2D isometric
4. Two assignment on cad Geometric modeling
5. Two assignments of Part programming using canned cycles, subroutines and do loops for turning component.
6. Two assignments of Part programming using canned cycles, subroutines and do loops for turning component.
7. Assignment on robot Application.(Take example from industry)
8. Assignment on Automation in manufacturing.(Take example from industry)

TEXT BOOK:

Sr.No	Title and Edition	Author	Publisher
1.	CAD/CAM/CIM	RadhaKrishna P. & Subramanyam	Wiley Eastern, Ltd
2.	CNC Machine	B.S.Pabla and M.Adithan	New age International Pvt. Ltd
3.	CNC Machines	M. S. Sherawat J. S. Narang	Dhanpatn Rai and co.

REFERENCE BOOK:

Sr.No	Title and Edition	Author	Publisher
1.	CAD/CAM Principles and Applications	P.N.Rao	Tata McGraw-Hill
2.	Computer Aided design and manufacturing	Groover M.P. & Zimmers Jr	Prentice hall of India

5R418-ADVANCED ENGINERING MATHEMATICS

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25		25	150
TOTAL	06	Duration	1.00	3.00	2.00	--	---	--

RATIONALE:

The subject is classified under basic sciences and intends to teach students basic facts, concepts and principles of mathematics, as a tool to analyze Engineering problems. Mathematics lies down the foundation to understand core technology subjects.

COMPETENCY STATEMENTS:
To inculcate the practice of mathematic
Comprehend the principles of other subjects
Solve problems by using analytical and systematic approach.

COURSE CONTENTS:-

Topic No	Name of the Chapter / topic (Follow S.I. units)	Hours	Marks
1	**Matrices** 1.1 Elementary row and column transformations 1.2 Rank of matrix 1.3 Echelon or normal matrix 1.4 Inverse of a matrix by elementary transformations 1.5 Linear Equations solution of homogeneous and non homogeneous equations 1.6 Linear dependence and independence 1.7 Linear and orthogonal transformations 1.8 Eigen values and Eigen victors 1.9 Cayley – Hamilton Theorem	**16**	**20**
2	**Complex numbers** 2.1 Introduction to number system. 2.2 Definition and examples of complex numbers. 2.3 Algebra of complex numbers(addition, subtraction, multiplication and Division) 2.4 Powers of the imaginary numbers " i " 2.5 Representation of complex numbers in a plane (Armand diagram) 2.6 Modulus and Amplitude of complex numbers. 2.7 Polar from of complex numbers. 2.8 Rules regarding modulus and amplitude of product, quotient and	**14**	**16**

	power of complex numbers. 2.9 Exponential form of complex numbers. 2.10 Powers of complex numbers De Moivres Theorem. 2.11 Roots of complex numbers. 2.12 Circular functions of complex numbers. 2.13 Hyperbolic functions. 2.14 Relation between Hyperbolic and circular functions. 2.15 Real and imaginary parts of circular and hyperbolic functions of complex numbers		
3	**Successive Differentiation** 3.1 n^{th} derivative of standard function. 3.1. 1 e^{ax} 3.1.2 log (ax + b). 3.1.3 $(ax+b)^{-1},(ax+b)^{n},(ax+b)^{-n}$ 3.1.4 $\sin(ax+b),\cos(ax\pm b)$ 3.1.5 $e^{ax}\sin(bx\pm c),e^{ax}\cos(bx\pm c)$. 3.2 Leibnitz's Theorem	**12**	**16**
4	**Partial Differentiation** 4.1 Partial derivatives of first and higher order. 4.2 Total differential coefficients, total differentials. 4.3 Differentiation of complex and implicit function. 4.4 Euler's theorem on homogenous function with two and three independent Variable (without proof). 4.5 Deductions from Euler's theorem.	**12**	**16**
5	**Solution of Algebraic Equation** 5.1 Introduction 5.2 Iterative Method 5.3 Starting and Stopping Iterative Method 5.4 Bisection method 5.5 Regula Falsi Method 5.6 Newton – Raphson Method	**10**	**12**
		64	**80**

List of experiments:

1) **Two experiments on each chapter, each experiment contains five examples.**

TEXT BOOKS

S.No.	Name of Book	Author
1	Higher Engineering Mathematics	B.S.GREWAL
2	Applied Mathematics Vol. I	P.N.WARTIKAR
3	Introductory Methods of Numerical Analysis	S.S. Sastry

5A501- AUTOMOBILE COMPONENT DESIGN

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks	20	80	25	--	25	150
TOTAL	06	Duration	1.00	4.00	--	--	--	--

RATIONALE:

The automobile engineering students should posses the knowledge of elementary basic design principles involved in design of machine parts and auto components. The course introduces simple design of machine elements like shafts, keys, joints, couplings, levers, springs, etc. The student will be supposed to maintain and sometimes modify the existing designs of machine parts and components. Fundamental knowledge of engineering mechanics, strength of materials, engineering materials and theory of machines is essential. Considering all these, this course is being introduced at this level.

COMPETENCY STATEMENT(S):

To identify, select, assemble and design simple machine elements / auto parts for various applications and draw cad drawing

COURSE CONTENTS:

Topic No.	Content	Hours	Marks
1.	**Basic concepts of Design** 1.1 Introduction to design 1.2 Classification of design 1.3 Design consideration 1.4 Design procedure 1.5 Stress analysis: 1.5.1 Types of external loads 1.5.2 Types of induced stresses: tensile, compressive, shear, Crushing and bearing pressure, bending, torsion, thermal stresses, creep, proof stresses, resilience, principal stresses 1.5.3 Stress – strain diagram for ductile & brittle material & it's importance 1.5.4 Variable stresses in machine parts, fatigue & endurance limit, stress – time diagrams for variable stresses 1.5.5 Working stresses for static load, variable or fatigue load	**06**	**08**

	1.5.6 Factor of safety, selection of factor of safety. 1.5.7 Stress concentration causes and remedies 1.5.8 Introduction to theories of failure –Maximum principle stress theory, Maximum shear stress theory, Distortion energy theory. 1.5.9 Selection of material and justifications for Automobile components. Advanced Materials for automotive components 1.6.0 Concept of standardization , Preferred numbers &Interchangeability in design practice.		
2.	**Design of Fasteners** 2.1 Common types of fasteners with their applications - 2.2 Through Bolts, tap bolts, studs, cap screws , and machine screws , 2.3 Designation of screw thread according to I.S., 2.4 Stresses in screw fasteners 2.5 Bolts of uniform strength.	**07**	**06**
3.	**Design of Machine Elements** 3.1 Design of socket & spigot type cotter joint. 3.2 Design of knuckle joint 3.3 Design of Turn buckle 3.4 Applications of above machine elements in an automobile	**06**	**10**
4.	**Design of Shafts, Keys and Couplings.** 4.1 Conceptual understanding of shaft, axles & spindles. 4.2 Design of shaft for torsion, rigidity, bending, combined Torsion & bending. 4.3 Comparison of solid & hollow shafts. 4.4 Design of propeller shaft, whirling & critical speed. 4.5 Design of rear axle. 4.6 Types of keys and their applications, design of sunk Rectangular key. 4.7 Effect of keyways on shaft. 4.8 Design of couplings- muff, flange, and bush pin type flexible	**10**	**14**
5.	**Design of Levers.** 5.1 Types of levers 5.2 Design of following levers for rectangular cross-section & fulcrum pin only. 5.2.1 Rocker arm, 5.2.2 Bell crank lever, 5.2.3 Hand lever	**06**	**06**
6.	**Design of Chassis Component.** 6.1 Design of clutch- Single plate & Multi plate. 6.2 Teeth calculation of gears for sliding mesh/constant mesh gear box for given data. 6.3 Design of semi elliptical leaf spring , helical spring – torsion & compression	**09**	**11**

7.	**Design of Engine Components.** 7.1 Data of engine specifications and calculations of cylinder dimensions for given power 7.2 Design of cylinder head thickness and bolts 7.3 Design of valve seat & valve lift 7.4 Design of piston crown by bending strength and thermal considerations. 7.5 Design of piston rings and skirt length 7.6 Design of piston pin for bearing, bending & shear considerations 7.7 Design of connecting rod cross -section (I section). 7.8 Design of big end, cap and bolts. 7.9 Design of overhung crank shaft.	**14**	**13**
8.	**Bearings** 8.1 Bearings-Classification 8.2 Bearing location in Automobiles systems 8.3 selection of bearings	**03**	**06**
9.	**Ergonomics and Aesthetic Consideration in Design** 9.1 Post design aspects - Ergonomic aspect. 9.2 Aesthetic Consideration (shape, color, surface finish) for Automobile	**03**	**06**
		64	**80**

LIST OF PRACTICALS

1. Identify & classify the different engine & chassis components according to the type of Load to which they are subjected. Also state the types of induced stresses in them.

2. Identify the different engine & chassis components which may fail due to stress Concentration, observe & state remedy to reduce stress concentration

3. Use of advanced materials with justifications for components like gears, piston, piston rings, leaf springs, cylinder head & block etc.

4. Identify different fasteners & bearings used in an automobile, justify their locations.

5. Design any machine element & coupling for specified data, select suitable materials, prepare assembly-detail drawing on CAD indicating overall dimensions, tolerances, hardness & surface finish, also Prepare bill of material.

6. DESIGN PROJECT
   Design of Power train(Piston, Piston rings, piston pin, connecting rod, crankshaft)/ transmission train (clutch, teeth calculations of gear box, propeller shaft and rear axle)/ leaf spring /coil spring for specified data, select suitable materials, prepare drawing indicating overall dimensions, tolerances, hardness & surface finish.

TEXT BOOK:

Sr.No	Title and Edition	Author	Publisher
1.	Machine Design	R.S.Khurmi S.Chand and Co. New Delhi	S.Chand and Co. New Delhi
2.	Machine Design	P.V.Mandke.	Nirali Publication, Pune
3.	Machine Design	R.K.Jain.	Khanna Publication
4.	Elements of Machine Design	Pandya and Shah.	Charotar Publication House
5.	Auto design	R B Gupta.	Satya prakashan

REFERENCE BOOK

Sr. No	Title and Edition	Author	Publisher
1.	Design Data Book	P.S.G.Coimbatore	P.S.G.Coimbatore
2.	Problems in Automobile Engineering	N.K Giri.	Khanna publication
3.	Auto design problems	K M Aggarwal	Satya prakashan

5R502- METROLOGY AND QUALITY CONTROL

COURSE STRUCTURE:

Teaching scheme		Evaluation Scheme						
TH	03		PT	TEE	TW	PR	OR	TOTAL
PR	02	Max. Marks	20	80	25	25	---	150
TOTAL	05	Duration	1.00	3.00				

RATIONALE:

The course Engineering Metrology and quality control makes the student to understand the process of measurement, the measuring instrument and its care and maintenance. The student should also understand the concept of quality control needed in any industry. Also the student should be able to use various measuring instruments, select the appropriate instrument for a particular application.

COMPETENCY STATEMENT:

- To use various types of measuring instruments and inspection gauges.
- To understand the various quality control and quality management techniques and practice them.
- To develop an ability of problem solving and decision making.
- To develop quality consciousness amongst the students.

COURSE CONTENTS:

Topic No	Content	Hours	Marks
1	**Fundamentals Of Metrology**: Definition of metrology, 1.1 Needs of inspection, 1.2 Common terminology used such as accuracy, precision, sensitivity, magnification errors, and sources of errors. 1.3 Line standard, end standard and wavelength standard. 1.4 Concept of calibration.	**03**	**06**
2	**Limits, Fits & Gauges**: 2.1 Basic terminology of limits and Fits. 2.2 Types of fits, hole basis system and shaft basis system of fits. 2.3 Types of gauges – Plug gauges, snap gauges, ring gauges and relation gauges.	**04**	**08**

	2.4 Taylor's principle of gauge design. 2.5 Simple numerical on tolerance calculations.		
3	**Angular Measurement**: 3.1 Concept of angular measurement, 3.2 Construction & working of bevel protractor, sine bar, angle gauges, clinometers, autocollimator, angle dekkor.	**04**	**06**
4	**Comparators** 4.1 Characteristics of a good comparator, 4.2 Principle of comparators, operation of various comparators. 4.3 Dial indicator as mechanical comparator, 4.4 Pneumatic comparator – Solex and high pressure dial type, 4.5 Electric comparators, 4.6 Relative merits and demerits of various comparators.	**04**	**06**
5	**Screw Thread & Gear Measurement:** 5.1 Terminology of screw thread, 5.2 Errors in threads, 5.3 Measurement of various parameters, of screw threads such as major diameter, minor diameter, effective diameter, pitch using instruments – screw thread micrometer, floating carriage micrometer, 5.4 Gear terminology, 5.5 Measurement of chordal thickness, addendum using gear tooth vernier, Parkinson gear tester,	**06**	**12**
6	**Surface Finish Measurement**: 6.1 Terminology, 6.2 Importance of surface finish, 6.3 Symbol representing surface finish on drawing, 6.4 Principle & operation of stylus probe instrument 6.5Tomlinson surface meter and Taylor-Hobson surface Talysurf.	**04**	**06**
7	**Testing Techniques**: 7.1 Straightness testing by straight edge & autocollimator, 7.2 Flatness testing by optical flats, 7.3 Various cases of square ness testing, parallelism testing by using dial indicator, circularity testing (Roundness testing) using dial indicator. 7.4 Machine Tool Testing:- Alignment test to be carried out on lathe machine and drilling machine	**04**	**08**
8	**Basic Concepts Of Quality**: 8.1 Definitions of quality, quality characteristics,	**05**	**06**

	8.2 Need of quality control, quality of design, quality of performance, and quality of conformance. 8.3 Quality function cost of quality, value of quality, quality control. 8.4 Quality assurance – concept, quality mindedness, quality audit. 8.5 Quality circle – concept, purpose, function.		
9	**Introduction To SQC & Other Control Techniques**: 9.1 Basic statistical concepts like mean, mode, median, standard deviation, dispersion, Process capability and indices - C_p, C_{pk}, 9.2 Concept of variable data & attribute data, control charts for variables and attributes, 9.3 Acceptance sampling, concept, sampling plans, O.C. curve, 9.4 Q.C. tools such as ISHIKAWA diagram scatter diagram, Parato diagram.	**06**	**10**
10	**Introduction to Quality management system:** 10.1 TQM, 10.2 ISO 9001:2000, 10.3 QS 14000, 10.4 TS 16949	**04**	**06**
11	**Recent Trends in Metrology** 11.1 Introduction to CMM 11.2 Working principle, 11.3 Purpose, 11.4 Advantages, 11.5 Classification of CMM, 11.6 Multi Gauging Inspection. 11.7. Online Inspection.	**04**	**06**
	TOTAL	**48**	**80**

PRACTICALS:

1. Use of basic measuring instruments such as vernier caliper, vernier height gauge, vernier depth gauge, outside micrometer, inside micrometer for measurement of actual jobs from industry.
2. Use of slip gauge to find unknown gap.
3. Set the sine bar for given angle and verify the angle by bevel protractor.
4. Use of dial indicator as mechanical comparator. 50 jobs manufactured on any machine by single operator for a particular dimension is checked as per job drawing with tolerances e.g. O.D. of shaft within 10 microns.
5. Use of screw thread micrometer and floating carriage micrometer (Two wire method) to measure effective diameter.
6. Use of surface finish testing machine to observe surface finish (Ra) values for specimens of grinding finish, lapping finish, honing finish, turning, milling, shaping.

7. Use of gear tooth vernier for chordal thickness and addendum measurement.
8. Use of optical flat for flatness testing.
9. To draw a frequency histogram for a set of 50 readings measured for a particular quality characteristic on 50 jobs from industry. Calculation of standard deviation, process capability.
10. To draw X & R chart for a given data of 50 readings actually measured in industry.
11. To draw P & C chart for the data taken in the industry.
12. Use of internet for SPC software's.
13. Visit to industry to understand various quality management systems.

REFERENCES:

Sr. No	Title of Book	Author	Publication
1	Engineering Metrology	R. K. Jain	, Khanna publications, 2004
2	Engineering Metrology	P.K.Sihna	, BPB Publication, 2001
3	Metrology	M. Mahajan,	Dhanpat Rai & co.,2000
4	Statistical Quality Control	M. Mahajan,	M. Mahajan, Dhanpat Rai & co.,2000
5	Handbook of Industrial Metrology		ASTME
6	Quality Planning & Analysis	J. M. Juran,	Tata Mc Graw hill 1985
7	IS Codes		
	IS 919-1993 Limit, fits & tolerances IS 2029-1962 Dial gauges IS 2909-1964 Guide for selection of fits IS 2984-1966 Slip gauges		

5A503- TRANSPORT MANAGEMENT

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	03		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks	20	80	25	--	25	150
TOTAL	05	Duration	1.00	3.00	--	--	--	--

RATIONALE:

The industrial development in India has brought a great revolution in manufacturing of automobiles. The different requirements of transportation are achieved by automobile manufacturing. The technical knowledge of automobile engines, automobile transmission and maintenance can be used in the study of this subject. This creates opportunities of providing service to the passengers or
goods transport business.

The service industry provides good opportunity for automobile diploma engineers as service engineer or other employment opportunities. The reputation, quality of service, convenience of scheduling, economics depends up on the true knowledge of motor vehicle act, working of different transport organizations, standard methods of record keeping, use of computers, valuation of vehicles and driving skills. By keeping some of the objectives in mind, the subject Transport Management and Motor Industry is essential to learn.

COMPETENCY STATEMENTS:

1. To know various motor Industries in India
2. To understand the transport management laws and gets expertise in their proper application

COURSE CONTENTS:

Topic No.	Content	Hours	Marks
1	**Introduction to Transport Management** 1.1 Motor Vehicle Act: Short titles used in MVA, Definitions, Terms regarding vehicle. 1.2 Licensing of Drivers of Motor Vehicle: Necessity, Age limit, Responsibility of owners, Restriction on holding a driving license, 1.3 General, Preliminary test and driving test. 1.4 Conductor's license: Necessity, Eligibility, Documents required and rules for conductors. 1.5 Registration of Vehicles: Necessity, Where to be	**12**	**22**

	made, How to be made, Temporary registration, Production of vehicle at the time of registration, Form and manner of display of registration mark, Size of letters and numerals of registration mark, 1.6 Transfer of Ownership of Motor Vehicle. Control of Transport: Transport authorities, Difference between STA and RTA, 1.7 Necessity of Permit, All types of Permit, Transfer of permit, Temporary permit, Tourist permit, and National permit. Speed limits. 1.8 Construction of Motor Vehicle: Overall dimensions, General provision regarding construction and maintenance of motor vehicle. Power of central government to make rules. 1.9 Taxation: Objectives, Basis of taxation, Methods of levying tax, Tax exemption. Insurance: Motor Vehicle Insurance, No-fault liability, 1.10 Procedure for accident claim.		
2	**Transport Management** 2.1 Terms used in transportation: Road transport service, Transport vehicle, Public service vehicle, Goods vehicle, Public place, Depot, Route, Trip, Time table, Vehicle schedule, Fare. Comparison of modes of transport. 2.2 Requirements of goods and passenger transport on the basis Of Volume, type, weight of material; class of passenger. 2.3 Basic elements in Transport Management: Market potential: Type of goods/ passengers, Period of use, Probable competition. 2.3.1 Selection of vehicle: Type of load, Class of passenger, Type of service. 2.4 Organization setup: Govt., Semi Govt., Private. Legal compliance: Documents required as per MVA, Registration. 2.5 Policies of transport organization: Policies towards passenger, employees, like Long distance service, Express service, Night service and others. 2.6 Layout of organization: Location, elements considered in location, Passenger amenities, infrastructural facilities. 2.7 Scheduling: Basic factors in bus, crew (staff) and maintenance scheduling, calculation of number of buses.	**12**	**20**
3	**Estimation and Valuation of Vehicle:** 3.1 Role of surveyor, Procedure of survey and valuation of vehicle, Accident survey report. 3.2 Importance of warranty system and protection of law: How to deal with defects, benefits of warranty	**08**	**14**

	system. Protection of law. 3.3 Buying a new vehicle: Factors to be considered Ex-showroom price and on road price, use of vehicle, when and where to buy, Closing the deal, Running in. inspecting the vehicle, 3.4 Points to check: test drive, Controls, Bonnet, Suspension, Switches, Seat, Noise, Ventilation, Safety, Boot, Interior Storage. 3.5 Buying a used vehicle: When and where to buy: Dealers, used car firms, Private sellers, Garages, Auctions. 3.6 Factors to be considered-Depreciation, Model and year, Oil leak, Oil Pressure, Exhaust , Battery, Odometer, Bonnet, Crash damage, Rust, Suspension damage, Tyres, Switches and accessories, Lights, Chrome, Wiring , Steering, Hydraulic System, Structural corrosion, Floor, Test drive. 3.7 Preparations for selling: When to sell, How to sell, Auctions, Garages, Private sale, preparing the car, Documentation, Selling price, Safeguards.		
4	**Driving skills:** 4.1Instructions in driving of motor vehicle : Driving theory, traffic education, light vehicle driving practice, Vehicle mechanism and repair, Public relations for drivers, Fire hazards, vehicle maintenance, first aid. 4.2 Traffic signs: Mandatory signs, Cautionary signs, Informatory signs. Traffic signals. 4.3 Causes of accident and remedies. Measures to avoid accidents 4.4 Defensive driving: Rain and flood, fog and mist, snow and ice, Fitness to drive: Driving and age, stress due to traffic jam, night driving.	**08**	**12**
5	**Motor Industry** 5.1 The Automobile Industry in India (Collection of Data of various companies) Importance of Automobile Engineer, 5.2 Working of Various State Transport Organizations. (MSRTC, BEST) Functions and Role in Automobile Industry: Various Research Organizations like-Central Institute of Road Transport. Automotive Research Association of India. Vehicle Research, Development and Establishment. Central Road Research Institute. Petroleum Conservation and Research Association	**08**	**12**
		48	**80**

PRACTICALS:

The following tutorials / assignments may be completed by group 5 or 6 students.

1. Study, fill up, highlight the important points and prepare report on following forms under M V rules
   a. Medical certificate b. Learner's license. c Driving license.
   d. Addition of license. e. Renewal license f. Registration of vehicle.
   g. Transfer of vehicle.
2. Prepare a report on buying of a new vehicle.
3. Prepare a report on buying /selling an old vehicle.
4. Prepare a report showing different road signs and signals.

TEXT BOOK:

Sr.No	Title and Edition	Author	Publisher
1.	Passenger amenities in STU	Dr. P. Sudarsanam.	CIRT, Pune
2.	Fare structure in STU	Dr. P. Sudarsanam.	CIRT, Pune
3.	Bus station Management	Dr. P. Sudarsanam.	CIRT, Pune
4.	Bus and Crew scheduling	Dr. P. Sudarsanam.	CIRT, Pune
5.	Industrial Organization and Management	O.P. Khanna.	Dhanpat Rai and sons
6.	Compedium of transport Terms	Dr. P.G. Patankar.	CIRT, Pune
7.	Vahan Mitra	Bharat Kalaskar	Sanjivini Prakashan, Pune

REFERENCE BOOK

Sr. No	Title and Edition	Author	Publisher
1	Book Of The Car--Drive	Automobile Association	Automobile Association
2	Motor Vehicle Act, 1988	Home Department (MS.)	HomeDepartment (MS.)
3	Central M. V. Rules 1989	Home Department (M.S.)	HomeDepartment (M.S.)

5R504- INTERNAL COMBUSTIONS ENGINES (ICE)

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks	20	80	25	--	25	150
TOTAL	06	Duration	01	03	---	---	---	---

RATIONALE:

The rise in the civilization is closely related to phenomenal improvements in the transportation. In the developments of transportation, I.C. engines occupy very important position. The Internal Combustion engines have provided a small power unit in the personalized transport and revolutionized the living habits to greater extent. Besides personalized transportation, The I.C. engines provide power to heavy and military vehicles, ships and aircrafts, generator sets, machines.

Considering the vital importance of the I.C. engines, it is utmost necessary to give exposure to the diploma engineers as regards the important and basic aspects of I.C. engines. Diploma engineers come across the I.C. engines in his/her all the while in the operating areas of Production, Maintenance, and Processing etc.

Present course is designed to give exposure to fundamental aspects of I.C. engines. Basic engines and their types are being covered in details. Fuel feed systems of S.I. and C.I. engines are also being covered including carburetion, Fuel injection aspects. Recent systems like M.P.F.I. are also covered. Various sub systems like Ignition, Cooling, and Lubrication etc are also covered.

Combustion systems in both the S.I. and C.I. engines are covered with emphasis on detonation Knock, Octane rating and Cetane Rating, I.C.engine fuels like conventional fuels along with Alternative fuels like Methanol, Ethanol, LPG, CNG, Bio-Diesel etc are also covered. Testing and performance aspects are also covered.

Advances in I.C. engines like Wankel engines, Stratified charge I.c. engines, direct injection gasoline engines, variable compression ratio engines are also being covered.

Most important area of Air pollution and emission control is covered with analysis of pollutants and controls systems.

COMPETENCY STATEMENTS:

1. Understand various types of the I.C. engines and systems.
2. Understand the fundamentals of combustion processes in S.I. and C.I. engines.
3. Understand about various types of conventional and alternative fuels used in I.C. engines.
4. Get the basics of testing of I.C. engines and able to compare and analyze the performance of engines.
5. Understand about modern advances in I.C.engines.
6. Get the concept of various recent developments in I.C. engines.
7. Know about emissions from I.C. engines, their nature and pollution caused by them and various emission measuring devices like the exhaust gas analyzers of petrol and diesel types. Various control measures.

COURSE CONTENTS:

Topic No.	Content	Hours	Marks
1	**ENGINES AND TYPES** 1.1 Types of engines, I, C, Engine classification, 1.2 Two stroke & Four stroke engines - Petrol & Diesel engine, their construction and working - Valve timing diagrams, Comparison 1.3 I.C. engine applications	**06**	**06**
2	**AIR STANDARD CYCLES** 2.1 Ideal or air standard cycles 2.2 Assumptions 2.3 Otto cycle, Diesel cycle ,Dual combustion cycle Joule Calculation of cycle efficiency, mean effective Pressures of cycles. (Simple Numericals) 2.4 Actual cycles, difference between actual cycle And fuel air cycle.	**04**	**06**
3	**FUEL FEED SYSTEMS IN I.C. ENGINES** **A) S.I. ENGINES:** 3.1 Properties of Air-fuel mixtures Mixture requirements for starting, Idling, slow speed and acceleration 3.2 Carburetor - Working and limitations of simple carburetor - Working of Carter, Solex & S.U. carburetors 3.3 Multi Port Fuel Injection System (M.P.F.I.) - Concept of Petrol injection - Lucas MPFI system - Fuel injection system components like Fuel injector, Fuel pump, Throttle sensor, Oxygen sensor, Engine coolant sensor, Manifold absolute pressure sensor, Mass air flow sensors. - Limitations of MPFI systems. - Introduction to direct fuel injection petrol engines. **B)C.I. ENGINES:** 3.4 Fuel injection systems- -Requirements and Types of Injection systems -Conventional plunger type fuel pump, Rotary fuel pump, -Fuel injectors, Types of nozzles.	**12**	**16**

4	**I.C. ENGINE SYSTEMS** 4.1 Ignition System: -Types of ignition systems -Working of Battery and Magneto ignition systems, Electronic ignition systems with and without contact breakers 4.2 Cooling system: -Need of cooling systems -Types of cooling systems as Air-cooling systems, liquid and pressurized liquid cooling systems. -Relative Advantages and disadvantages. 4.3 Lubrication system: **-**Need of lubrication system **-**Different lubrication systems like splash, modified splash and pressurized lubrication systems **-**oil pumps, filters, crank case ventilation **-**types of lubricants, lubricant additives and their advantages	**10**	**12**
5	**COMBUSTION IN I.C.ENGINES** 5.1 Combustion in S.I. engines: -Introduction - Stages of combustion - Effects of engine parameters on ignition lag, flame propagation 5.2 - Abnormal combustion - Detonation or Knocking - Theories of detonation - Effect of engine variables on knocking - Disadvantages and Control of detonation. - Pre ignition - Octane rating of fuel, 5.3**.** Combustion in C.I. Engines: **-** Air-fuel ratio in C.I. engines **-** Stages of combustion **-** Delay period or ignition lag, 5.4 Diesel knock **-** Methods of controlling diesel knock 5**.**5 C.I. engine combustion chambers **-** Principles of combustion chamber design as Open, Swirl, Man chambers **-** Cold starting of CI engines.	**08**	**11**
6	**I.C.ENGINE FUELS** 6.1 Introduction 6.2 Structure of Petroleum 6.3 Products of refining process 6.4 Fuels for SI engines 6.5 Octane number requirements (ONR) 6.6 Diesel fuels 6.7 Non –petroleum fuels 6.8 Additives	**04**	**06**

	6.9 Alternative fuels ,Alcohols, Bio- diesel		
7	**TESTING AND PERFORMANCE OF I.C.ENGINES** 7.1 Introduction 7.2 Performance parameter 7.3. Basic Measurements - Measurements of speed, fuel consumption, air consumption, exhaust smoke, B.P.,I.P. & F.P. - Willan's line method, Morse test & Motoring test 7.4 Efficiencies and Specific Fuel Consumption (SFC's) 7.5 Heat balance and heat balance sheet. (Simple Numericals)	**08**	**09**
8	**ADVANCES IN I.C.ENGINES** 8.1 Elementary introduction to Wankel engine 8.2 Stratified charge engine (Direct Injection Engines) 8.3 Variable compression ratio engines 8.4 Stirling engines 8.5 Supercharging of I.C. engines. - Introduction - Objectives of supercharging - Supercharging limits - Methods of supercharging	**04**	**06**
9	**ENVIRONMENTAL AIR POLLUTION AND CONTROL** 9.1 Introduction 9.2 Pollutants from petrol engines - Sources of pollution - Exhaust emissions - Effect of engine maintenance on exhaust emissions 9.3 Petrol engine emission control – - Engine design modifications - Exhaust gas oxidation methods - Exhaust emission control by fuel variations - Blow by control - Control of Oxides of nitrogen by Exhaust Gas Recirculation Method (EGR) - Total emission package - Thermal reactor package, Catalytic converter, package 9.4 Diesel emission Diesel smoke & control Diesel odour & control 9.5 Exhaust gas analyzers for petrol and diesel engines -Construction and working	**08**	**08**
		64	**80**

TERM WORK :

1. To dismantle and assemble four stroke petrol engine.
2. To dismantle and assemble four stroke diesel engine.
3. To dismantle and assemble two stroke petrol engine.
4. Trial on four-stroke petrol engine with variable loading.
5. Trial on four stroke diesel engine with variable loading.
6. To dissemble and assemble Solex carburetor.
7. To dissemble and assemble SU carburetor.
8. To study and analyze MPFI system car like Maruti ,Hundai,Indica etc
9. To study Battery and Magneto Ignition systems.
10. To take a trial on petrol and diesel exhaust gas analyzer and analyze the results.
11. To study EGR systems in engines

REFERENCES

Sr No	Title of Book	Author and Publication
1	Internal Combustion Engines	Mathur and Sharma, Dhanpat Rai
2	Internal Combustion Engines	Ganeshan,TMH
3	Internal Combustion Engines	Maleev
4	High Speed Internal Combustion Engines	Ricardo
5	Internal Combustion Engines	Obert TMH
6	Automobile Engineering	Kirpal singh Vol I and Vol II
7	Automobile Engineering	R.P.Sharma ,S.CHAND
8	Diesel Engines	- Heissler –SAE publications

5A505- AUTOMOBILE AIR CONDITIONING

COURSE STRUCTURE:

Teaching Scheme		**Evaluation scheme**						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks	20	80	25	--	25	150
TOTAL	06	Duration	1.00	3.00	--	--	--	--

RATIONALE:

All the major global players in Automobile sector have launched their products in India. Modern cars, Multi-utility vehicles, heavy passenger & goods vehicles are equipped with “heating ventilation & air conditioning (HVAC) system”. HVAC system not only provides comfort but also ultimately results in road safety. HVAC servicing, therefore offers good job opportunities for diploma engineers. The prerequisite for this subject is Heat Power engineering & Hydraulics & Pneumatics.

This subject will make student to understand & apply the knowledge in servicing various systems & subsystems of HVAC.

OBJECTIVE:

The student will be able to:

1. Identify various HVAC systems and sub systems.
2. Explain working & construction of HVAC Systems and sub systems.
3. Carry out repair and maintenance of HVAC Systems and sub systems.
4. Carry out retrofitting and alteration of HVAC Systems.
5. Know environmental aspects related to HVAC Systems.

COURSE CONTENTS:

Note: No numerical be asked in examination

Chapter	Name of Topic	Hours	Marks
01	**Introduction** 1.1 Environmental & safety aspects in heating, ventilation & air conditioning systems 1.2 Human comfort control - comfort zone, air movement, wind chill factor, odour problems & effects of humidity. 1.3 Heat transfer fundamentals- forced & naturalconvection, radiation, evaporation & conduction. 1.4 Requirements of heating, ventilation & air conditioning in cars, multi utility vehicles, vans, safari, heavy passenger vehicles, coaches, cargo vehicle cabin, vehicle carrying perishable commodities & cryogenic substances. 1.5 Controlled & uncontrolled ventilation - orking,pplication& comparison.	**10**	**12**
02	**Case & Duct System** 2.1 Construction & working of Air intake section, core section & distribution section. 2.2 Construction & working of Downstream, upstream, split & hybrid.	**06**	**10**
03	**Air Conditioning System** **Part A** 3.1 General layout of Air conditioning system. 3.2 Construction & working of following refrigeration sub systems – thermostatic expansion valve, fixed orifice tube & rotary vane air cycle system. 3.3 Construction & working of evaporator, condenser, accumulator. 3.4 Receiver driers & accumulator- Types,construction&working Construction & working of reciprocating, scroll & rotary vane compressors. Drive systems for compressors.	**08**	**10**
	Part B 3.5 Construction & working of electromagnetic clutch 3.6 Metering devices- comparison of thermostatic expansion valve & fixed orifice tube. Types working & comparison of thermostatic expansion valves i.e. H valve, block type, internally equalized & externally equalized. 3.7 Functions of thermostatic expansion valve i.e. Throttling action, modulating action & controlling action.Construction & working of remote bulb.	**08**	**10**

04	**System Control Devices & Electrical Circuits** 4.1 System controls - Construction & working of typical vacuum system & electronic temperature control system. 4.2 Construction & working of vacuum operated devices i.e. Vacuum reserve tank, vacuum restrictor, vacuum motor, check valve & check relays. 4.3 Switches - Construction & working of high- side temperature switch, low-side temperature switch, high-pressure switch, low- pressure switch, pressure regulator, ambient switch & superheat switch. 4.4 Sensors- Construction & working of sun load sensor, outside temperature sensor & in car temperature sensors. 4.5 Construction & working of Aspirator. 4.6 Construction & working of blower clutch control, heater control, and time delay relay for heater control. 4.7 Mode doors and temperature doors. 4.8 Electrical circuits- Typical climate control system & Electronic climate control system, their electrical circuits & working.	**16**	**18**
05	**Repairs & maintenance of Air Conditioning system** 5.1 Visual & acoustic check, side glass, leak test, temperature test, Procedure of charging & discharging. Moisture removal procedure. Service equipments & tools – Vacuum pump, Manifold & gauge i.e. Low side & high side, gauge calibration, recovery unit & recycling unit, Halide (freon) & Fluorescent leak detector, nitrogen leak test 5.2 Compressor service - Symptoms, faults, cause & remedy. 5.3 Electromagnetic clutch service - Symptoms, faults, cause & remedy. 5.4 Performance testing procedure of thermostatic expansion valve & fixed orifice tube. 5.5 Refrigerant lubricants- Properties & types 5.6 Refrigerant- types, Packaging, storage, restrictions, color code & purity test 5.7 Hoses & connectors – construction of system hoses, charging hose with shutoff valve & connectors. Retrofitting from CFC- R12 to HFC- 134 A – need, procedure & Precautions	**12**	**15**
06	**Comfort Heating System** 6.1 Function, construction, working, maintenance, general faults and their remedies of Comfort Heating System.	**04**	**05**
	Total	**64**	**80**

PRACTICAL:
Skills to be developed:

Intellectual Skills:

- Select tools for servicing of heating, ventilation & air conditioning system. (HVAC).
- Diagnose electrical system faults, control system faults.
- Diagnose various faults in car HVAC system.
- Understand charging & evacuation procedures of refrigerant from the HVAC system.
- Understand construction of three different compressors & to identify them.

Motor Skills:

- Perform lubrication of air conditioning system & servicing of heating system as per manufacturer's service procedure.
- Carry-out diagnostic procedure to trace faults in car heating, ventilation & air conditioning.

List of Practical:

Sr. No	Name of Practical
01	Demonstration of all parts of all subsystems & assembly & disassembly of three different types of compressors.
02	Identification & use of tools, gauges & equipment for servicing.
03	Demonstration of charging & evacuation of refrigerant from system.
04	Demonstration of leakage testing using soap solution & other techniques.
05	Diagnosis of electrical systems faults.
06	Diagnosis of control systems faults.
07	2.3 Construction & working of rear heating & cooling system.
08	Retrofitting from CFC- R12 to HFC- 134 A
09	Diagnosis of various running faults in car HVA C

Learning Resources:

REFERENCE BOOKS:

Sr. No.	Author	Title	Publisher
01	Boyce H. Dwiggins	Automobile Air Conditioning	Thomson Learning
02	--	Service Manual	Subros Company
03	--	Service Manual	Sanden Company
04	--	Service Manual	Baher Company

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5A506- ALTERNATIVE ENERGY SOURCES

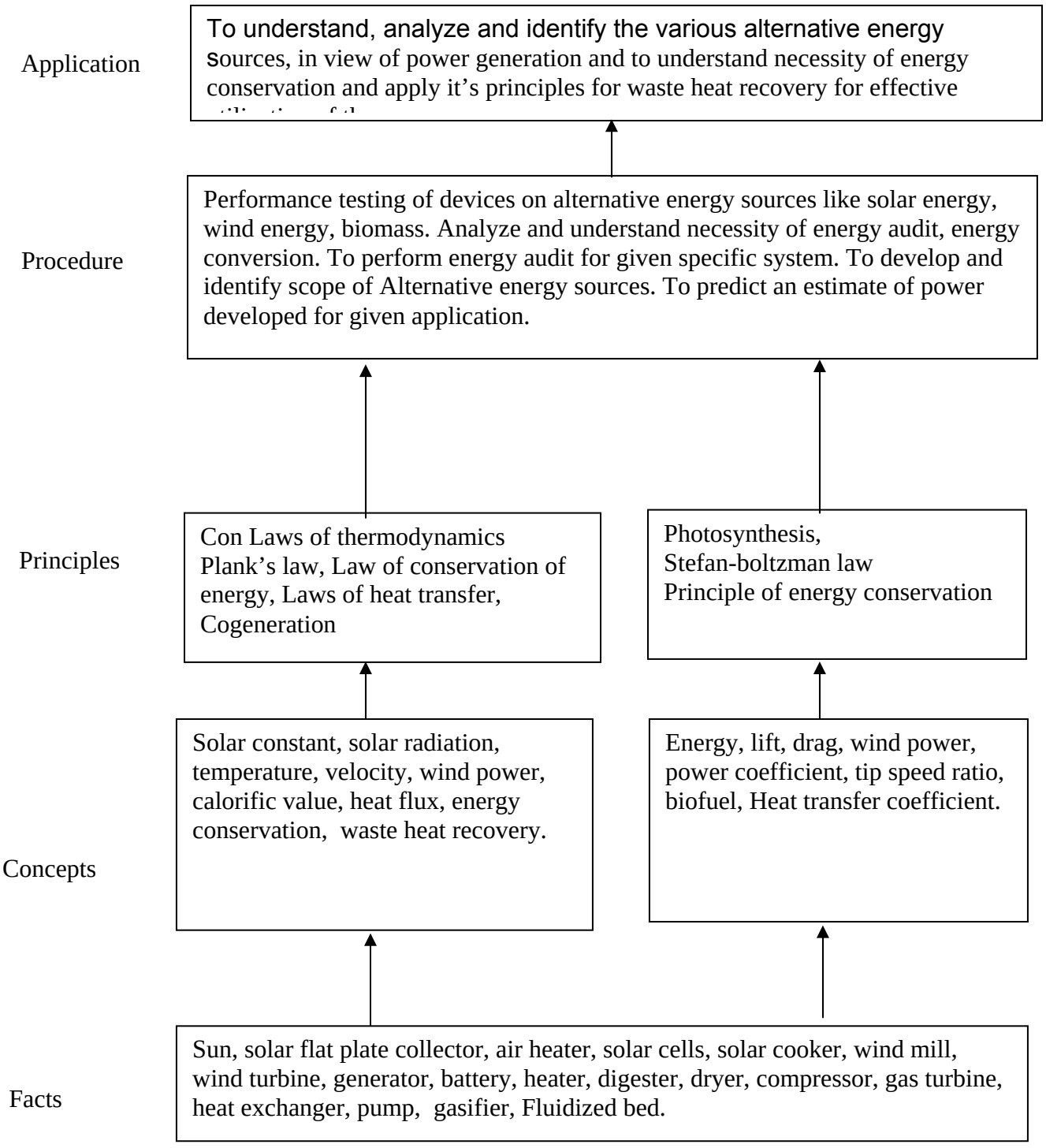
COURSE STRUCTURE:

Teaching Scheme		**Evaluation scheme**						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks	20	80	25	--	25	150
TOTAL	06	Duration	1.00	3.00	--	--	--	--

RATIONALE:

In the power generation sector, alternative energy is the only answer to environmental concerns. Working with renewable and inexhaustible sources, alternative energy solutions are present in many energy plans around the world. Technicians in the near future will need to be familiar with a variety of alternative energy solutions, their implementation & installation. Solar and Wind energy plays an important role in alternative energy sources. Recently significant advances are made in utilization of solar energy in heating & electrical energy conversion applications. Solar operated devices are used in daily life of common people. Solar operated cars, bikes & vehicles are having great potential in future. Wind mills for power generation are also developed significantly. Hybrid units comprised of wind & solar energy are also developed. Energy from biomass & bio fuels is also having good potential. Engineers will have to work with alternate energy systems & equipments in future. Considering the growing potential of alternate energy sources, present course is introduced. This course will give introduction to alternate energy sources with their conversion, conservation & applications. Important topics like energy management & energy audit are also covered.

CONCEPT STRUCTURE:



OBJECTIVE:

Students should be able to:

1. Develop awareness for effective utilization of alternative energy sources.
2. Identify different components of solar energy and wind energy devices.
3. Identify and analyze biomass plant.
4. Identify and apply energy conservation techniques for commonly used power absorbing and generating devices.
5. Apply principles of energy conservation and energy management techniques.

COURSE CONTENT:

Topic No	Name of Topic	Hours	Marks
01	**Introduction to Energy Source** 1.1 Major sources of energy: Renewable and Non-renewable. 1.2 Primary and secondary energy sources. 1.3 Energy Scenario in India and world 1.4 Need and genesis of AES.	8	7
02	**Solar Energy** 2.1 Principle of conversion of solar energy into heat and electricity 2.2 Solar Radiation: Solar Radiations at earth's surface 2.3 Solar Radiation Geometry: Declination, hour angle, altitude angle, incident angle, zenith angle, solar azimuth angle 2.4 Applications of Solar energy • Construction and working of typical flat plate collector and solar concentrating collectors and their applications, • advantages and limitations • Space heating and cooling. • Photovoltaic electric conversion. • Solar distillation, Solar cooking and furnace. • Solar pumping and Green House. • Agriculture and Industrial process heat. (no derivations and numerical	10	14
3	**Wind Energy** 3.1 Basic Principle of wind energy conversion. 3.2 Power in wind, Available wind power formulation, Power coefficient, Maximum power 3.3 Main considerations in selecting a site for wind mills. 3.4 Advantages and limitations of wind energy conversion. 3.5 Classification of wind mills	10	12

	3.6 Construction and working of horizontal and vertical axis wind mills, their comparison 3.7 Main applications of wind energy for power generation and pumping. (No mathematical treatment)		
4	**Energy from Biomass** 4.1 Common species recommended for biomass. 4.2 Methods for obtaining energy from biomass 4.3 Thermal classification of biomass a) Gasified, b) Fixed bed and fluidized 4.4 Application of gasifier 4.5 Bio-diesel production and application Agriculture waste as a biomass 4.6 Biomass digester Comparison of Biomass with conventional fuels	10	12
5	**Energy Conservation** 5.1 Energy conservation and Management:-Global and Indian energy market 5.2 Energy scenario in various sectors and Indian economy, Need and importance of energy conservation and management 5.3 Concept of Payback period, Return on investment (ROI), Life cycle cost. 5.4 Sankey diagrams, specific energy consumption	6	10
6	**Energy Conservation Techniques** 6.1 Distribution of energy consumption, Principles of energy conservation, 6.2 Energy audit , Types of audit , Methods of energy conservation, Cogeneration and its application , Combined cycle system. 6.3 Concept of energy management, Study of different energy management techniques like, Analysis of input 6.4 Reuse and recycling of waste - Energy education Conservative technique and energy audit	10	12
7	**Economic approach of Energy Conservation** 7.1 Costing of utilities like steam, compressed air, electricity and Water. 7.2 Ways of improving boiler efficiency, Thermal insulation, Critical thickness of insulation, Waste heat recovery systems, their applications, criteria for installing unit. 7.3 An introductory approach of energy conservation in compressed air, refrigeration, air conditioning, pumps and fans.	10	13
		64	80

Experiments:

1) To collect information about global and Indian energy market.
2) To collect commercial information on solar flat plate collector used for water heating.
3) To study construction and working of photo voltaic cell.
4) To study construction, working and maintenance of solar cooker.
5) Visit to plant of solar heating system for hotel/hostel/railway station etc.
6) To study construction and working of horizontal axis wind mill or to visit a nearest wind farm.
7) To visit a biomass/ biogas plant of municipal waste or else where.
8) Perform energy audit for workshop/Office/Home/SSI unit.
9) Study of various waste heat recovery devices.

Text Books:

Sr. No	Title of Book	Author and Publication
1	Non conventional energy Resources	Dr B.H.Khan Tata McGraw Hill
2	Non conventional energy sources	G. D. Rai Khanna publication
3	Solar energy	S. P. Sukhatme Tata McGraw Hill
4	Solar energy	H. P. Garg Tata McGraw Hill
5	Power plant engineering	Arrora Domkundwar Dhanpat Rai and co.
6	The energy sector	P.H. Henderson India- Oxford University Press
7	Industrial energy conservation	D. A. Ray Pergaman Press
8	Non-conventional energy source	K. M. Mittal
9	Energy resource management	Krupal Singh Jogi Krupal Singh Jogi

CASSETTES/CD/WEBSITES:

1. CDs developed by National Power Training Institute, (Under the ministry of Power, Government of India) Opposite VNIT, South Ambazari road, Nagpur
2. Website of Bureau of Energy and Efficiency.(www.bee-india.nic.in)
3. Website for Akshay Urja News Bulletin. (www.mnes.nic.in)

5A507-AUTO VEHICLE TESTING

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max.Marks	20	80	25	--	25	150
TOTAL	06	Duration	1.00	3.00	--	--	--	--

RATIONALE:

Vehicle testing is a vital part of an automobile manufacturing industry. To ensure maximum performance and achieve quality standards every automotive manufacturer is required to undergo testing and assure the quality of product. The subject intends to understand the general test procedure for vehicle; its components and various quality standards. By studying this subject students would get familiar with various instruments and equipments needed for testing as well as their use and capabilities.

Objectives:

The students will able to:

1. Define and understand the terms efficiency, Vehicle performance, testing.
2. Understand the meaning of vehicle testing and quality assurance.
3. Classify vehicle testing as Component level and Vehicle level testing.
4. Identify the various instruments and equipments required for testing and know their use and capabilities and analyze the parameters to be recorded.
5. Use the proper instrument/equipment and measure the required quantity accurately.
6. Use appropriate correlations to calculate efficiency, power, torque, fuel consumption etc.
7. Get acquainted with standard test procedures and conduct the same.
8. Evaluate and tabulate the test data in appropriate manner.
9. Plot the performance Characteristics graphically and interpret the results.

COURSE CONTENTS:

Topic no	Content	Hours	Marks
01	**Overview of Vehicle Testing** 1.1 Need and importance of vehicle testing 1.2 Classification, Accuracy, Test data. 1.3 Basis of tests- driving cycles, Homologation 1.4 Requirements of test- Test equipments, Procedure, 1.5 Testing instruments and equipments- Use, capabilities and Parameters of the following equipments to be recorded Engine dynamometer, Compression tester, Stroboscope, Computerized engine analyzer, Petrol/Diesel engine scanner, Infrared exhaust gas analyzer, Diesel smoke meter, Vacuum tester, Chassis dynamometer etc. 1.6 Significance of test.	**16**	**16**
02	**Laboratory Testing of Vehicle Subsystems** **Part A:** 2.1 Noise, Vibration and Harshness (NVH) testing- Types of NVH- Pass by noise, In cab noise, Floor vibrations. 2.2 Engine Performance parameters testing- Power, Torque, Efficiency, Fuel consumption, Dry and wet compression test. test, Starter motor voltage drop test, Ignition system Oscilloscope test. 2.3 Engine emission testing as per Indian driving cycles. 2.4 Lubricating oil pump pressure test. **PART B:** 2.5 Cooling system- Leakage test, pressure test, Vacuum test of pressure cap, Corrosion test- Hot spots and cold spots. 2.6 Transmission Testing- Efficiency Vs O/P Speed, Torque ratio Vs O/P Speed, Input speed Vs O/P Speed, O/P Torque Vs O/P Speed, Parasitic losses Vs Input Speed, NVH test. 2.7 Tyre Testing- Tyre wear pattern identification and causes, Endurance test, Strength test, High speed performance test.	**14** **14**	**16** **16**

03	**On-Road Testing of Vehicles** **PART A:** 3.1 Introduction of sampling technique. 3.2 Vehicle level performance parameters- Acceleration, Drive ability, Gradeability, Restartability, Brakes testing, Steering effort Testing, Speedometer and odometer testing. 3.3 Accelerated endurance testing procedures- Torture tracks e.g. Belgian Pave, Corrugated, Long wave pitching, Pot hole, Sand patch, Mud patch, Steering pad, High speed, Serpentine courses, Gradient, Shallow water trough, Deep wading trough, Step Climbing, Draw bar or winch pull test. **PART B:** 3.4 Moving barrier collision test- Frontal impact, Rear impact, Side impact, roof crash. 3.5 Barrier Collision test with vehicle acceleration and occupant loading. 3.6 Roll over test without collision. 3.7 Vehicle ride and handling parameters and effect of steering changes, suspension changes on handling characteristics- Definitions of – Ride and comfort, Roll, Lurch, Tramp, Yaw, pitching, bouncing, Steady-state cornering, Steering characteristics.	**10** **10**	**16** **16**
	Total	**64**	**80**

Practical:
Skills to be developed:

Intellectual Skills:

- Understand methods of temperature and pressure measurement of cooling system.
- Understand performance characteristics/ parameters of a motor vehicle and to analyze the same after a test drive.
- Understand the fuel measurement methods.
- Understand the use of exhaust gas analyzer and to analyze the exhaust gas constituents.

Motor Skills:

- Observe the measurement of temperature and pressure of cooling system.
- Observe various test facilities at organizations like ARAI, VRDE, TATA MOTORS and alike.

List of Practical/ Assignments:

1. Study of any three test instruments and three equipments
2. NVH testing.

3. Prepare report onTesting Standards- SAE, ASMT standards; ARAI, CMVI regulations
4. Check exhaust emission of petrol/ diesel vehicle.
5. Prepare a report based on industrial visit to test tracks of any organization like VRDE, ARAI, TATA Motors.
6. Fuel Injection pump – pressure test, Injector testing, Calibration and Phasing.
7. Study of Inverted vehicle drop test

Learning Resources:
Books:

Sr. No.	Name of Author	Title	Publisher
01	R.B. Gupta	Automobile Engineering	Satya Prakashan
02	SAE International Handbook	-----	SAE Publication
03	W.H. Crouse, D.L. Anglin	Automotive Mechanics	Tata Mc Graw Hill
04	Anil Chikkara	Automobile Engineering Vol. III	Satya Prakashan
05	M. L. Mathur, R.P. Sharma	Internal Combustion Engines	Dhanpat Rai & Sons
06	N. K. Giri	Automobile Mechanics	Khanna Publication.
07	Ken Layne	Automotive Engine Performance	Prentice Hall career Technology
08	Don Knowles	Automobile Mechanics: Understanding New Techniques	Prentice Hall career Technology
09	VRDE & CIRT Manuals		

5A508 – C PROGRAMMING

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	--	25	150
TOTAL	06	Duration	01	03	--	--	--	--

RATIONALE:

In advanced age of computer, it becomes essential to understand how to give instructions to computers. This course intends to expose a student to the basic principles of programming through a structured programming language like 'C'. Study of this course would enable the students to learn any advanced Object Oriented Language.

COMPETENCY STATEMENTS:

1. To use and work in a programming environment.
2. To enhance logical thinking.
3. To develop 'C' programs for simple applications.
4. To interpret 'C' programs
5. To solve problems using 'C'.
6. Implementing 'C' functions.

COURSE CONTENTS:

Topic No.	Content	Hours	Marks
1.	**Steps in program development** 1.1 Programming process, 1.2 Algorithm 1.3 Flowcharting & different symbols	06	06
2.	**Study of 'C' as a programming language** 2.1 History of 'C' 2.2 Introduction to 'C' 2.3 Basic structure 'C' program, sample 'c' program 2.4 Execution of 'C' program	03	08
3.	**Constant variables and data types** 3.1 Character set 3.2 Key words and identifiers 3.3 Constants 3.4 Data types 3.5 Variables and declaration of variables	06	12
4.	**Operators and Expressions** 4.1 Arithmetic, relational, logical operators 4.2 Assignment, increment and decrement operators 4.3 Conditional and special operators 4.4 Bit wise operators 4.5 Arithmetic expressions	07	10

	4.6 Evaluation of expressions 4.7 Type conversion in expressions		
5.	**Managing input and output operator** 5.1 Reading a character 5.2 Writing a character 5.3 Formatted input 5.4 Formatted output	03	08
6.	**Decision making, branching and looping** 6.1 Decision making with IF statement 6.2 Simple IF statement, 6.3 IFELSE statement, 6.4 Nesting of IF ELSE statement 6.5 Else IF ladder 6.6 SWITCH statement 6.7 GOTO statement 6.8 WHILE statement 6.9 DO statement 6.10FOR statement	10	12
7.	**Functions** 7.1 User defined functions, 7.2 A multifunction program, 7.3 The form of 'C' function 7.4 Return value and their types 7.5 Calling a function 7.6 Category of functions 7.7 No arguments and no return value 7.8 Arguments with return value 7.9 Nesting of functions and recursion	10	10
8.	**Arrays** 8.1 One, two, multidimensional arrays	10	06
9.	**Strings** 9.1 Declaring and initializing strings 9.2 Reading string form a terminal 9.3 Writing strings to screen 9.4 Comparison of two strings 9.5 String handling functions 9.6 Table of strings	09	08
		64	80

TERM WORK:

1. Demonstration of Turbo C compiler, creating a program, compiling and linking, executing programs.
2. Programs based on declaring variables and assigning values to variables.
3. Preparing at least 5 Programs based on expressions and operators.
4. Programs using printf( ), scanf( ), getch( ). Putch( ).
5. Programs using control statements such as IF Statement, SWITCH statement, GOTO statement.
6. Programs using loop controls such as WHILE loop, DO WHILE lloop, FOR loop.
7. Programs using functions.

8. Programs using arrays.
9. Programs using string operations such as comparison, concatenation, copying counting, and append.

TEXT BOOK:

Sr.No	Title and Edition	Author	Publisher
1.	Let us 'C'	Yashwant Kanitkar	BPB publications
2.	Programming in 'C'	Balguruswamy	Tata Mc- Graw Hill
3	'C' for engineers	Prakash khanale, Madhuri Joshi	-

REFERENCE BOOK:

Sr.No	Title and Edition	Author	Publisher
1.	Introduction to 'C' programming	Denis Ritchie and Kerninghan	Prantice Hall Publications
2.	Introduction to 'C' programming	Byron Gotfried	Tata McGraw Hill

5A509 – AUTOMOTIVE MECHATRONICS AND SYSTEMS

COURSE STRUCTURE:

Teaching Scheme		Evaluation Scheme						
TH	04		PT	TEE	TW	PR	OR	Total
PR	02	Max. Marks	20	80	25	--	25	150
TOTAL	06	Duration	01	03	--	--	--	--

RATIONALE:

The integration of electronics engineering, electrical engineering, computer technology and control engineering is referred as Mechatronics. Application of mechatronic system with automobile engineering is increasingly forming a crucial part in the design, manufacture and maintenance of wide range of automotive products. As a consequence there is a need for a diploma engineers to understand mechtronic systems used in an automobile and an automotive manufacturing.

COMPETENCY STATEMENTS:

Students should be able to:

1. Study of different components of mechatronics system and its working.
2. Locate different components of mechatronics system.
3. Identify mechatronic system in a device / machine.
4. Operate mechatronics system.
5. Locating the faults in mechatronics system.
6. Identify various input and output devices in an automated system.
7. Understand, draw ladder diagrams & write simple programs for PLCs.
8. Use simulation software provided with the PLC.
9. Understand interfacing of input and output devices.
10. Study the application of mechatronic system in an automobile.

COURSE CONTENTS:

Topic No.	Content	Hours	Marks
1.	**Introduction :** 1.1 Concept of mechatronics. Traditional v/s mechatronics approach. 1.2 Need and scope. Elements of measurement systems. 1.3 Control system-open and closed systems. Basic elements of closed loop system, 1.4 Building blocks of mechatronics - Electronics, Instruments, Sensor & Measurement, Actuators, Microprocessor, and mechanical components.	**08**	**08**

2.	**Sensors, Transducers and Actuators** 2.1 Sensors - Principle, working and applications of - Limit switches, proximity switches like inductive, capacitive and optical (deflecting and through beam type), Thumb wheel switches magnetic reed switches. 2.2 Transducers – Types, principle, working of transducers, optical encoders - displacement measurement, rotary, incremental, opto -couplers. 2.3 Actuator – Types, Linear and rotary, Mechanical, electrical, hydraulic and pneumatic, solenoids – on-off applications, latching, triggering, Types of relays- solid state, Types of motors – DC motors, DC brushless motors, AC motors, stepper motors , servo motors	**10**	**12**
3.	**Signal conditioning:** 3.1 Signal conditioning process 3.2 Operational amplifiers-inverting, non-inverting, summing, integration, differential, instrumentation amplifier, logarithmic amplifiers, 3.3 Analog to digital converter and vice versa	**06**	**05**
4.	**Microprocessor & Microcontroller** 4.1 8085 Microprocessor - Architecture, Pin configuration, working of microprocessor, and applications., Introduction to ICs used for interfacing such as –Programmable peripheral devices , USART, memory, keyboard, display – LCD,LED,I/O device, ADC, DAC etc 4.2 8051 Microcontroller - Architecture, Pin configuration, working of microcontroller, Applications Comparison of microprocessor and microcontroller, advantages and disadvantages	**06**	**08**
5.	**Programmable Logic Controller (PLC)** 5.1 Introduction, PLC definition, PLC block diagram, 5.2 Difference between relay panel and PLC, power supply, 5.3 Input/output modules (analog, digital) 5.4 concepts of sink/source, set/reset, latch/unlatch, 5.5 Advantages and disadvantages, installation, troubleshooting and maintenance	**06**	**08**
6.	**PLC Programming** 6.1 Introduction, programming formats, equipment 6.2 Ladder diagrams and sequence listing, large process ladder diagram construction, flowcharting as a programming method , 6.3 Basic PLC functions Register basics, timer functions, counter functions ,Intermediate functions – Arithmetic functions, number comparison and number conversion functions	**10**	**12**

	6.4 Data handling functions- SKIP, Master control relay, Jump, Move, Block move, Table to register and register to table move functions. 6.5 FIFO and LIFO functions, File Arithmetic and Logic function 6.6 PLC digital bit functions and applications Sequencer functions and cascading of sequencers, PLC matrix functions, 6.7 Discrete and analog operation of PLC, 6.8 Networking of PLCs, PLC auxiliary commands and functions,		
7.	**Electronics in Automobile** 7.1 Basic Electrics, Wiring Diagram, components, sockets & pin diagrams, 7.2 Principle & applications of sensors, 7.3 Digital Electronics, CAN BUS Basics of CAN bus, Networking of control units using CAN bus, Location of 7.4 CAN voltage distributor, Interior & Exterior CAN.	**06**	**09**
8.	**Automobile electronic systems** 8.1 Power train Drive consisting of electronic engine management 8.2 Electronic transmission, electronic networks; 'Safety systems' such as Antilock Brake systems, air bag triggering, anti–theft, suspension, steering, skid systems; 8.3 Comfort body systems' such as Air conditioner, seat adjusting, dashboard displays; 8.4 Communication systems' such as Global positioning system, radio reception, information systems. Each of these systems requires Electronic Control Unit (ECU) for efficient performance.	**12**	**18**
		64	**80**

TERM WORK:

1 Study of Building blocks of a mechtronic system.
2 Identification and demonstration of different sensors and actuators.
3 Demonstration of the working of various digital to analog and analog to digital converters.
4 Study of PLC and their components.
5 Development of ladder diagram, programming using PLC for any four of the following
   a) measurement of speed of a motor
   b) motor start and stop by using two different sensors
   c) simulation of a pedestrian traffic controller

d) simulation of four road junction traffic controller
e) lift / elevator control
f) washing machine control
g) tank level control
h) soft drink vending machine control

6 Trace, interpret and demonstrate working of at least two electro pneumatic systems.
7 Trace, interpret and demonstrate working of at least two electro hydraulic systems
8 Study of any four electronic controls in any two vehicles.

TEXT BOOK:

Sr.No	Title and Edition	Author	Publisher
1.	Programmable Logic Control – Principles and Applications	NIIT	Prentice Hall of India
2.	Mechatronics systems design		Vikas Publishing, New Delhi
3.	Mechatronics principles, concepts and applications	Mahalik N.P.	Tata McGraw Hill

REFERENCE BOOK:

Sr.No	Title and Edition	Author	Publisher
1.	Mechatronics- Electronic control systems in automobile and Electrical Engineering	Bolton W.	Pearson Education Ltd.
2.	Introduction to Mechatronics and Measurement systems	Histand B.H. and Alciatore D.G.	Tata McGraw Hill
3.	Programmable Logic Controllers	John W. Webb and Ronald Reis	Prentice Hall of India

EQUIVALANCE SUBJECT FOR 3rd to 4th REVISION

Exiting Curriculum					New Curriculum					Diff. in credit	
Course code	Course name	Theory credits	Practical credits	Total Credits	Course code	Course name	Theory credits	Practical credits	Total Credits	Plus	Minus
GE151	Communication skill	2	2	4	4G301	English	3	2	5	1	
GE152	Basic Mathematics	4	0	4	4G101	Basic Mathematics(BMT)	4	0	4	0	
GE153	Engineering Mathematics	4	0	4	4G102	Engineering Mathematics (EMT)	4	0	4	0	
GE154	Basics Science	3	2	5	4G104	Engineering Chemistry	4	2	6	1	
GE155	Applied Science	3	2	5	4G103	Engineering Physics	4	2	6	1	
GE156	Workshop Practice	0	4	4	4G105	Work Shop Practice (WP)	0	3	3		1
GE157	Engineering Graphics	1	2	3	4G106	Engineering Graphics (EGR)	2	2	4	1	
GE158	Basics of computer systems	1	2	3	4G107	Basics of Computer System (BCS)	1	2	3	0	
AE251	Workshop Technology	2	4	6	4A208	Mechanical Technology	2	3	5		1
AE 252	Electrical Engineering	2	2	4	4A301	Basics of electrical Engineering and Electronics	4	2	6		2
AE 253	Basic Electronics	2	2	4							
AE 254	Engineering Drawing	2	4	6	4A201	Engineering Drawing	2	4	6		0
AE 255	Engineering Mechanics	3	2	5	4A204	Applied Mechanics	4	2	6	1	

AE 256	Theory of Machines	4	2	6	4A406	Theory of Machines	3	2	5		1
AE 257	Thermal Engineering	3	2	5	4A205	Heat Engineering	3	2	5	0	
AE 258	Manufacturing Processes	2	4	6		Any new subject	2	4	6	0	
AE 259	Strength Of Materials	3	2	5	4A412	Strength Of Materials	4	2	6	1	
AE 260	Fluid Power	3	2	5	4A401	Fluid Power	3	2	5	0	
AE 261	Machine Drawing	2	4	6	4A402	Machine Drawing	2	4	6	0	
GE371	Material Management	3		3	4A305	Industrial Management	3	2	5	2	
GE372	Financial Management	3		3	4A305	Industrial Management	3	2	5	2	
GE373	Marketing Management	3		3	4A305	Industrial Management	3	2	5	2	
GE374	Production Management	3		3	4A305	Industrial Management	3	2	5	2	
GE375	Industrial Management	3		3	4A305	Industrial Management	3	2	5	2	
AE377	Computer Aided Drafting	1	4	5		Any new subject					
AE379	Mechanical Engineering Materials	3	2	5	4A411	Mechanical Engineering Materials	3	2	5	0	
AE380	Industrial Visits	0	4	4	4A413	Implant Training	0	4*	4	0	
AE451	Automobile systems	3	4	7	4A202	Automobile systems-I					
AE452	Entrepreneurship Development	3	3	6	4G303	Any new subject					
AE453	Heat Power Engineering	4	2	6	4A504	IC Engines	4	2	6	0	

AE454	Automobile Engines	3	2	5	4A409	Advance automobile engines	3	2	5	0	
AE455	Auto component design	4	2	6	4A501	Automobile component Design	4	2	6	0	
AE456	Seminar	0	3	3	4A403	Seminar	0	2	2		1
AE457	Project	0	4	4	4A404	Project	0	4	4	0	
AE458	Vehicle Maint and Garage Practice	3	2	5	4A408	Vehicle maintenance	2	4	6	1	
AE459	Alternative Energy Sources and Mgt	3	2	5	4A506	Alternate Energy Sources	4	2	6	1	
AE551	Auto Vehicle Testing	3	2	5	4A507	Auto Vehicle Testing	4	2	6		1
AE552	Auto solid modeling	1	3	4	4A407	3-D Modeling	1	4	5	1	
AE553	Metrology and Quality Control	4	3	7	4A502	Metrology and Quality Control	3	4	7	0	
AE554	Environmental Pollution and control	3	2	5	4G304	Any new Subject					
AE 555	Auto Manu. Processes	2	4	6	4A203	Automobile Manufacturing Process	3	3	6		
AE 556	Transport Management laws and Motor Industries	3	2	5	4A503	Transport Mgt	3	2	5		

AE557	Auto Mechatronics and System	3	2	5	4A509	Automotive Mechatronics	4	2	6	1	
AE558	Special. Auto Vehicles and Systems	3	2	5	4A415	Special purpose vehicle	4	2	6	1	
AE559	Auto Air-conditioning System	3	2	5	4A505	Automobile Air Conditioning	4	2	6	1	
AE560	Vehicle aerodynamics and Design	3	2	5	4A416	Vehicle Aerodynamic & Design	4	2	6	1	

NEW COURSES ADDED IN 4TH REVISION	4A206	Development of life skills	2	2	4		
	4A207	Professional Practices	0	3	3		
	4G302	Communication Skill	2	2	4		
	4G303	Entreprenurship Develpoment	2	2	4		
	4M417	Advance Mathematics	4	2	6		
	4A405	Auto Electrical & Electronics Systems	4	2	6		
	4M508	C-Programming	4	2	6		
	4G304	Environmental Science	2	0	2		
	4A410	Auto Systems II	3	2	5		
	4A414	Production Engineering	4	2	6		
	4A417	CAD/CAM & Automation	4	2	6		

EQUIVALANCE SUBJECT FOR 4th to 5th REVISION

3rd revision		4th revision					5th revision					difference	
Course code	Course name	Course code	Course name	TH cr	PR cr	Total Cr	Course code	Course name	TH cr	PR cr	Total Cr	Plus	Minus
GE151	Communication skill	4G301	English	3	2	5	5G301	English	2	2	4		-1
GE152	Basic Mathematics	4G101	Basic Mathematics(BMT)	4	0	4	5G101	Basic Mathematics(BMT)	4	0	4		
GE153	Engineering Mathematics	4G102	Engineering Mathematics (EMT)	4	0	4	5G102	Engineering Mathematics (EMT)	4	0	4		
GE154	Basics Science	4G104	Engineering Chemistry	4	2	6	5G104	Engineering Chemistry	3	2	5		-1
GE155	Applied Science	4G103	Engineering Physics	4	2	6	5G103	Engineering Physics	3	2	5		-1
GE156	Workshop Practice	4G105	Work Shop Practice (WP)	0	3	3	5G105	Work Shop Practice (WP)	0	3	3		
GE157	Engineering Graphics	4G106	Engineering Graphics (EGR)	2	2	4	5G106	Engineering Graphics (EGR)	2	2	4		
GE158	Basics of computer systems	4G107	Basics of Computer System (BCS)	1	2	3	5G107	Basics of Computer System (BCS)	1	2	3		
AE251	Workshop Technology	4A208	Mechanical Technology	2	3	5	5R208	Mechanical Technology	2	3	5		
AE252	Electrical Engineering	4A301	Basics of electrical Engineering and Electronics	4	2	6	5R301	Basics of electrical Engineering and Electronics	4	2	6		
AE253	Basic Electronics												
AE254	Engineering Drawing	4A201	Engineering Drawing	2	4	6	5R201	Engineering Drawing	2	4	6		
AE255	Engineering Mechanics	4A204	Applied Mechanics	4	2	6	5Q201	Applied Mechanics	4	2	6		
AE256	Theory of Machines	4A406	Theory of Machines	3	2	5	5R406	Theory of Machines	3	2	5		

AE257	Thermal Engineering	4A205	Heat Engineering	3	2	5	5A205	Thermal Engineering	3	2	5		
AE259	Strength Of Materials	4A412	Strength Of Materials	4	2	6	5Q202	Strength Of Materials	3	2	5		-1
AE260	Fluid Power	4A401	Fluid Power	3	2	5	5R401	Fluid Power	3	2	5		
AE261	Machine Drawing	4A402	Machine Drawing	2	4	6	5R402	Machine Drawing	2	4	6		
GE371	Material Management	4A305	Industrial Management	3	2	5	5G305	Industrial Management	3	2	5		
AE379	Mechanical Engineering Materials	4A411	Mechanical Engineering Materials	3	2	5	5R411	Mechanical Engineering Materials	3	2	5		
AE380	Industrial visit	4A413	Implant Training	0	4*	4	5R413	Industrial visit	0	2	2		
AE451	Automobile systems	4A202	Automobile systems-I	3	2	5	5A202	Automobile systems-I	3	2	5		
AE453	Heat Power Engg.	4A504	IC Engines	4	2	6	5R504	IC Engines	4	2	6		
AE454	Automobile engines	4A409	Advance automobile engines	3	2	5	5A409	Advance automobile engines	3	2	5		
AE455	Auto component Design	4A501	Automobile component Design	4	2	6	5A501	Automobile component Design	4	2	6		
AE456	Seminar	4A403	Seminar	0	2	2	5R403	Seminar	0	2	2		
AE457	Project	4A404	Project	0	4	4	5R404	Project	0	4	4		
AE458	Vehicle maintenance & Garage practice	4A408	Vehicle maintenance	2	4	6	5A408	Vehicle maintenance	2	3	5		-1
AE459	Alternate Energy Sources & mgt.	4A506	Alternate Energy Sources	4	2	6	5A506	Alternate Energy Sources	4	2	6		
AE551	Auto Vehicle Testing	4A507	Auto Vehicle Testing	4	2	6	5A507	Auto Vehicle Testing	4	2	6		

AE552	Auto Solid Modeling	4A407	3-D Modeling	1	4	5	5R407	3-D Modeling	1	2	3		-2
AE553	Metrology and Quality Control	4A502	Metrology and Quality Control	3	4	7	5R502	Metrology and Quality Control	3	2	5		-2
AE555	Automobile Manufacturing Process	4A203	Automobile Manufacturing Process	3	3	6	5A203	Automobile Manufacturing Process	3	3	6		
AE556	Transport Mgt Laws & motor industries	4A503	Transport Mgt	3	2	5	5A503	Transport Mgt	3	2	5		
AE557	Automotive Mechatronics & systems	4A509	Automotive Mechatronics	4	2	6	5A509	Automotive Mechatronics	4	2	6		
AE558	Special Auto vehicles & systems	4A415	Special purpose vehicle	4	2	6	5A415	Special purpose vehicle	4	2	6		
AE559	Auto Air Conditioning systems	4A505	Automobile Air Conditioning	4	2	6	5A505	Automobile Air Conditioning	4	2	6		
AE560	Vehicle Aerodynamic & Design	4A416	Vehicle Aerodynamic & Design	4	2	6	5A416	Vehicle Aerodynamic & Design	4	2	6		
NEWLY ADDED IN 4TH & 5TH REVISION		4A206	Development of life skills	2	2	4	5R206	Development of life skills	0	2	2		
		4A207	Professional Practices	0	3	3	5R207	Professional Practices	0	2	2		
		4G302	Communication Skill	2	2	4	5G302	Communication Skill	1	2	3		
		4G303	Entreprenurship Develpoment	2	2	4	5G303	Entreprenurship Develpoment	2	2	4		
		4M417	Advance Mathematics	4	2	6	5M417	Advance Mathematics	4	2	6		
		4A405	Auto Electrical & Electronics Systems	4	2	6	5A405	Auto Electrical & Electronics Systems	3	2	5		
		4M508	C-Programming	4	2	6	5M508	C-Programming	4	2	6		

	4G304	Environmental Science	2	0	2	5G304	Environmental Science	2	0	2		
	4A410	Auto Systems II	3	2	5	5A410	Auto Systems II	3	2	5		
	4A414	Production Engineering	4	2	6	5A414	Production Engineering	4	2	6		
	4A417	CAD/CAM & Automation	4	2	6	5A417	CAD/CAM & Automation	4	2	6		

LIST OF NEW SUBJECTS INDUCTED IN REVISED CURRICULUM

- Engineering Physics and Chemistry (Common subjects separated).
- Auto systems-I
- Heat engineering
- Development of Life skills
- Professional Practice.
- Basics of Electronics and Electrical Engineering.
- Auto Electrical & Electronic systems
- 3-D Modeling
- Vehicle Maintenance(Earlier optional now compulsory)
- Advance automobile engines
- Auto systems-II
- Environmental science
- Industrial Visit
- Production Engg.
- CAD/CAM & Automation
- Advanced Mathematics
- I.C.Engines
- C-Programming

LIST OF SUBJECTS DELETED IN REVISED CURRICULUM

- Thermal Engg.
- Manufacturing Processes
- Material Management
- Financial Management
- MarketingManagement
- Production Management
- Computer Aided Drafting
- Implant Training
- Automobile Systems
- Heat power Engineering
- Automobile engines
- Auto Vehicle Testing(Earlier Compulsory now elective)
- Auto solid Modeling
- Enviromental pollution & control
- Basic Electronics

- Electrical Engineering

LIST OF DEGREE SUBJECTS

S. N	Course Code	Course Name	Teaching Scheme				Examination Scheme					
			Th	Pr	Cr	Term	PT	Th	Pr	Tw	Or	Total
1	5R411	Mechanical Engg. Materials	3	2	5	III	20	80	0	25	25	150
2	5R403	Project	0	4	4	VI	0	0	0	100	50	150
3	5R404	Seminar	0	2	2	V	0	0	0	50	50	100
4	5A405	Auto Electrical & Electronics Systems	3	2	6	VI	20	80	0	25	25	150
5	5R408	3 D Modeling	1	2	3	VI	0	0	0	50	50	100
6	5A409	Advance automobile engines	3	2	5	VI	20	80	0	25	25	150
07	5A410	Auto Systems II	3	2	5	V	20	80	0	25	25	150
08	5A501	Automobile component Design	4	2	6	VI	20	80	0	25	25	150
09	5R502	Metrology and Quality Control	3	2	5	VI	20	80	25	25	0	150
10	5A503	Transport Mgt	3	2	5	IV	20	80	0	25	25	150
11	5R504	IC Engines	4	2	6	V	20	80	0	25	25	150
12	5A505 to 5A509	Elective (Group B)	4	2	6	VI	20	80	0	25	25	150
			31	26	58		900		800			1700