



Integral University, Lucknow  
University Polytechnic  
Study and Evaluation Scheme  
Program: Diploma in Mechanical Engineering

**Semester V**

S. No.	Course code	Course Title	Type of Paper	Period Per hr/week/sem			Evaluation Scheme				Sub. Total	Credit	Total Credits	Attributes						
				L	T	P	CT	TA	Total	ESE				Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics
<b>THEORIES</b>																				
1	DME-501	Kinematics of Machine	Core	03	01	00	40	20	60	40	100	3:1:0	4	Y	Y	Y				
2	DME-502	M/C Tools Technology & Maintenance	Core	03	01	00	40	20	60	40	100	3:1:0	4	Y	Y	Y		Y	Y	
3	DME-503	Design & Estimation	Core	03	01	00	40	20	60	40	100	3:1:0	4	Y	Y	Y				
4	DME-505	Production Technology	Core	03	01	00	40	20	60	40	100	3:1:0	4	Y	Y	Y		Y	Y	
5	DME-506	Automobile Engine.	Core	03	01	00	40	20	60	40	100	3:1:0	4	Y	Y	Y		Y	Y	
6	DME-507	Computer Aided Design & Manufacturing	Core	03	01	00	40	20	60	40	100	3:1:0	4	Y	Y	Y			Y	
<b>PRACTICAL</b>																				
7	DWS-551	Mechanical Workshop	Core	00	00	03	40	20	60	40	100	0:0:1.5	1.5	Y	Y	Y		Y	Y	
8	DME-554	Computer Aided Design Lab	Core	00	00	02	40	20	60	40	100	0:0:1	1	Y	Y	Y		Y	Y	
9	DME-556	Automobile Lab	Core	00	00	02	40	20	60	40	100	0:0:1	1	Y	Y	Y		Y	Y	
10	DME-557	Field Exposure		-	-	-	-	-	-	40	40			Y	Y	Y		Y	Y	
11	GP-551	General Proficiency		-	-	-	-	-	60	-	60							Y	Y	
<b>Total</b>				<b>18</b>	<b>06</b>	<b>07</b>	<b>360</b>	<b>180</b>	<b>600</b>	<b>400</b>	<b>1000</b>		<b>27.5</b>							

## KINEMATICS OF MACHINES-

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#### UNIT-I

##### MECHANISMS AND MACHINES:

Definition, Kinematic pairs, types of mechanism, Special types of mechanism, Space mechanisms. 5

#### UNIT-II

##### KINEMATIC ANALYSIS

Displacement, Velocity and Acceleration of plane mechanism, Graphical and analytical techniques.

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#### UNIT-III

##### SYNTHESIS OF MECHANISMS-

Crank Rockers, Four Bar Mechanisms, Slider Crank Mechanisms. 6

#### UNIT-IV

##### CAMS AND CAM FOLLOWER MECHANISMS:

Purpose of using cam- Follower mechanisms, types of cams and cam follower mechanisms, Nomenclature synthesis of disc cam profiles for prescribed follower motion, determination of basic dimension, Graphical and analytical approaches for different types of followers, Dynamics of cam – follower systems - Jump and crossover stock. 7

#### UNIT-V

##### GEARS AND GEAR DRIVES:

Power transmission by gears and fundamental law of gearing, Involute profile and conjugate action, Characteristics of involute tooth gear - Pinion to system, Under cutting and interference, Minimum number teeth, types of gears, Various gear drives - Spur, Helical, worm and Bevel gear, Gear train Simple compound and epicyclic gear trains, Differential gears. 9

Ref Books:

1.Theory of Machines by : R.S. Khurmi

2.Theory of Machines by : S.S. Ratan

**MACHINE TOOL TECHNOLOGY &  
MAINTENANCE (DME-502)**

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**UNIT-I**

**BASIC FEATURES AND KINEMATICS**

Various types of machining operations and machine tools. Common features of all basic machine tools, work holding and tool holding devices, Drive systems, sources of power, Bed, body or frame. Mechanical drive system for providing reciprocating, oscillating and rotational movement. Systems of stepped and stepless, friction and positive drives. Principle of setting upper, Lower and Intermediate speeds. Mechanical methods of providing automaticity in machine tools.

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**UNIT-II**

**CENTRE LATHE, SHAPING, PLANING & SLOTTING MACHINES**

The centre lathe and its principle of working. Types of lathes, Lathe specification and size, Features of lathe bed. Head stock and tail stock. Feed mechanism and change-gears, carriage saddle, Cross slide, Compound rest, Tools post, Apron mechanism, lathe accessories, Chucks, Face plate, Angle plate, Driving plate, Lathe dogs, mandrills, Steady

rest, Lathe attachments. Lathe operations-plane and step turning, Taper turning, Screw cutting, Drilling, Boring, reaming, Knurling, Parting off, Under cutting, Relieving. Types of lathe tools and their uses. Brief description of semi automatic and automatic lathes such as capstan and turret lathes, their advantages and disadvantages over centre lathe, types of job done on them. General and periodic maintenance of a centre lathe. Working principles of planer, shaper and slotter. Differences and similarities among them, quick return mechanism applied to the machines. Types of work done on them, types of tools used, their geometry . General and periodic maintenance of a shaper.

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**UNIT-III**

**MILLING MACHINES:**

Types of milling machines, constructional features of horizontal milling M/C. general maintenance of the machine, types of milling cutters, milling operations like plane milling, space milling, angular milling form milling, straddle milling, gang milling, Negative rack milling, cutting speed and speed for different tools in up and down milling. Simple compound and Differential indexing, milling of spur gears and racks. General and periodic maintenance of milling machine.

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## UNIT-IV

### **DRILLING & BORING MACHINES GRINDING MACHINES BROACHING MACHINES:**

Types of tools used in drilling and boring. Classification of drilling and boring machines, principle of working and constructional details of simple and radial drilling M/C and general and periodic maintenance. Operations like facing, counter boring , tapering. Common abrasive grinding wheel materials, Bonds, Grain or grits of abrasive, Grain structure and shapes of common wheels, various speeds and feeds, Use of coolants, Methods of grinding. Types of grinding machines, precision finishing operations like honing. Broaching- internal and external surface, Types of work done on broaching machine. Simple types of broaches and their uses, Types of broaching machines. Comparison of broaching with others processes.

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## UNIT-V

### **JIGS AND FIXTURES COOLING PROCESS AUTOMATION OF MACHINING CENTRES:**

Object of Jigs and Fixture. Difference between jigs and fixtures. Principle of location. Principle of clamping. Locating and clamping devices. Types of jigs -Simple open and closed (or box) jigs. Drill jigs- Bushes ( Fixed liner, Renewal slip). Template. Plate jigs. Channel jigs, Leaf jigs. Simple example of milling, turning, grinding, horizontal boring fixtures and broaching fixtures. Welding fixtures. devices. Coolants and cutting fluids difference between coolant and cutting fluid, Function and action of cutting fluids. Requirement of good cutting fluids, their selection for different materials and operations. Introduction to CNC Machine tools (Computer Numerical Control Lathe) and

FMS (Flexible Manufacturing System) Introduction only.

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### **Ref Books:**

1. J.K. Kapoor : Bharat Bharti Prakashan.

**DESIGN AND  
ESTIMATION (DME-503)**

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**UNIT-I**

**INTRODUCTION TO DESIGN & MACHINE PARTS SUBJECTED TO DIRECT LOADS AND SHEAR LOADS:**

General design consideration in machine parts. Mechanical properties of materials of construction, steps in machine design. Factor of safety, Selection of materials. Threaded connections, core and nominal diameter of screw, boiler-Stay. Design for number of studs or bolts and their diameter for cylinder covers due to external forces. Punching and shearing. Design of cotter and Knuckle joints.

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**UNIT-II**

**RIVETED AND WELDED JOINTS MACHINE PARTS SUBJECTED TO BENDING MOMENT:**

Types of riveted joints, possible failure of riveted joints. Strength and efficiency of riveted joint. Unwins formula. Determination of safe load and pitch of rivets. Design of lap and butt joints. Common type of welded joints, definition of leg length, throat thickness and size of weld. Simple design for 'V' butt welded joint, Transverse fillet and parallel filletwelded joints. Design for the diameter of railway-Wagon axle, axle used in road-vehicles. Semi-elliptic Laminated spring-Proof load and proof stress stiffness. Expression for max. stress and deflection.determination of different dimensions number of Laminations, Central deflection in a Laminated spring.

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**UNIT-III**

**MACHINE PARTS SUBJECTED TO TWISTING MOMENT, MACHINE PARTS SUBJECTED TO COMBINED BENDING AND TWISTING MOMENT:**

Springs. Maximum shear stress induced for given axial load. Expression for axial deflection, spring index, solid length and stiffness. Calculation for number of coils, mean coil dia and dia of spring wire for axial gradual loads. Simple cases of composite springs. Design of keys and coupling bolts for a rigid flanged coupling

Theory of failures:

(i) Maxm. Principal stress theory.

(ii) Maxm. shear stress theory concept of equivalent bending moment, equivalent torque, Design of over hung crank pin. Design of shaft dia for over hung pulley in a belt drive.

**UNIT-IV****MACHINE PARTS SUBJECTED TO COMBINED DIRECT AND BENDING STRESS AND DESIGN OF GEAR:**

Eccentric load and eccentricity. Max. and minimum stress intensities. Reversal of stress. Design for safe load on small columns. Design of brackets and clamps for eccentric

loading. Selection of material, Design analyzing, Lewis equation, Stress concentration, Dynamic load, Surface compressive stress, Beam strength, Bending stress, check or plastic deformation, Design procedure for Spur gear and Helical gear.

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**UNIT-V****ESTIMATION OF MATERIAL REQUIREMENT & ESTIMATION OF TIME FOR DIFFERENT MACHINING OPERATIONS:**

Estimation of weight of simple machine parts. Review of the area/volume of triangle, equilateral triangle, Hexagon, rectangle, Square rhomboid, parallelogram, Octagon, circle, Hollow circle, Sector of circle, Sector of Hollow circle circular, Semi circle, Cube prism, Square prism, general prism, Cylinders, Sphere, Hollow sphere segment of sphere,

Zone of a sphere, Cones pyramids, Frustum of a pyramid, Frustum of a cone.

Turning, Facing, Chamfering, Knurling, Taper Turning, Threading, Drilling, Boring, Shaping and planning, Milling, Broaching, Simple problems pertaining to above.

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**Ref Books:**

1. Machine Design by : V.B. Bhandari
2. Machine Design by : R.S. Khurmi
3. Machine Design by : Dr. Rajendra Kaur, Laxmi Publications.

**PRODUCTION  
TECHNOLOGY (DME-505)**

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**UNIT-I**

**INTRODUCTION AND METAL FORMING PROCESSES:**

Concept of manufacturing processes, classification and application.

**(a) FORGING:**

Hammer forging, drop-forging, dies for drop-forging, drop hammers, press forging, forging machines or up setters, forging tools, forging defects and remedies. Concept of losses in forging operation, estimation of stock required for hand forging considering scale and shear losses

**(b) ROLLING:**

Elementary theory of rolling, hot and cold rolling, types of rolling mills, rolling defects and remedies.

**(c) PRESS FORMING:**

Types of presses, working, selection of press dies, die-material. Press operation-Shearing, piercing trimming, shaving, notching guering or rubber forming, embossing, stamping, punching.

**(d)** Drawing, extrusion, pipe and tube drawing.

**(e)** Energy forming technique - Explosive forming, electromagnetic forming.

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**UNIT-II**

**CONVENTIONAL METAL CUTTING PROCESSES:**

**(a)** Gear manufacturing process- Gear hobbing, gear shaping gear shaving, gear generating, gear burnishing, forming 'V' generator, straight bevel gear manufacturing, spiral bevel gear manufacturing.

**(b)** External threading process-Roll threads, thread milling, thread grinding, thread rolling, thread chasing, Die heads.

**(c)** Machining of cylindrical holes - Multiple spindle drill press, gang drill press, drilling deep holes and small diameter holes, boring, coordinate method of locating holes, Jig boring machine.

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**UNIT-III**

**METAL FINISHING PROCESS,SURFACE TREATMENT & FINISHING:**

Grinding Process, Diamond machining, Honing, Lapping, Super finishing, Polishing and buffing. Meaning of the terms surface treatment and its purpose. Elements of surface treatment cleaning protecting, Coloring, Altering surface properties. Surface Treatment Processes- Wire brushing. Belt sanding. Alkaline cleaning, Vapour degreasing. Pickling. Ultrasonic cleaning. Solvent cleaning. Painting application by dipping. Hand spraying. Automatic spraying. Electrostatic spray finishing. Electro coating. Hot dip coating. Phosphate coating- Packerising and Bondersing. Buffing. Blackening, Anodising. Electro Nickle Plating. Nickle carbide plating. Sputtering.

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#### **UNIT-IV**

##### **PLANT MAINTENANCE:**

Maintenance, definition, scope of maintenance, maintenance strategies, economics and performance measures, objective of maintenance, concepts of general approach to eliminate Losses, classification of maintenance-corrective, scheduled, preventive, predictive and productive maintenance. common techniques to monitor the conditions of systems-vibration based, radiographic, thermo graphic, ferro graphic, computer based diagnosis etc, forms of wear, wear on guide surfaces, breakdown and remedies of machine tools, repair cycle, installation and maintenance of machine tools, PERT in maintenance.

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#### **UNIT-V**

##### **PLANT ORGANISATION:**

Objective of maintenance organization, function and duties of maintenance department, inspections and scheduling, routine-servicing and scheduled repair, maintenance planning, concepts of maintenance management.

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##### **Ref Books:**

1. Production Technology: R.K. Jain & S.C. Gupta.
2. Production Technology: M.I. Khan



**AUTOMOBILE**  
**ENGINE (DME-506)**

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**UNIT-I**

**GENERAL CONCEPT OF AUTOMOBILES:**

Their classification name and make of some India made automobiles. Layout of chassis. Meaning of the terms : Front wheel drive, Rear wheel drive, Four wheel drive, Front and Rear wheeled vehicles. Basic requirements of an automobile. Study of specifications of different engines used in Indian vehicles.

**CHOICE OF POWER UNIT FOR AN AUTOMOBILE:**

Torque and power requirements of an automobile in various conditions.  
Torque characteristics of some power units such as Gas turbine, Electric motor and I.C. engine; their suitability to automobile needs. Drawback of I.C. engine to meet these needs.  
Measures taken to make it suitable to these needs.

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**UNIT-II**

**I.C. ENGINE:**

Multicylinder engine, Construction and material of its Piston and Connecting rod Assembly;

Crank shaft, Fly wheel and Bearings; Engine valve and Valve operating mechanism (Cam shaft, Valve timing gears, Tappet, Push rod, Rocker and Valve springs). Advantage of multicylinder engine for automobiles use,

Firing order, Arrangement of cylinders. Valve positions and design of combustion chamber cylinder head and gasket. Wankle rotary engine. Idea of super charging, its advantages phenomenon of knocking or detonation, its cause and effect on engine. Octane number and cetane number.

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**UNIT-III**

**FUEL SUPPLY AND IGNITION SYSTEM:**

**PETROL ENGINE:**

Fuel supply circuit components (fuel tank to engine), their function. Exhaust pipe and silencer. Construction and working of mechanical and electrical fuel pumps, carburetor, its function. Simple carburetor, its limitations. Modified carburetor-Zenith, Carter, Solex and S.U. carburetors,

their

construction and working. Carburetor Controls-Throttle, Choke (Conventional, Automatic). Air fuel ratio, its variation with speed. Magneto and Coil Ignition Systems-Working of coil ignition system for multi cylinder engine and electronic ignition system, Ignition timing, Ignition advance and retard-Their need and factors on which they depend. Spark Plugs-their types as used in automobile engines. Location of spark plug.

#### **DIESEL ENGINE:**

Fuel supply circuit for Diesel engine, Primary and secondary fuel filter, their positioning in the circuit. Construction and working of fuel pump and fuel injection pump. Governor and injector, Solid and Air injection in Diesel engine. Distributor types of diesel Injection pump. Turbulence in filters wet and dry

types. Inlet and exhaust manifolds arrangement. Exhaust pipe and silencer. Concept of fuel energy saving. MULTI POINT FUEL SUPPLY FOR PETROL ENGINE :

Construction, Fuel Supply system and working

Introduction to other fuels - CNG, Battery, etc.

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#### **UNIT-IV**

##### **COOLING SYSTEM:**

Necessity for cooling the engine Air cooling, Shapes of cooling fins. Field of application for air cooling. Water Cooling- Thermosyphon system, Pump circulated water cooling system.

Details of water cooling system-Water jackets, Hose, radiators and fans.

Thermostat, Water pump and pressure type radiator cap, Anti freeze and anti corrosive additives.

Engine cooling liquids other than water and their characteristics.

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#### **UNIT-V**

##### **LUBRICATION SYSTEM OF AUTOMOBILE ENGINES:**

Principle of lubrication on multicylinder petrol/diesel engine.

Types of lubrication systems-Splash type, Pressure type and Combined. Types of lubrication pumps, pump drive, Relief valves, Oil pressure, Oil filters and their location in lubrication system,

Crank case ventilation, Crank case dilution.

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#### **Ref Books:**

1. AUTOMOBILE ENGINE: G.B.S NARANG.
2. AUTOMOBILE ENGINE: R.K. RAJPUT

# COMPUTER AIDED DESIGN AND

## MANUFACTURING DME-507/DAE-

507

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### UNIT-1

Introduction to CAD and CAM. Need, Scope & Importance of CAD in Industries, Design Steps & Reasons for Implementing CAD System, Salient Features, Benefits & Functional Areas of CAD.

Introduction to CAM, Functions of CAM, Benefits of CAM, Integrated CAD/CAM Organization-Concept, Necessity of CAD/CAM Integration, Computer Integrated Production System-Features & Advantages. 7

### UNIT-2

Hardware & Software In CAD SYSTEM, Input & output devices- types, configuration, applications & Installation.

Graphic packages: Types, features, system requirements & applications; GUI-concept, meaning & features; Graphic standards such as GKS, PHIG, IGES. 2D & 3D geometric transformations, translation, scaling, rotation, Mirror, zooming.

Geometric modeling; types, features & applications, Animation concepts, need applications. 10

### UNIT-3

3D modeling, Difference between 2D & 3D, Axes nomenclature. Surfaces- types & applications.

Solid modeling- methods & applications, Feature based modeling-concept, meaning & applications.

Parametric modeling- concept, meaning & applications.

Constraints – concept, meaning, common. Constraints & their utilities.

Dimensional relationships- concept, meaning & utility.

Model tree- concept, applications & benefits. 8

### UNIT-4

CNC Machines, components and part programming.

Numerical control: Introduction, features, Advantages & limitations, Layout of CNC system, functions of each component of NC system, manufacturing methodology of NC system, Development of CNC & DNC Systems.

Computer numerical control (CNC): Introduction, types & classification, features, specifications, benefits & applications, Salient construction features of CNC machines differing from conventional machines.

CNC tooling-types, working & applications.

Working of Automatic Tool Changer (ATC) & Automatic Pallet Changer (APC), Work holding & loading devices.

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## **UNIT-5**

### **CNC PART PROGRAMMING**

CNC axes, motion nomenclature & coordinate system, Various positions like machine zero, home position, work piece zero, program zero .

Machine control systems- types & applications.

Preparatory functions (G codes) & miscellaneous functions (M codes).

APT programming, tool nose radius compensation, linear & circular interpolation methods- coding.

Macros, subroutines, fixed cycles, canned cycles.

Programming practice problems on plain, step & taper turning. Recent trends in CAD/CAM. Adaptive control-Definition, meaning, block diagram & applications.

Direct Numerical Control -Definition, meaning, block diagram, applications.

Flexible Manufacturing System- Concept, evaluation, main elements, layout, importance & applications.

Robotics- Definition of robot, classification, types of robot, elements of robot & applications.

Computer Integrated Manufacturing- Concept, definitions, area covered benefits.

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### **References:-**

- 1-CAD/CAM/CIM by R. Radhakrishnan, S. Subramanain, New Age International Ltd.
- 2- CAD/ CAM by Ibrahim Zeid, Mastering TMH Publishing Company Ltd.
- 3- CAD/CAM by Mikell P. Groover, Emory Zimmens, Jr. Prentice Hall of India
- 4- Computer Integrated Design and Manufacturing, McGraw Hill-Bedworth David. D
- 5- Computer Integrated Manufacturing, PHI-Paul G. Ranky

**MECHANICAL  
WORKSHOP (DWS-551)**

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**MAKING UTILITY JOBS ON LATHE INVOLVING:**

1. Step turning, Parallel Turning, Taper turning and Knurling
2. Drilling, Boring, Counter boring and Internal taper turning under cutting, Chamfering & Facing.
3. V. thread cutting (Internal and External)
4. Square threads cutting (internal and external)

**MAKING UTILITY JOBS ON :**

1. Planer - Planning of C.I Block & finish it on surface grinder to given specification
2. Shaper - 'V' Block of different size

**GROUP WORK ON MILLING MACHINE INVOLVING DOWN AND CLIMB MILLING:**

1. Slab Milling
2. Groove Cutting(Dovetail, Square, T-slot and RADIUS)

**FITTING SHOP:**

1. To make different types of keys.
2. Making male and female fitting jobs.

## **COMPUTER AIDED DESIGN**

### **LAB (DME-554)**

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1. Development of simple graphic package using 2-D and 3-D transformation and algorithms for generation of lines and circles (programming using C)
2. Development of wire frame models of simple 3-D objects like box , cylinder, cone, pyramids, prisms and sphere (programming using C).
3. FEM Mesh generation
4. Stress analysis / heat conduction analysis using standard FEM package.
5. Stress analysis of cantilever using U.D.L.
6. Stress analysis of simply supported beam using point load.
7. Banching of circular plate and analysis of stress and strain.
8. Heat conduction analysis using circular bar.
9. Design and analysis of crank shaft.

## **AUTOMOBILE ENGINE**

### **LAB DME-556**

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1. Study and Sketch Of:

- i. Battery Ignition System.
- ii. Magnetic Ignition System.

2. Study and Sketch Of:

- i. Head Light Model.
- ii. Wiper and Indicator.

3. Study and Sketch Of:

- i. Radiator.
- ii. Water Pump.
- iii. Oil Pump.
- iv. Shock Absorber.

4. Study and Sketch Of:

- i. A. C. Pump
- ii. S. V. Pump
- iii. Master Cylinder

5. Study and Sketch Of:

- i. Rear axle
- ii. Differential
- iii. Steering System
- iv. Bendix Drive

6. Checking and setting of ignition on timing using timing light for advance and retard.

7. Charging of Automobile battery and measuring cell voltage and specific gravity of electrolyte.

8. Determination on of gear ratio of an auto engine tachometer/stroboscope.

9. Cleaning and adjustment a carburetor.

10. Changing of wheels and checking the alignment of wheels.