



उत्तराखण्ड प्राविधिक शिक्षा परिषद् रुड़की (हरिद्वार)

पता: सुनेहरा रोड (निकट-के. एल. पालीटेक्निक छात्रावास), काशीपुरी -247 667
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सेवा में,

समस्त प्रधानाचार्य/निदेशक
परिषद् से सम्बद्ध समस्त
डिप्लोमा इंजीनियरिंग संस्थान।

पत्रांक 1311 / पाठ्यचर्या / आई.आर.डी.टी. / 2013-14 दिनांक 12 / 07 / 2013

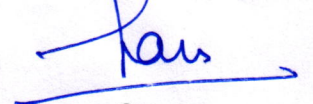
महोदय,

उत्तराखण्ड प्राविधिक शिक्षा परिषद् की दिनांक 24 जून 2013 को हुई शैक्षणिक समिति की बैठक में दिये गये सुझावों को समावेश करते हुए अध्यक्ष शैक्षणिक समिति द्वारा तृतीय/चतुर्थ सैमिस्टर हेतु अनुमोदित पाठ्यचर्या सत्र 2013-14 से लागू की जानी है।

परिषद् से सम्बद्ध समस्त संस्थान नवीन पाठ्यचर्या लागू करना सुनिश्चित करें, आगामी सैमिस्टर परीक्षाएं संशोधित नवीन पाठ्यचर्या से ही करायी जाएगी।

संलग्नक - तृतीय/चतुर्थ सैमिस्टर इंजीनियरिंग ब्रान्चों की नवीन पाठ्यचर्या।

(हरि सिंह)


सचिव

सूचना

तृतीय एवं चतुर्थ सेमेस्टर के विभिन्न इंजीनियरिंग पाठ्यक्रमों की संशोधित पाठ्यचर्या सुझावों आमंत्रण हेतु परिषद् की वेबसाइट पर प्रसारित की गई थी। तदनुसार प्राप्त उपयोगी सुझावों को विशेषज्ञ समूह के साथ मंथन के उपरान्त पाठ्यचर्या में समाहित कर दिया गया है। सत्र 2013-14 से लागू की जाने वाली इंजीनियरिंग पाठ्यक्रम हेतु तृतीय एवं चतुर्थ सेमेस्टर की पाठ्यचर्या परिषद् की वेबसाइट पर प्रसारित की जा रही है। पाठ्यचर्या में यदि कहीं पर spelling/ Evaluation sheet या अन्य कोई त्रुटि हों तो कृपया अधोहस्ताक्षरी की E-mail : rpgupta0106@gmail.com पर अवगत कराने का कष्ट करें।

(आर०पी०गुप्ता)
संयुक्त सचिव
आई०आर०डी०टी०

UTTARAKHAND BOARD OF TECHNICAL EDUCATION,
ROORKEE

CURRICULUM
FOR
DIPLOMA PROGRAMME IN
AUTOMOBILE ENGG
FOR UTTARAKHAND
(Third & Fourth Semester Only)



Approved by:

UTTARAKHAND BOARD OF TECHNICAL EDUCATION
ROORKEE
247 667

STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN AUTOMOBILE ENGINEERING

THIRD SEMESTER

S. No	Subject	L	T	P	TOT	EVALUATION SCHEME						Total Marks
						Internal Assessment		External Assessment (Examination)				
						Theory	Practical	Theory		Practical		
						Max. Marks	Max. Marks	Max. Marks	Hrs	Max. Marks	Hrs	
3.1	Applied Mechanics*	4		2	6	20	30	80	2.5	30	3	160
3.2	Engineering Materials	5		2	7	20	30	80	2.5	30	3	160
3.3	Basics of Auto Engines	5		3	8	20	30	80	2.5	30	3	160
3.4	Chassis, body & Transmission**	5		3	8	20	30	80	2.5	30	3	160
3.5	Measurement, Instrumentation & Control***	5		2	7	20	30	80	2.5	30	3	160
3.6	Auto Engineering Drawing**	-		8	8	-	50	100	3.0	-	3	150
3.7	General Proficiency#	-		4	4	-	25	-	-	-	-	25
3.8	Industrial exposure (Assessment at Institute Level)	-		-	-	-	25	-	-	-	-	25
Total		24		24	48	100	250	500		150		1000

*Common with other diploma courses

** Common with 3rd Sem. Mechanical (Automobile) Engineering

*** Common with 4th sem. Mechanical(Automobile) Engineering

General Proficiency will comprise of various co-curricular activities like games, hobby clubs, seminars, declamation contests, extension lectures, NCC, NSS and cultural activities, elementary mathematics, GS & G.K etc.

Note: 1- Each period will be 50 minutes.

2- Each session will be of 16 weeks.

3- Effective teaching will be at least 12.5 weeks.

FOURTH SEMESTER (AUTOMOBILE ENGINEERING)

S. No	Subject	L	T	P	T O T	EVALUATION SCHEME						Total Marks
						Internal Assessment		External Assessment (Examination)				
						Theory	Practical	Theory		Practical		
						Max. Marks	Max. Marks	Max. Marks	Hrs	Max. Marks	Hrs	
4.1	Mechanics of Materials	4		2	6	20	30	80	2.5	30	3	160
4.2	Principle of Thermal Engineering *	4		3	7	20	30	80	2.5	30	3	160
4.3	Auto Engines	4		2	6	20	30	80	2.5	20	3	150
4.4	Suspension, Steering & Braking**	5		2	7	20	30	80	2.5	30	3	160
4.5	Auto Electrical & Electronics Equipment**	5		2	7	20	30	80	2.5	30	3	160
4.6	Manufacturing Technology**	5		6	11	20	30	80	2.5	30	3	160
4.7	General Proficiency #	-		4	4	-	25	-	-	-	-	25
4.8	Industrial exposure (Assessment at Institute Level)	-		-	-	-	25	-	-	-	-	25
4.9	Industrial Training	Industrial Training of 30 days done after 4 th Semester would be evaluated in 5 th semester through Report and Viva-voce.										
		27		21	48	120	230	480		170		1000

*Common with 3rd Sem. Mechanical (Automobile)

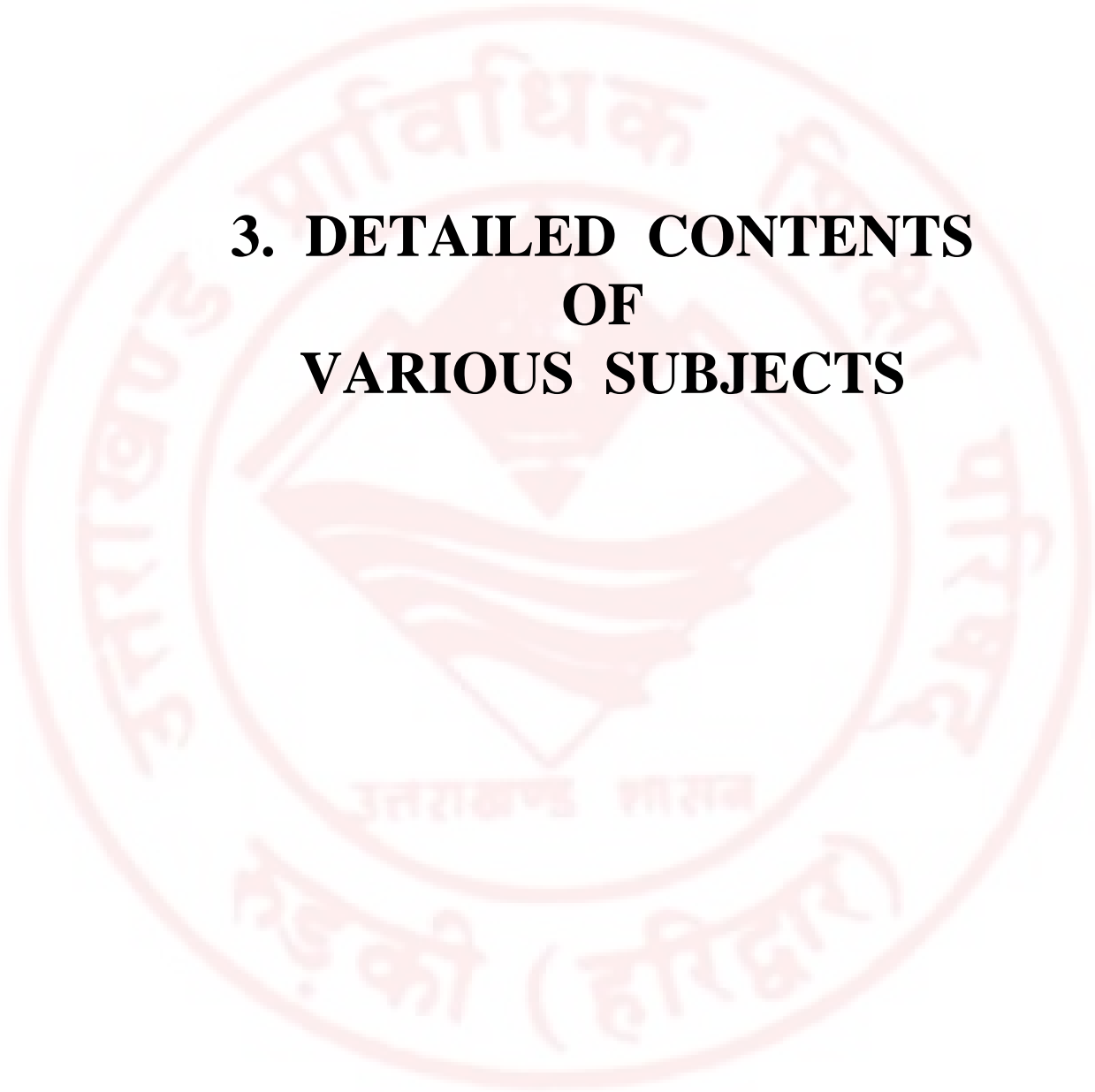
**Common with 4th Sem. Mechanical(Automobile)

General Proficiency will comprise of various co-curricular activities like games, hobby clubs, seminars, declamation contests, extension lectures, NCC, NSS and cultural activities, elementary mathematics, GS & G.K etc.

- Note:**
- 1- Each period will be 50 minutes.
 - 2- Each session will be of 16 weeks.
 - 3- Effective teaching will be at least 12.5 weeks.

The logo of Uttarakhand State Open University is a circular emblem. It features a central diamond shape containing a stylized mountain range. Below the mountains are several horizontal wavy lines representing water or a river. The entire emblem is enclosed within a circular border. The text in Hindi is arranged as follows: 'उत्तराखण्ड प्राविधिक राज्य' at the top, 'परिषद्' on the right side, 'उत्तराखण्ड शासन' at the bottom, and 'देहरादून (हरिद्वार)' at the bottom. The text 'THIRD SEMESTER' is superimposed in the center of the logo in a bold, black, serif font.

THIRD SEMESTER



3. DETAILED CONTENTS OF VARIOUS SUBJECTS

3.1 APPLIED MECHANICS

L T P
Periods/week 4 - 2

RATIONALE

The subject Applied Mechanics deals with basic concepts of mechanics like laws of forces, moments, friction, centre of gravity, laws of motion and simple machines which are required by the students for further understanding of other allied subjects. The subject enhances the analytical ability of the students.

DETAILED CONTENTS

1. Introduction (08 period)
 - 1.1 Concept of engineering mechanics definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields. Definition of Applied Mechanics.
 - 1.2 Definition, basic quantities and derived quantities of basic units and derived units
 - 1.3 Different systems of units (FPS, CGS, MKS and SI) and their conversion from one to another density, force, pressure, work, power, velocity, acceleration
 - 1.4 Concept of rigid body, scalar and vector quantities

2. Laws of forces (12 period)
 - 2.1 Definition of force, measurement of force in SI units, its representation, types of force: Point force/concentrated force & Uniformly distributed force, effects of force, characteristics of a force
 - 2.2 Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of super-position
 - 2.3 Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, triangle law of forces, polygon law of forces - graphically, analytically, resolution of forces, resolving a force into two rectangular components
 - 2.4 Free body diagram
 - 2.5 Equilibrant force and its determination
 - 2.6 Lami's theorem (concept only)
[Simple problems on above topics]

3. Moment (10 period)
- 3.1 Concept of moment
 - 3.2 Moment of a force and units of moment
 - 3.3 Varignon's theorem (definition only)
 - 3.4 Principle of moment and its applications (Levers – simple and compound, steel yard, safety valve, reaction at support)
 - 3.5 Parallel forces (like and unlike parallel force), calculating their resultant
 - 3.6 Concept of couple, its properties and effects
 - 3.7 General conditions of equilibrium of bodies under coplanar forces and beams, fixed support, roller, support, over hanging, Uniformly distributed load, point load, varying load
 - 3.8 Position of resultant force by moment
[Simple problems on the above topics]
4. Friction (10 period)
- 4.1 Definition and concept of friction, types of friction, force of friction
 - 4.2 Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction
 - 4.3 Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane, friction in simple screw jack
 - 4.4 Calculation of least force required to maintain equilibrium of a body on a rough inclined plane subjected to a force:
 - a) Acting along the inclined plane Horizontally
 - b) At some angle with the inclined plane*[Simple problems on the above topics]*
5. Centre of Gravity (08 period)
- 5.1 Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies
 - 5.2 Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion
 - 5.3 Determination of center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed
[Simple problems on the above topics]

6. Moment of Inertia
(06 period)

Concept of moment of inertia and second moment of area and radius of gyration, theorems of parallel and perpendicular axis, second moment of area of common geometrical sections: rectangle, triangle, circle (*without derivations*). Second moment of area for L, T and I sections, section modulus.

7. Simple Machines (10 period)

- 7.1 Definition of effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machines
- 7.2 Simple and compound machine (Examples)
- 7.3 Definition of ideal machine, reversible and self locking machine
- 7.4 Effort lost in friction, Load lost in friction, determination of maximum mechanical advantage and maximum efficiency
- 7.5 System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency
- 7.6 Working principle and application of wheel and axle, different pulley blocks, simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application
[Simple problems on the above topics]

LIST OF PRACTICALS

- 1. Verification of the following laws:
 - a) Parallelogram law of forces
 - b) Triangle law of forces
 - c) Polygon law of forces
- 2. To verify the forces in different members of jib crane.
- 3. To verify the reaction at the supports of a simply supported beam.
- 4. To find the Mechanical Advantage, Velocity Ratio and efficiency in case of an inclined plane.
- 5. To find the Mechanical Advantage, Velocity Ratio and efficiency of a screw jack.
- 6. To find the Mechanical Advantage, Velocity Ratio and efficiency of worm and worm wheel.
- 7. To find Mechanical Advantage, Velocity Ratio and efficiency of single purchase crab.
- 8. To find out center of gravity of regular lamina.

9. To find out center of gravity of irregular lamina.
10. To determine coefficient of friction between three pairs of given surface.

RECOMMENDED BOOKS

1. A Text Book of Applied Mechanics by S Ramamurtham, Dhanpat Rai Publishing Co. Ltd.
2. A Text Book of Engineering Mechanics (Applied Mechanics) by RK Khurmi; S Chand and Co. Ltd., New Delhi.
3. A Text Book of Applied Mechanics by RK Rajput; Laxmi Publications, New Delhi.
4. Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	08	08
2	12	16
3	10	18
4	10	18
5	08	10
6	06	08
7	10	16
Total	64	100

3.2 ENGINEERING MATERIALS

L T P

Periods/week 5 - 2

RATIONALE

Lot of developments have taken place in the field of materials. New materials are being developed and it has become possible to change the properties of materials to suit the requirements. Diploma holders in this course are required to make use of different materials for various applications. For this purpose, it is necessary to teach them basics of metal structure, properties, usage and testing of various ferrous and non ferrous materials and various heat treatment processes. This subject aims at developing knowledge about the characteristics, testing and usage of various types of materials used in industries.

DETAILED CONTENTS

1. Introduction (12 period)
Material, History of material origin, Scope of Material Science, Overview of different engineering materials and application, Classification of materials, Thermal, chemical, electrical, mechanical properties of various materials, present and future needs of materials Usage –Economic, Environmental and Social
2. Crystallography (12 period)
 - Fundamentals - Crystal, Unit Cell, Space, Arrangement of atoms in Simple Cubic Crystal, BCC, FCC and HCP Crystals, Number of atoms per unit Cell, Atomic packing Factor
 - Deformation - Overview of deformation and its mechanisms, behavior of materials under load and stress – strain
 - Failure Mechanism - Overview of failure modes, fracture, fatigue and creep
3. Metal and Alloys (20 period)
 - Introduction - History and development of iron and steel, Different iron ores, Raw Materials in Production of Iron and Steel, Basic Process of Iron making and steel making, Classification of iron and steel
 - Cast Iron - Different types of Cast Iron, manufacture, properties and their usage
 - Steels - Steels and alloy steel, Classification of plain carbon steels, availability, Properties and usage of different types of Plain Carbon Steels, effect of various

alloys on properties of steel, Uses of alloy steels (high speed steel, stainless steel, spring steel, silicon steel, ultra light steel)

- Non Ferrous Materials - Properties and uses of Light Metals and their properties, properties and uses of White Metals and their alloys, Aluminum , Magnesium, Titanium & Copper-Properties and their use in automobile industry

4. Theory of Heat Treatment (14 period)

Purpose of heat treatment, Solid solution and its types, Iron Carbon diagram, Formation and decomposition of Austenite, Martensite Transformation – Simplified Transformation Cooling Curves various heat treatment processes – hardening, tempering, annealing, normalizing, Case hardening and surface hardening. Types of heat treatment furnaces required for above operations (only basic idea)

5. Engineering Plastics (08 period)

Important sources of plastics, Classification – Thermoplastic and Thermo Set and their uses, various trade names of engineering plastics, Plastic Coatings

6. Other Important Materials (14 period)

- Composites - Classification, properties, application
- Ceramics and Silicon - Classification, properties, application
- Heat Insulating Materials
- Bio Materials
- SMART materials

LIST OF PRACTICALS

1. Classification of about 25 specimen of materials/parts into
 - Metals and Non Metals
 - Metals and Alloys
 - Ferrous and non ferrous metals
 - Ferrous and non ferrous alloys
2. Given a set of specimen of metals and alloys (copper, brass, aluminum, cast iron, HSS, Gun metal), identify and indicate the various properties possessed by them
3. Study of heat treatment furnace
4. Study of metallurgical microscope and a specimen polishing machine.
5. To prepare specification of following materials for microscopic examination and to examine the micro structure of specimens of following materials

(i) Brass (ii) Copper (iii) Grey CI (iv) Malleable CI (v) Low carbon Steel (vi) High carbon steel (vii) HSS

6. To anneal a given specimen and find out difference in hardness as a result of annealing
7. To normalize a given specimen and to find out the difference in hardness as a result of normalizing
8. To temper a given specimen to find out the difference in hardness as a result of tempering

INSTRUCTIONAL STRATEGY

While imparting instruction, teacher should show various types of engineering materials to the students. Students should be asked to collect samples of various materials available in the market. Visits to industry should be planned to demonstrate use of various types of materials or Heat Treatment Processes in the industry.

RECOMMENDED BOOKS

1. Text book of Material Science by RK Rajput; SK Kataria and Sons Pubs, Ludhiana
2. Text book of Material Science Material Science by Varinder Kumar, Eagle Publisher, Jalandhar
3. Text book of Material Science by V. K. Manchanda, India Publishing House, Jalandhar
4. Engineering Metallurgy by R. A. Higgins, Standard Publishers, New Delhi
5. Introduction to Materials Science by A.R. Gupta, Satya Prakashan, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Period)	Marks Allotted (%)
1	12	15
2	12	15
3	20	24
4	14	18
5	08	10
6	14	18
Total	80	100

3.3 BASICS OF AUTO ENGINE

L T P
Periods/week 5 - 3

RATIONALE

Engine forms the heart of an automobile. This subject deals with engine terminology, basic concept of 2 stroke and 4 stroke engine, classification of engines, constructional details of engine, cooling system and lubrication system.

DETAILED CONTENTS

1. Introduction (16 period)

Layout and working of internal combustion engine

- Engine terms - Bore, stroke, dead centres, compression ratio, swept volume, clearance volume, capacity, torque, power at the crank shaft
- Classification and brief description of engines as per stroke, cycle, fuel, ignition, cooling, number and arrangement of cylinders, valve arrangement
- Rotary engine
- HCCI engine
- Atkinson cycle engine, Miller cycle engine
- Alternate Fuel Engine
 - LPG/CNG vehicles
 - Electric vehicles
 - Hybrid vehicles
 - Plug in hybrid vehicles
 - Wheel motor vehicles
 - Fuel cell vehicles

2. Constructional Details (16 period)

- Constructional details of cylinder block, cylinder head, cylinder liner, piston, piston coatings, piston rings, gudgeon pin, connecting rod, crankshaft, camshaft, valve timing, variable valve timing and lift, valve mechanisms, camless engines, flywheel and damper

3. Performance of Engine (12 period)

Performance curves, Effect on engine performance due to atmospheric temperature, pressure, compression ratio, engine speed, working conditions, dirt, desert, hills, injection timing/spark timing. Air fuel ratio, RAC/SAE/DIN engine ratings

4. Cooling System (12 period)

Necessity of cooling system. Air cooling, Water cooling system. Components of water cooling system- Radiators, thermostat, water pump, fan, pressure cap, water jackets, antifreeze solution. Trouble shooting

5. Lubrication System (12 period)

Necessity of lubrication, types of lubricants, lubricant rating, oil additives, effect of engine conditions on consumption of lubricant oil, crank case ventilation, pressure lubrication system, splash lubrication. Components of lubrication system-oil pump, oil lines, oil filters, oil coolers, classification and service ratings of lubricating oil, additives for lubricants.

6. Fuels (12 period)

Desirable properties of engine fuels, types of auto engine fuels. Properties of conventional fuels (petrol, diesel), properties of alternative fuels (Alcohols, LNG, CNG, LPG, Bio-Diesel, Hydrogen)

LIST OF PRACTICALS

1. Servicing of lubricating system
2. Servicing of fuel systems in petrol engines
3. Servicing of fuel injector
4. Servicing of F.I.P (Fuel Injection Pump)
5. Engine tune up
6. Study of turbocharger
7. Servicing of cooling system
8. Study of engine block
9. Servicing of fuel system in diesel engine
10. Study of M.P.F.I engine

INSTRUCTIONAL STRATEGY

The teacher should lay emphasis on making the students conversant with the principles and practices related to various types of engines. Audio visual aids should be used to show engine features and working. Demonstrations should be made in automobile shop to explain various engine components.

RECOMMENDED BOOKS

1. Automobile Engineering – Vol. II by Dr. Kirpal Singh; Standard Publishers Distributors, 12th edition

2. Automobile Engineering by R.B. Gupta; Satya Prakashan, New Delhi
3. Automotive Engines by Srinivasan, TMH, Delhi
4. Automobile Engineering by Chikara, Dhanpat Rai and Sons, New Delhi
5. Automobile Engineering by KM Gupta, Umesh Publishers, Delhi
6. Auto Engine –I by G.S. Aulakh, Eagle Prakashan, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Period)	Marks Allotted (%)
1	16	22
2	16	22
3	12	14
4	12	14
5	12	14
6	12	14
Total	80	100

3.4 CHASSIS, BODY AND TRANSMISSION

L T P
Periods/week 5 - 3

RATIONALE

Chassis, body and transmission forms the core of automobile engineering. The subject focuses at imparting knowledge and skills regarding chassis and body and transmission system.

DETAILED CONTENTS

1. Chassis (12 period)
Classification of vehicles, types of chassis, layout of conventional type of chassis, function and arrangement of major assemblies. Alternating arrangement used such as engine position, drive types, their merits and demerits
2. Body (26 period)
Classification of automobiles on different basis. Car body types, Chassis construction, types of commercial vehicles, Commercial vehicle body details. Selection of paint and painting process, body trim items, Chassis construction types- frame and unitary, body components and their constructional details. Ergonomics in design of seat, controls and displays, gear lever, steering wheel and foot control.
3. Clutch (14 period)
Necessity, function and requirements of clutch, types of clutch - single plate clutch, multiplate clutch, hydraulic power assisted and wet and dry plate clutch, clutch plate and lining material, construction and working of centrifugal, semi centrifugal, diaphragm clutch and fluid coupling
4. Transmission (14 period)
Necessity, function and types of transmission- Sliding, constant mesh and synchromesh. Over drive, over running clutch, description and operation of transfer gear box. Common faults and remedies, types of automatic transmission, working of epicyclic gear box, torque converter
5. Final Drive (14 period)
Propeller shaft – function, construction details. Universal joints - functions and types. Types of final drive – hotchkiss drive, torque tube drive. Differential – principle, functions and it's working. Rear axles – semi floating, three quarter floating, fully floating. Common faults and remedies

LIST OF PRACTICALS

1. Study and sketches of Heavy and Light vehicle chassis.
2. Study and sketches of Motor cycle and scooter chassis
3. Study and sketches of single plate clutch(coil pressure spring and diaphragm type)
4. Study and sketches of multiple clutch
5. Study and sketches of sliding mesh gear box
6. Study and sketches of constant mesh gear box
7. Study and sketches of synchromesh gear box
8. Study and sketches of universal joints, slip joint and propeller shaft
9. Study and sketches of different floating axles
10. Study and sketches of differential

INSTRUCTIONAL STRATEGY

Teacher should make use of audio visual aids to show features of chassis, body and transmission. Demonstration should be made in the automobile shop to explain various aspects of chassis, body and transmission.

RECOMMENDED BOOKS

1. Automobile Engineering, Vol. I by Dr. Kirpal Singh, Standard Publishers
2. Automobile Engineering by GBS Narang, Khanna Publishers, Delhi
3. Automobile Engineering (in Hindi) by Dr. Kirpal Singh, Standard Publishers Distributors, Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Period)	Marks Allotted (%)
1	12	14
2	26	38
3	14	16
4	14	16
5	14	16
Total	80	100

3.5 MEASUREMENT, INSTRUMENTATION AND CONTROL

L T P
Periods/week 5 - 2

RATIONALE

A diploma holder should have knowledge of measurement systems, various sensors, transducers and devices for measuring various parameters. Hence this subject.

DETAILED CONTENTS

1. Measurements and Measurement Systems (06 period)
Definition, significance of measurement, generalized measurement systems, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, sources of errors in measurement, classification of errors
2. Sensors, Transducers and Strain Gauges (12 period)
Introduction, classification, primary sensing elements, photo sensors, hall effect sensors, transducer conditioning, transducer selection and specification, resistance transducers, variable inductance type transducers, capacitive transducers, piezoelectric transducers, introduction to strain gauges, gauge materials,
3. Measurement of Force, Torque, Shaft Power, Speed and Acceleration (10 period)
Introduction, force and weight measurement systems, measurement of torque, shaft power, speed and velocity, acceleration, pressure measurements
4. Temperature and Strain Measurement (10 period)
Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, pyrometer, optical pyrometer, strain measurements, strain gauge, preparation and mounting of strain gauges, gauge factor
5. Comparators and Angular Measurement (12 period)
Introduction to comparators, characteristics, classification of comparators, mechanical comparator, electric and electronic comparators- principles. LVDT, pneumatic comparators, angular measurements, bevel protractor
6. Determination of Count and Measurement of Time, Time Interval and Frequency (10 period)
Introduction, counters, time and frequency standards, clock and watches, frequency interval and frequency

7. Signal Transmission and Processing (10 period)
Introduction, interfacing circuits, amplifiers, modulation and demodulation, filters, transmission of signal and data, devices and systems, signal display & recording devices
8. Measurement of Process Variables -Pressure, Temperature, Flow and Level (04 period)
Introduction, pressure, temperature, flow rate, level measurement, thermometers, bimetallic thermocouples, thermistors and pyrometers.
9. Automation and Control (06 period)
Definition, types, need of automation, advantages and disadvantages of automation, introduction of control system terminology introduction to numerical control, basic concepts of NC, CNC and DNC. PLC and its applications in automotive industry

INSTRUCTIONAL STRATEGY

1. Use computer based learning aids for teaching learning
2. Demonstrations should be made to explain the concepts

RECOMMENDED BOOKS

1. Mechanical Measurements by Beckwith Marangoni and Lienhard; Pearson Education, 6th Ed., 2006
2. Engineering Metrology by R.K. Jain; Khanna Publishers, 1994
3. Industrial Instrumentation by Alstuko and Jerry. D. Faulk; Thompson Asia Pvt. Ltd.2002
4. Mechanical Measurements by Beckwith Thomas G; Narosa Publishing House, N. Delhi
6. Measurement Systems, Application Design by Doeblein E.O; McGraw Hill, 1990
6. Mechanical Measurements and Control by Kumar D.S ; Metropolitan, N. Delhi
7. Mechanical Measurement by Sirohi; New Age Publishers
8. Instrumentation and Control by D, Patranabis; ISBN No. 81-88114-30-8, Umesh Publications

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Period)	Marks Allotted (%)
1	06	08
2	12	16
3	10	12
4	10	12
5	12	14
6	10	12
7	10	12
8	04	06
9	06	08
Total	80	100

3.6 AUTO ENGINEERING DRAWING

L T P
Periods/week - - 8

RATIONALE

An Automobile Engineering diploma holder, irrespective of his field of operation in an industry or transport undertaking, is expected to possess a thorough understanding of engineering drawing, which includes clear spatial visualization of the subject and the proficiency in reading and interpreting a wide variety of drawings. Besides this, he is also expected to have a certain degree of drafting skills depending upon his job functions to perform his day-to-day activities e.g. communicating and discussing the ideas with his superiors and passing on instructions to his subordinates in an unambiguous way. The teachers are recommended to lay emphasis on showing automobile components to students..

DETAILED CONTENTS

Assembly Drawings of the following automotive components:

1. Joints and Bearings (30 period)
 - Cotter Joint
 - Knuckle Joint
 - Universal joint
 - Bush bearing
 - Plummer block or pedestal bearing
 - Ball bearing
 - Roller bearing- Straight and Needle type
2. Engine Components (30 period)
 - Four Stroke Petrol Engine Piston
 - Diesel Engine Piston
 - Connecting rod
 - Crank shaft – 4 cylinder Engine
 - Spark Plug
3. Gears (24 period)
 - Nomenclature of gears
 - Profile of spur gear by ‘Approximate method’
 - Profile of spur gear by “Unwin’s Method’
4. Cam Profile (26 period)
 - Different types of cams and followers
 - Drawing of cam profile for following motion of follower
 - a. Uniform velocity motion
 - b. Simple harmonic motion (SHM)
 - c. Uniformly accelerated and retarded motion

5. Coupling (18 period)

Flange coupling – Protected, unprotected and flexible, muff coupling, Oldham coupling

INSTRUCTIONAL STRATEGY

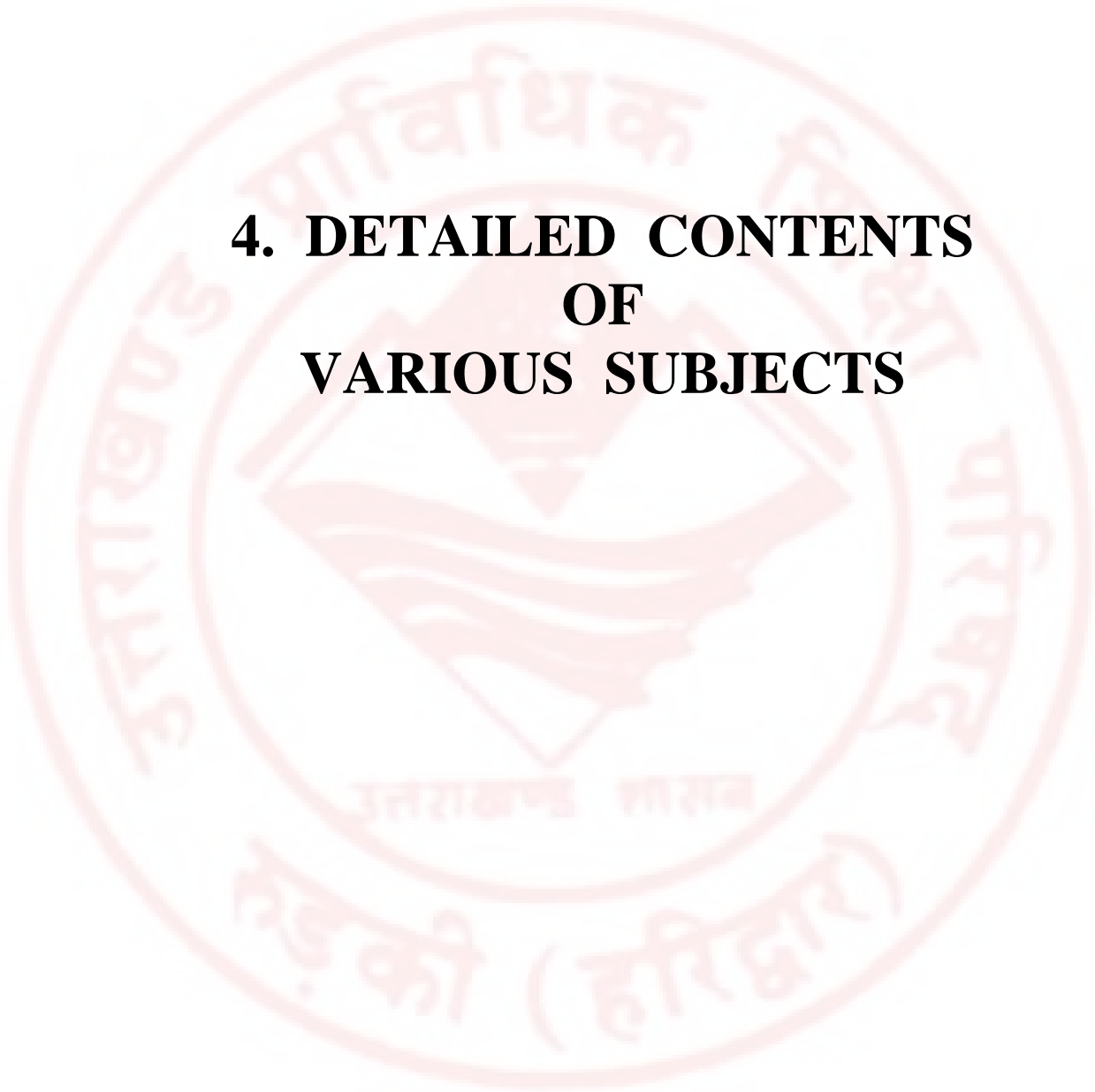
Teacher should make use of models while explaining the details of drawing of various automobile parts and components. Emphasis should be laid on cleanliness and quality of drawings.

RECOMMENDED BOOKS

1. Auto Engineering Drawing by RB Gupta; Satya Parkashan, New Delhi
2. Automobile Engineering Drawing by Raj Kumar, North Publication, Jalandhar
3. Machine Drawing by PS Gill; BD Kataria and Sons, Ludhiana
4. Machine Drawing by Lakshminarayan; Jain Brothers, New Delhi
5. Automobile Engineering- Vol. I and II by Dr. Kirpal Singh, Standard Publishers Distributors, Delhi



FOURTH SEMESTER



**4. DETAILED CONTENTS
OF
VARIOUS SUBJECTS**

4.1 MECHANICS OF MATERIALS

L T P
Periods/week 4 - 2

RATIONALE

Diploma holders in this course are required to analyze reasons for failure of different components and select the material for different applications. For this purpose, it is essential to teach them concepts, principles, applications and practices covering stress, strain, bending moment, shearing force, shafts and springs. Hence this subject has been introduced.

DETAILED CONTENTS

1. Introduction to Material Properties (4 Periods)
Mechanical properties of materials such as elasticity, plasticity, ductility, brittleness, toughness, hardness, tenacity, fatigue, malleability, stiffness. Elastic bodies, plastic bodies and rigid bodies, deformation, stress concentration factor
2. Stresses and Strains (12 Periods)
 - 2.1 Force, its definition and types, units, different types of loads.
 - 2.2 Definition of stress and strain, axial loading, different types of stresses and strains, tensile and compressive stress and strain, elastic limit, Hooke's law, stress-strain curve for ductile and brittle material, salient features of stress-strain curve. Young's modulus of elasticity
 - 2.3 Factor of safety, safe stresses, ultimate stress
 - 2.4 Stress and strain in straight, stepped bars and taper bar of circular cross section, determination of stress and elongation of a bolt in a bolted joint when subjected to direct external load only
 - 2.5 Temperature stresses for single section
 - 2.6 Stress and strain on composite section under axial loading, stress and strain due to temperature variations in homogeneous and composite bars and metallic tyres
 - 2.7 Shear load, shear stress and strain, modulus of rigidity, lateral strain, Poisson's ratio
 - 2.8 Volumetric strain, bulk modulus. relation between modulus of elasticity, modulus of rigidity and bulk modulus
3. Shear Force and Bending Moment (12 Periods)
 - 3.1 Types of beams and types of supports and loads
 - 3.2 Concept of shear force and bending moment, sign convention
 - 3.3 Shear force and bending moment diagram for cantilever and simply supported beams subjected to point load and uniformly distributed loads only. Maximum bending moment and point of contra flexure, simple numerical problems

4. Theory of Simple Bending (10 Periods)
- 4.1 Concept of pure bending, neutral axis, moment of resistance, section modulus, assumptions of simple bending and limitations, bending equation, bending of simple and flitched beams, beams of uniform strength, section modulus, flexural rigidity
 - 4.2 Application of flexural formula for solid rectangular and circular section, Channel section, hollow rectangular and circular section
 - 4.3 Simple numerical problems
5. Torsion (10 Periods)
- 5.1 Pure torsion, torsion equation (relation between twisting moment, shear stress and angle of twist), polar modulus of section
 - 5.2 Assumptions in theory of pure torsion
 - 5.3 Strength of circular solid shaft and hollow shaft in pure torsion
 - 5.4 Power transmitted by shaft
 - 5.5 Torsion in helical springs
 - 5.6 Simple numerical problems
6. Strain Energy (04 Periods)
- 6.1 Concept of strain energy, proof resilience and modulus of resilience
 - 6.2 Stresses developed due to gradual, sudden and impact load
 - 6.3 Strain energy stored due to gradual, sudden and impact load
 - 6.4 Strain energy due to bending and torsion
 - 6.5 Simple numerical problems
7. Springs (08 Periods)
- 7.1 Types of springs and their uses
 - 7.2 Laminated spring (semi-elliptical and quarter-elliptical type), determination of number of plates, maximum deflection under axial load
 - 7.3 Helical Springs closed coiled and open coiled helical springs subjected to axial load
 - 7.4 Angle of twist, strain energy, shear stress and maximum deflection under axial load
 - 7.5 Effect of falling load helical spring
 - 7.6 Simple numerical problems
8. Column and Strut (04 Periods)
- 8.1 Definition of column and strut, classification
 - 8.2 Buckling, slenderness ratio, buckling factor
 - 8.3 Euler's formula and Rankine formula
 - 8.4 Eccentric loading, stress diagram
 - 8.5 Simple numerical problems

LIST OF PRACTICALS

1. Tensile test on bars of mild steel and aluminum.
2. Shear test on specimen of two different metals.
3. Bending test on a steel bar or wooden beam.
4. Perform following impact test:
 - (a) Izod impact test
 - (b) Charpy test
5. Torsion test on specimen of different metals for determination of angle of twist for a given torque.
6. Determine the stiffness of a helical spring and plot a graph between load and extension.
7. Hardness test on metal and find Brinell hardness, Rockwell hardness and Vicker's hardness.

INSTRUCTIONAL STRATEGY

1. Use computer based learning aids for effective teaching-learning
2. Expose the students to real life problems
3. Plan assignments so as to promote problem solving abilities and develop continued learning skills

RECOMMENDED BOOKS

1. Mechanics of Materials by Kirpal Singh; Standard Publishers, New Delhi
2. Strength of Materials by R.S. Khurmi; S. Chand and Company, Delhi
3. Strength of Materials by S. Ramamurtham; Dhanpat Rai Publishing Co.(P) Limited, Delhi
4. Strength of Materials by SS Rattan, TMH, Delhi
5. Elements of Strength of Materials by D.R. Malhotra and H.C, Gupta; Satya Parkashan, New Delhi
6. Mechanics of Solids by VS Prasad; Galgotia Publications, New Delhi
7. Strength of Materials Dr. B.C Puniya & S.Rama Murthi; Laxmi Publication, New Delhi
8. Mechanics of Solids by J.K.Kapoor; Bharat Bharati Prakashan, Meerut

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	06
2	12	20
3	12	20
4	10	16
5	10	16
6	04	06
7	08	10
8	04	06
Total	64	100

4.2 PRINCIPLES OF THERMAL ENGINEERING

L T P
Periods/week 4 - 3

RATIONALE

A diploma holder in Automobile Engineering is supposed to look after the I.C engines, air compressors and air conditioning of automobiles. Therefore, it is essential to teach concepts, principles, applications and practices covering laws of thermodynamics, basic air cycles, types of fuel used and their properties and components of air conditioners. Hence this subject has been included in this course.

DETAILED CONTENTS

1. Thermodynamic terminology (08 periods)
Concept of thermodynamics, heat, temperature, intensive and extensive properties, path, process, system, surroundings, enthalpy, internal energy and thermodynamic work
2. Gas Laws (08 periods)
Boyle's law, Charle's law, Joule's law, Characteristic gas equation, gas constant, universal gas constant. Simple numerical problems based on above laws.
3. Laws of Thermodynamics (10 periods)
Zeroth law of thermodynamics, Irreversible process, First law of thermodynamics, Second law of thermodynamics (concept only), Thermal efficiency, Heat pump, heat engine and heat sink, concept of entropy, Constant volume, constant pressure, isothermal, adiabatic, polytropic, throttling and free expansion processes. Numericals based on above processes
4. Air Cycles (10 periods)
Carnot cycle – concept only, Otto cycle, Diesel cycle, Dual combustion cycle, Numericals based on above cycles
5. Air Compressors (08 periods)
Reciprocating air compressor, Centrifugal compressor, Rotary air compressor - its types. Working of single stage and double stage compressor and applications, super charging
6. Heat Transfer (08 periods)
Modes of heat transfer – Conduction, convection, radiation, Fourier's Law, Numericals based on Fourier's Law

7. Refrigeration and Air Conditioning (12 periods)

- Concept of refrigeration, Unit of refrigeration, refrigerants, heat pump, coefficient of performance, rating of refrigeration machines
- Principles of air conditioning, Concept of human comfort, Air-conditioning system, components of air conditioning system and their function

LIST OF PRACTICALS

1. To find flash point and fire point of a given fuel.
2. Study and Sketch of four stroke and two stroke Engine
3. Identification of components in air-conditioning system
4. Study of components of a refrigerator
5. To study different air compressors
6. To study room air conditioning system

INSTRUCTIONAL STRATEGY

Teachers should provide simple exercises to students involving applications of various concepts and principles being covered in the subject. Problems on various topics should be prepared and students should be asked to solve them. In practical work, students should independently perform practicals.

RECOMMENDED BOOKS

1. Thermal Engineering by SK Kulshreshtha; Vikas Publishing House Pvt. Ltd., Delhi
2. Thermal Engineering by A.S. Sarao; Satya Prakashan, New Delhi
3. Engineering Thermodynamics by Valan A. Arasu, TMH, Delhi
4. Thermal Engineering by P.L. Ballaney; Khanna Publishers, Delhi
5. Thermal Engineering by R.K. Rajput; Laxmi Publications, New Delhi
6. Refrigeration and Air conditioning by G.S. Aulakh, Eagle Prakashan, Jalandhar
7. Thermodynamics –I by B.S. Ubhi, S.K. Kataria & Sons, Delhi
8. Hydraulics & Pneumatics by Birinder Singh, Kaption Publishing house, New Delhi
9. Hydraulic and Pneumatic control by Shammuga Sundram, S.Chand & Company Ltd., New Delhi
10. Pneumatic controls by Festo Didactic, Bangalore

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1	08	12
2	08	12
3	10	16
4	10	18
5	08	12
6	08	12
7	12	18
Total	64	100

4.3 AUTO ENGINES

L T P
Periods/week 4 - 2

RATIONALE

A diploma holder in this field must have knowledge of combustion phenomenon, fuel system and ignition system in engine. In addition, knowledge about engine testing and engine pollutants is also necessary. Hence this subject.

DETAILED CONTENTS

1. Combustion (10 periods)
Phenomenon of combustion in C.I engines and S.I engines, phases of combustion and after burning. Methods producing turbulence. Various types of combustion chambers for petrol and diesel engines. Detonation, preignition and knocking, octane and cetane numbers, swirl and squish
2. Fuel System (20 periods)
 - Fuel System in Spark Ignition Engine: Fuel feed system, fuel pumps- their types , construction and working, fuel tank, fuel lines, fuel filters, concept of carburetion. Working and construction of a simple carburetor. Advantages of using fuel injection system in spark ignition engines. Concept of MPFI system, Constructional details of an MPFI system. Dry and wet air cleaners, Direct injection in petrol engines.
 - Fuel System in Diesel Engine: Fuel filters-primary and secondary, Fuel injection pumps- plunger and barrel type, distributor type; priming of fuel feed pumps, Fuel injectors and solid injection, Common rail direct Injection(CRDI). Layout and details of a CRDI fuel supply system. Type of nozzles, Governing and type of governors. Use of turbo charger and super charger in diesel engine
3. Ignition System in S.I. Engine (12 periods)
 - Concept of ignition system, battery ignition systems. Function and constructional details of ignition coil, condenser, contact breaker point, distributor, spark plugs. Ignition timing systems. Distribution less ignition system, Capacitor discharge system, Coil on plug system
4. Engine Testing (12 periods)
Classification of tests, fault finding test, routine test, measurement of IP, BP , mechanical efficiency, fuel consumption, thermal efficiency relative efficiency, air consumption, volumetric efficiency, lubricating oil consumption. Heat balance sheet
5. Engine Pollutants and its control (10 periods)
 - Sources of engine pollutants of S.I and C.I engine. Effect of pollutants on human beings and environment

- Methods of Control – Crank case ventilation, fuel tank ventilation, carburetion and recirculation. Redesigning of various engine systems, V.V.T, Exhaust gas recirculation systems. Catalytic converters. Close loop feedback selective catalytic reaction, electronic integrated engine management system. Exhaust gas treatment for diesel engines. Emission Norms (Latest Bharat/ Euro norms)

LIST OF PRACTICALS

1. Dismantling, inspection and assembling of fuel injection pump.
2. Dismantling, inspection and assembling of fuel injector.
3. Phasing and calibration of fuel injection pump on calibration machine.
4. Gasoline engine Emission test using exhaust gas analyser.
5. Diesel engine Emission test using smokemeter.
6. Study of CRDT engine
7. Servicing of valves and valve-mechanism
8. To prepare heat balance sheet of an IC engine
9. To conduct Morse test an multi cylinder petrol engine

RECOMMENDED BOOKS

1. Automobile Engineering, Vol 2, by Dr. Kirpal Singh; Standard Publishers Distributors, 12th or later edition.
2. Automobile Engineering by R.B. Gupta; Satya Parkash, New Delhi
3. I.C. Engines by M.L. Mathur and Sharma; Dhanpat Rai and Sons, Delhi
4. Auto Engines by Halderman and Mitchell; Pearson Publications

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	10	14
2	20	32
3	12	20
4	12	20
5	10	14
Total	64	100

4.4 SUSPENSION, STEERING & BRAKING

L T P
Periods/week 5 - 2

RATIONALE

Suspension, steering and braking forms the important components of automobile engineering. The subject aims at imparting knowledge and skills regarding suspension, steering and braking system of vehicles.

DETAILED CONTENTS

1. Suspension System (12 periods)
Function, types- independent, rigid axle. Springs – functions, construction materials and types (coil spring, leaf spring and torsion bar) sprung and unsprung weight, characteristics of springs, spring eye, bushes, variable rate spring, helper leaves, leaf sections, camber grading and nipling spring seats, rubber pads, pressure blocks, spring cover, interleaf inserters. Function and construction of hydraulic dampers (shock absorbers). Pneumatic suspension system – lay out and working. Function and Construction of hydraulic damper (shock absorber). Diagnosis of common faults and their rectifications
2. Front Axle (03 periods)
Types – Stub double drop, fully dropped, load distribution, effect of braking on axle shape, steering head, Elliot and reverse Elliot, steering knuckle
3. Steering (14 periods)
 - Power steering - necessity, types, Construction features and working of hydraulic and electronic power steering system, Four wheel steering, Common steering system troubles and remedies
 - Steering mechanism, function, Davis and Ackerman's Principle of steering. Working and constructional details of steering gear, steering linkages, sector arm, center arm, drag link and tie rod steering stops. Front wheel geometry-caster, camber, steering axis inclination, toe in and toe out. Cornering force, cornering power and self-righting torque. Over steering and under steering. Common steering troubles and remedies
4. Wheel and Tyres (09 periods)
Wheels – types, hub attachment, wheel specification, Tyres - classification and types. Construction of pneumatic tyres, composition of covers, tread breaker, bead and casing, comparison of cross-ply and radial-ply tyres. Causes of excessive tyre wear. Tyre care and maintenance. Static and dynamic balance. Tubeless tyres, Run flat tyres, retreading of tyers

5. Braking System

(10 periods)

- Purpose of brakes, layout of braking system, components, Types of brakes- mechanical, hydraulic, power. Principle of hydraulic brakes, braking action, master cylinder, wheel cylinder, leading and trailing shoes, self adjusting brakes, self applying and self releasing action, anti-skid devices, pedal travel, brake enclosures, Drum brakes- Construction & Working, Disc. Brakes- Construction and Working. Common faults and their rectification.
- Power Brakes - Air, air-hydraulic, hydro-vac brakes-their construction components and working details. Brake fluid and its characteristics, brake liner, hand brake, Antilock brake systems. Brake test, common faults and their rectification.

LIST OF PRACTICALS

1. Study and sketch of suspension system - coil spring, leaf spring, torsion bar, shock absorber
2. Study and sketch of power brake system
3. Study and sketch of epicyclic gear box
4. Study and sketch of torque converter
5. Study and sketches of mechanical and hydraulic brake system and its parts

INSTRUCTIONAL STRATEGY

Teacher should make use of audio visual aids to show features of chassis, body and transmission. Demonstration should be made in the automobile shop to explain various aspects of chassis, body and transmission.

RECOMMENDED BOOKS

1. Automobile Engineering, Vol. I by Dr. Kirpal Singh, Standard Publishers, Delhi
2. Automobile Engineering by GBS Narang, Khanna Publishers, Delhi
3. Automobile Engineer (in Hindi) by Dr. Kirpal Singh, Standard Publisher, Delhi
4. Chassis, Body and Transmission by Vijay Singh & Raj Kumar, Ishan Publications, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1	20	24
2	06	08
3	22	28
4	16	20
5	16	20

Total	80	100
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4.5 AUTO ELECTRICAL AND ELECTRONICS EQUIPMENT

L T P

Periods/week 5 - 2

RATIONALE

Diploma holders in Automobile Engineering have to deal with different types of batteries, their charging and testing, regulators, ignition system, lighting system and various other electrical accessories used in Automobile Engineering. Hence the subject of automotive electric equipment is very essential for these technicians.

DETAILED CONTENTS

1. Introduction (04 periods)
Various Electrical components/systems in Automobile. Their functions and demands, earth return system, types of earthing, 6V, 12V system
2. Batteries (16 periods)
 - 2.1 Lead Acid Batteries - Construction, working, elements, types, materials used, electrolyte and its strength, effect of added plate area and temperature, rating, capacity, efficiency, temperature characteristics, terminal voltages, charging and discharging
 - 2.2 Battery Testing: Electrolyte testing by hydrometer, voltage test, high discharge and cadmium test (voltage)
 - 2.3 Battery Charging: Constant potential and constant current, initial charging, normal charging, trickle charging, intermittent charging, boost charging.
 - 2.4 Battery Defects: Stipulation, plates decay, working, erosion, cracking, sedimentation, separator defects, short circuits, overcharging
 - 2.5 Alkaline Batteries: Construction, working, merits and demerits of Ni-Fe, Ni-Cd, Ag-Zn cells
 - 2.6 Lithium ion battery - Construction and working
3. Charging System (10 periods)
 - 3.1 Circuits, function and various components, dynamo and alternator, types, construction, working, advantages and disadvantages of dynamo and alternators, drives, cut out relay
 - 3.2 Regulation: Functions of various components of two unit, three unit and heavy duty Regulators, Regulator adjustments, Regulators for alternators
4. Starting System (14 periods)
Function of various components, torque terms, principle and constructional details of starter motor, switches, types, starter to engine drive and their types, Starter-alternators
5. Ignition System (10 periods)
 - 5.1 Constructional details of coil, distribution, condenser, meaning of cam angle, ignition timing, ignition advancing mechanisms, centrifugal and vacuum type,

- transistorized ignition system, construction and working details of magneto ignition system
- 5.2 Spark Plugs: Constructional details of spark plugs, classification as per reach, heat range, diameter, and effect of leaded fuels, care and maintenance of spark plug
6. Lighting System (08 periods)
- 6.1 Various lighting circuits, head lamp, type and constructional details, sealed beam, double filaments, asymmetric and dual units, vertical and side control of lamps, fog light, side light, brake light, instrument light, indicator lights, reversing light, lamp mounting
- 6.2 Wiring: HT and LT, their specifications, cable colour codes, wiring Harness, Cable connections, Wiring diagrams of cars and two wheeler, Fuses, faults and rectification
7. Electrical Accessories (07 periods)
- Fuel gauges- bimetallic and balancing coil type, Air pressure gauges, temperature gauges, Ammeter, warning light, speedometer, wind screen wipers, horns, horn relay, electric fuel pump, Faults and rectification
8. Miscellaneous Electrical Equipment (03 periods)
- Impulse Speedometer, tachometer, heaters, defrosters, Air conditioner, and Electric door locks, window actuation, Seat adjusters, Electric motors and Pumps – Definition, types and various application of single phase and three phase motors, type of pumps and their applications, direct online starter and star delta starter
9. Electronic Devices (02 periods)
- Automobile electronic devices, Sensing units, Computer controlled sensors
10. Electronics and Computer Applications in Automobiles (06 periods)
- Introduction to circuit-symbols, Integrated circuits, Amplifiers, filters stepper and synchronous motors, Logic gates, Combinational and sequential logics, Flip flops, sensors. Analog and digital devices, converters, signal conditioners, communication chips, multiplexed wiring, working of ECU, microprocessor and its applications, concept of operation by wire

LIST OF PRACTICALS

1. Testing of Battery with hydrometer and high rate discharge tester, charging of Batteries.
2. Testing and measurement of ignition timing and dwell angle with timing light and cam angle tester.
3. Testing, cleaning and setting of spark plug on spark plug cleaning and testing machine.
4. Testing of alternator rotor and stator winding for short circuit, ground and broken circuit.
5. Head light beam setting.

6. Testing and setting of horn and relay.
7. Testing and fault tracing of field winding, armature and magnetic switch for short circuit, grounding of a starter.
8. Testing dipper switch, flasher unit and indicator circuits and fault tracing.
9. Testing and fault tracing of different components of transistorized ignition system.
10. Testing of magneto ignition circuit and Adjustment.
11. Identification of colour codes for continuity test in a wiring harness.
12. Study and sketching of complete wiring circuit of an Indian vehicle.
13. Dismantling, inspection and assembling of alternator.
14. Dismantling, inspection and assembling of starter motor.
15. Identify various electrical components on the mock up wiring board.
16. Removing and refitting head light assembly, head light beam setting.
17. Checking and setting of horn, relay, dipper switch, flasher unit and indicator circuits.

INSTRUCTIONAL STATREGY

Teachers should lay emphasis on concepts and principles while imparting instructions. As far possible, subject teaching should be supplemented by demonstrations in the laboratory. During practical work, individual students should be given opportunities to perform practicals independently.

RECOMMENDED BOOKS

1. Automobile Engineering by Kirpal Singh, Standard Publishers, Delhi
2. Automotive Electrical Equipment by P.L. Kohli, Tata McGraw Hill, Delhi
3. Automotive Electrical Equipment by William H. Crouse, Tata McGraw Hill, Delhi
4. Automobile Engineering by R.B. Gupta, Satya Prakashan, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	05
2	16	20
3	10	12
4	14	16
5	10	12
6	08	10
7	07	09
8	03	05
9	02	02
10	06	09
Total	80	100

4.6 MANUFACTURING TECHNOLOGY

L T P
Periods/week 5 - 6

RATIONALE

The knowledge of manufacturing techniques in the area of foundry, machine shop (fitting shop, lathe machines and shaping), inspection and gauging and in coating both on metallic and non-metallic is essential at the first stage for understanding technology. Hence this subject.

DETAILED CONTENTS

1. Fitting (15 periods)
Fits, limits and tolerances and their applications, unilateral and bilateral tolerances, gauges, gauge tolerances, use of micrometer, vernier, height gauges, dial comparator, straight edge, surface plate. Metal cutting, metal shear, metal sawing, metal bending processes
2. Metallic and Non-metallic Coatings (15 periods)
Necessity of metallic and non-metallic coatings, principles and processes of electroplating, galvanizing, metal spraying, painting and their applications, preparation of base materials. Uses of primers, paints and finish coatings, powder coating and its advantages
3. Foundry (15 periods)
Introduction, types of patterns, pattern materials, cores and core boxes, core materials, preservation and storage of patterns,. Introduction to moulding, types of moulding, types of moulds, preparation of cores, defects in moulds and their remedies, casting defects and their remedies
4. Lathe (15 periods)
 - Introduction, types of lathes, specifications, description and functions of lathe parts, feed mechanism, drives and transmission, work holding devices, turning tools
 - Lathe operations – plain turning, facing, centring, parting off, undercutting, taper turning, eccentric turning, drilling, reaming, thread cutting and knurling. Speed, feed and depth of cut
 - Introduction to capstan and turret lathes, copying lathe and their attachments, difference between capstan and turret lathes and heads, tool holders and tool layout, tool geometry and use of throwaway tips, brazed tools and HSS tools

5. Shaper (05 periods)

Operation and mechanism

6. Inspection Instruments and Gauges (15 periods)

Height gauge, depth gauge, bore gauge, slip gauge, sine bar, measurement of taper by use of slip gauges, interchangeability, Go and Not-Go gauges, screw thread micrometer, thread gauge, radius gauge, dial gauge, and gear tooth vernier, hardness checking instruments, coating thickness checking instruments, surface finish checking instruments. Quality Control, concept of control chart.

LIST OF PRACTICALS

1. Fitting shop

Bench work and fittings; simple male-female fitting (fitting of pulley, bearings, gears on shafts), scraping, pipe fittings with leak proof joints, checking alignment and centre distance

2. Pattern making and Foundry shop

- To prepare pattern of rectangular block, 'V' block, step pulley with core box, split pattern
- Preparation of open floor mould of solid pattern, cope drag mould using split pattern
- Visit to foundry to see castings of cast iron, steel, non-ferrous materials, hand moulding, machine moulding and melting furnaces. Induction heating and gas fired furnace

3. Lathe

- Introduction to turning machine and allied services like cutting tool grinding, general shop layout including maintenance, oils, tools and gauge stores.
- Different exercises in turning like plain turning, step-turning, facing, chamfering, knurling, parting off and thread cutting, use of compound slide and tailstock, tool grinding, selection of coolant and lubricants and speed and feeds. Use of safety goggles

INSTRUCTIONAL STRATEGY

1. Teachers should lay emphasis on making the students conversant with concepts, principles, procedures and practices related to various manufacturing processes.
2. Focus should be laid in preparing jobs using various machines in the workshop.

RECOMMENDED BOOKS

1. Workshop Technology by BS Raghuwanshi, Dhanpat Rai & Sons, Delhi
2. Elements of Workshop Technology by SK Choudhary & Hazara, Asia Publishing House
3. Principles of Foundry Technology by Jain, Tata McGrawHill, New Delhi
4. Workshop Technology, Vol-I, II & III by Chapman, Standard Publishers Distributors, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	15	18
2	15	18
3	15	18
4	15	18
5	05	10
6	15	18
Total	80	100

4.9 INDUSTRIAL TRAINING

Industrial training provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice.

For this purpose, students at the end of fourth semester need to be sent for industrial training for a minimum of 4 weeks duration to be organised during the semester break starting after IV Semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. A teacher may guide a group of 4-5 students. A minimum of one visit by the teacher is recommended. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

Internal assessment and external assessment have been provided in the study and evaluation scheme of V Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations. The formative and summative evaluation may comprise of weightage to performance in testing, general behaviour, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from industry, if any. The components of evaluation will include the following.

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|--------------------------------------|-----|
| a) Punctuality and regularity | 15% |
| b) Initiative in learning new things | 15% |
| c) Relationship with workers | 15% |
| d) Industrial training report | 55% |