

SCHEME OF EXAMINATION
B.TECH. 3rd Year Mechanical Engineering (Auto) -6th Semester

S. No	Code	Subject Name	Teaching Schedule (Hrs)				Examination Schedule (Marks)			Total Marks	Duration of Exam
			L	T	P/D	Total	Sessional	Theory	Practical/ viva-voce		
1	ME 302 E	Refrigeration and Air Conditioning	3	1	-	4	50	100	-	150	3
2	MEA 305E	Automotive Electricals & Systems	3	1	-	4	50	100	-	150	3
3	HUT 302E	Fundamentals of Management	3	1	-	4	50	100	-	150	3
4	ME 308 E	Computer Aided Design and Manufacturing	4	1	-	5	50	100	-	150	3
5	ME 310 E	Machine Design-II	2	-	6	8	50	100	-	150	4
6	MEA 312E	IC Engines, Emissions and Pollution Control	3	1	-	4	50	100	-	150	3
7	ME 312 E	Refrigeration and Air Conditioning Lab	-	-	2	2	25	-	25	50	3
8	ME 316 E	Computer Aided Design and Manufacturing Lab	-	-	2	2	50	-	25	75	3
9	MEA 318 E	Automotive Electricals & Systems Lab	-	-	2	2	25	-	25	50	3
	TOTAL		18	5	12	35	400	600	75	1075	

Note: Students will be allowed to use Non-Programmable scientific calculator. However, sharing of calculator will not be permitted. Duration of theory as well as practical exams time is three hrs for all courses except ME-310 E for which it is 4 hrs.

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B. Tech. (Sixth Semester) Mechanical Engineering (Auto)
Refrigeration and Air Conditioning
ME 302 E

L	T	P/D	Total
3	1	-	4

Sessional : 50 Marks
 Theory : 100 Marks
 Total : 150 Marks

Duration of Exam: 03 hours

NOTE: In the semester examination, the paper setter will set 8 questions in all, two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT I

Basics of heat pump & refrigerator; Carnot's refrigeration and heat pump; Units of refrigeration; COP of refrigerator and heat pump; Carnot's COP; ICE refrigeration; evaporative refrigeration; refrigeration by expansion of air; refrigeration by throttling of gas; Vapor refrigeration system; steam jet refrigeration; thermoelectric cooling; adiabatic demagnetization.

Basic principles of operation of air refrigeration system, Bell-Coleman air refrigerator; advantages of using air-refrigeration in aircrafts; disadvantages of air refrigeration in comparison to other cold producing methods; simple air refrigeration in air craft; simple evaporative type air refrigeration in aircraft; necessity of cooling the aircraft.

UNIT II

Simple Vapor Compression Refrigeration System; different compression processes(wet compression, dry or dry and saturated compression, superheated compression); Limitations of vapour compression refrigeration system if used on reverse Carnot cycle; representation of theoretical and actual cycle on T-S and P-H charts; effects of operating conditions on the performance of the system; advantages of vapour compression system over air refrigeration system.

Methods of improving COP; flash chamber; flash inter cooler; optimum interstate pressure for two stage refrigeration system; single expansion and multi expansion processes; basic introduction of single load and multi load systems; Cascade systems.

Basic absorption system; COP and Maximum COP of the absorption system; actual NH₃ absorption system; functions of various components; Li-Br absorption system; selection of refrigerant and absorbent pair in vapour absorption system; Electro refrigerator; Comparison of Compression and Absorption refrigeration systems; nomenclature of refrigerants; desirable properties of refrigerants; cold storage and ice-plants.

UNIT III

Difference in refrigeration and air conditioning; Psychometric properties of moist air (wet bulb, dry bulb, dew point temperature, relative and specific humidity of moist air, temperature of adiabatic saturation); empirical relation to calculate P_v in moist air.

Psychometric chart, construction and use, mixing of two air streams; sensible heating and cooling; latent heating and cooling; humidification and dehumidification; cooling with dehumidification; cooling with adiabatic humidification; heating and humidification; by-pass

factor of coil; sensible heat factor; ADP of cooling coil; Air washer.

UNIT IV

Classification; factors affecting air conditioning systems; comfort air-conditioning system; winter air conditioning system; summer air-conditioning system; year round air conditioning. unitary air-conditioning system; central air conditioning system; room sensible heat factor; Grand sensible heat factor; effective room sensible heat factor. Inside design conditions; comfort conditions; components of cooling loads; internal heat gains from (occupancy, lighting, appliances, product and processes); system heat gain (supply air duct, A.C. fan, return air duct); external heat gain (heat gain through building, solar heat gains through outside walls and roofs); solar air temperature; solar heat gain through glass areas; heat gain due to ventilation and infiltration.

Transport air conditioning; evaporative condensers, cooling towers; heat pumps.

References and Text books

1. Refrigeration and air-conditioning by C.P arora
2. Basic Refrigeration and air-conditioning by Annanthana and Rayanan, TMG
3. Refrigeration and air-conditioning BY Arora and Domkundwar, Dhanpat rai

B. Tech. (Sixth Semester) Mechanical Engineering (Auto)
Automotive Electricals & Systems
MEA 305 E

L	T	P/D	Total
3	1	-	4

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 03 Hrs

NOTE: In the semester examination, the paper setter will set 8 questions in all, two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT I

Introduction

Earth returns and insulated return systems, 6, 12, and 24-volt systems. Positive & negative earth systems. Fusing of circuits, relays, switches, low and high voltage automotive cables, wiring diagram for typical automotive wiring systems, maintenance and servicing.

Batteries

Principles of lead acid cells and their characteristics - construction and working of lead acid battery, types of batteries, testing of batteries, effect of temperature on: capacity and voltage, battery capacity, voltage, efficiency, charging of batteries, sulphation and desulphation, maintenance and servicing, Battery failures & checking, Maintenance free Batteries, High energy and power density batteries for electric vehicles.

UNIT II

Charging system

Principle of generation of direct current. Shunt generator characteristics. Armature reaction. Third brush regulation. Cut-out. Voltage & current regulators, compensated voltage regulator. Alternators - principle, constructional and working aspects, bridge rectifiers. Principle of Magneto, Flywheel Magneto, Maintenance and servicing. Trouble shooting in charging systems.

Starting system

Condition at Starting – starting torque and power requirements, behavior of starter during starting. Series motor and its characteristics. Principle & construction of starter motor. Working of different starter drive units, care & maintenance of starter motor. Starter switches. Safety mechanism. Maintenance, servicing and trouble shooting.

UNIT III

Ignition system

Types, construction & working of battery & coil and magneto ignition systems. Relative merits, Ballast Resistor, Ignition coil, Distributor, Contact breaker Point, centrifugal and vacuum advance mechanisms, Limitations of conventional ignition systems, Transistorized Ignition systems, Spark plugs - construction, different types, plug fouling, maintenance, servicing and fault diagnosis, Electronic Ignition system. Programmed ignition, distributor less ignition.

Lighting system

Principle of automobile illumination, headlamp construction and wiring, reflectors – types,

signaling devices- flashers, stop lights, fog lamps, auxiliary lighting-engine, passenger, reading lamp. Regn-plate lamps. Automatic illumination system. Head light levelling devices. Study of a modern headlight system with improved night vision.

UNIT IV

Electrical Equipment and Accessories

Oil pressure gauge, fuel level gauge, engine temperature gauge, electrical fuel pump, speedometer, odometer, trip meter, engine rpm meter, Headlamp & Windshield washer and wiper, heaters and defrosters, horns, stereo/radio, power antennae. Central locking, power window winding. Sun/Moon Roof. Motorized rear view mirrors, reverse warning, Bumper collision warning. Other accessories in modern vehicles.

Fuel cell

Thermodynamic aspects; types-hydrogen and methanol, power rating and performance. Various components and working of fuel cell. Heat dissipation.

Drive Motors and controllers:

Drive arrangements in Hybrid and Electric vehicles. Drive motors: types and construction. Controlling of motor operations. Motor-generator in hybrid vehicles and its controls.

Books

1. "Automotive Electrical Equipment ", P.L. Kohli, Tata McGraw-Hill Co. Ltd. New Delhi, 1975.
2. "Principles of Electricity and electronics for the Automotive Technician", Chapman, Thomson Asia, 2000.
3. "Modern Electrical Equipment of Automobiles", A.W. Judge. Chapman & Hall, London.
4. "Automobile Electrical and Electronic Equipments ", A.P. Young. & L. Griffiths, English Languages Book Society & New Press, 1990.
5. "Storage Batteries ", G.W. Vinal. John Wiley & Sons Inc., New York, 1985.
6. "Automobile Electrical Equipment ", W.H. Crouse. McGraw Hill Book Co. Inc., New York,
7. "Electrical Ignition Equipment ", F.G. Spreadbury, Constable & Co Ltd., London, 1962.
8. "Basic Automotive Electrical Systems", C.P.Nakra, Dhanpat Rai
9. Fuel Cells by Bockris and Srinivasan; McGraw Hill
10. Automobile Engineering Vol –II by Kirpal Singh

B. Tech. (Sixth Semester) Mechanical Engineering (Auto)
Fundamentals of Management
HUT 302E

L	T	P/D	Total	Sessional	: 50 Marks
3	1	-	4	Theory	: 100 Marks
				Total	: 150 Marks
				Duration of Exam:	3 hours

NOTE: The question paper shall have eight questions in all organized into four sections, each section having two questions from each of the four units. The candidate shall have to attempt five questions in all, selecting at least one question from each unit.

UNIT-I

Financial Management: Introduction of Financial Management, Objectives of Financial Decisions, Status and duties of Financial Executives. Financial Planning – Tools of financial planning. Management of working capital, Factors affecting requirements of working capital. Capital Structure decisions. Features of appropriate capital structure. Sources of finance.

UNIT-II

Personnel Management: Personnel Management – Meaning, Nature and Importance; Functions of Personnel Management – (a) Managerial Functions and (b) Operative functions. Job Analysis: Meaning and Importance; Process of Job Analysis; Job Description and Job specification. Human Resource Development-Meaning and concept.

UNIT-III

Production Management: Production Management: Definition and Objectives Plant location: Ideal plant location. Factors affecting plant location. Plant Layout: Ideal plant layout, factors affecting plant layout. Work Measurement: Meaning, Objectives and Essentials of work measurement. Production Control: Meaning and importance of production control and steps involved in production control.

UNIT-IV

Marketing Management : Nature, scope and importance of marketing management. Modern Marketing concepts. Role of marketing in economic development. Marketing Mix. Marketing Information System. Meaning, nature and scope of International Marketing.

Text Books:

1. Operations Management – SCHOROEDER, MGH, New York.
2. Production Operations Management – CHARY, TMH, New Delhi.

Reference Books:

1. Production Operations Management – ADAM & EBERT, PHL, New Delhi
2. Operational Management –MONKS, McGraw Hill, Int.
3. Production & Operations Management – I. Hill, Prentice Hall, Int.
4. Production Planning & Inventory Control – NARASIMHAM etal, PHL, New Delhi
5. Production & Operation Management- Panneerselvam, PHI, New Delhi

B. Tech. (Sixth Semester) Mechanical Engineering (Auto)
Computer Aided Design and Manufacturing
ME 308 E

L	T	P/D	Total
4	1	-	5

Sessional	: 50 Marks
Theory	: 100 Marks
Total	: 150 Marks
Duration of Exam:	03 Hrs

NOTE: In the semester examination, the paper setter will set 8 questions in all, two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT I

Introduction to CAD/CAM, Historical Development, Industrial look at CAD/CAM, Introduction to CIM Basic of Geometric & Solid modeling, Coordinate systems, Explicit, Implicit, Intrinsic and parametric equation Part families, Part classification and coding, product flow analysis, Machine cell Design, Advantages of GT

UNIT II

Introduction, Transformation of points & line, 2-D rotation, Reflection, Scaling and combined transformation, Homogeneous coordinates, 3-D scaling, shearing, rotation, reflection and translation, combined transformations, Orthographic and perspective projections Algebraic and geometric forms, tangent & normal blending functions, reparametrization Straight line, conics, cubic splines, bezier curves and B-spline curves

UNIT III

Algebraic and geometric forms, tangent & twist vectors, normal blending function, reparametrization, Sixteen point form, four Curve form, Plane surface, ruled surface Surface of revolution, tabulated cylinder Bi -cubic surface, bezier surface, B-spline surface Solid models and representation scheme B-rep & CSG, sweep representation ,Cell decomposition, spatial occupancy enumeration

UNIT IV

Introduction, fixed programmable and flexible automation, Types of NC systems, MCU & other components, Co-ordinate system, NC manual part programming, G & M codes, part program for simple parts, Computer assisted part programming Introduction, FMS component, Types of FMS, FMS layout, Planning for FMS, advantage and applications Introduction, conventional process planning, Steps in variant process planning, types of CAPP, planning for CAPP

Suggested Reading:

CAD/CAM theory & practice (Ibrahim Zeid)

CAD/CAM (Groover & Zimmer)

Numerical control and computer aided manufacturing by RAO and Tiwari, TMG

B. Tech. (Sixth Semester) Mechanical Engineering (Auto)
Machine Design-II
ME 310 E

L	T	P/D	Total
2	-	6	8

Sessional : 50 Marks
 Theory : 100 Marks
 Total : 150 Marks
 Duration of Exam: 04 Hrs

NOTE: In the semester examination, the paper setter will set 8 questions in all, two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT I

Classification of Gears; Selection of type; Law of Gearing, Standard system of Gear tooth, Various Failure modes, Interference, undercutting & minimum no. of teeth Force Analysis ,Beam strength of Gear tooth, Effective load on tooth, Estimation of module based on beam strength and wear strength, Gear lubrication, materials; Design Procedure, Gear Box design Terminology, Force Analysis, Virtual no. of teeth, Beam strength, Effective load, Wear strength Terminology, force analysis, beam strength & wear strength, effective load on gear tooth Terminology, properties, force analysis, friction, material selection

UNIT II

Design of flat belts & Pulleys, Design /selection of V belts & Pulleys, Design/selection of wire ropes, Design/selection of chains Single & multiple Plate clutch, Cone clutch External shoe brake, Internal shoe brakes

UNIT III

Coil Springs, Leaf Springs Hydro dynamically lubricated bearings, Selection of ball bearings, Selection of roller bearings, Selection of taper roller bearings Mechanism Design, Design of cam & Follower

UNIT IV

Design of Cylinder, Design of Piston, Design of Crank shaft, Design of connecting rod Design of Crane Hook Design of Flywheels

SUGGESTED READING:

Design of Machine Elements	Bhandari	TMH
Machine Design	Sharma Aggarwal	Katson Publishers
PSG Design Data Book	PSG College of Engg	PSG Publication
Machine Design an integrated Approach	Robert I Norton,	prentice hall
Fundamental of machine component design	R.C Juvinnal,	Johan wiley& sons

B. Tech. (Sixth Semester) Mechanical Engineering (Auto)
IC Engines, Emissions and Pollution Control
MEA 312 E

L	T	P/D	Total
3	1	-	4

Sessional	: 50 Marks
Theory	: 100 Marks
Total	: 150 Marks
Duration of Exam:	3 hours

NOTE: In the semester examination, the paper setter will set 8 questions in all, two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT – I

I.C. Engines: Valve Timings. Actual indicated diagrams. Combustion calculations. Carburetion and fuel injection. Supercharging. Lubrication and cooling methods. Governing methods. Engines performance & Testing.

Auto engines classifications-arrangement of cylinders, valves and camshaft, Types of fuels used, engine speed, methods of cooling, engine balance, Combustion in S.I. and C.I. Engines: Normal & Abnormal Combustion. Pre-ignition. Detonation. Knocking. Comparison of knocking in S.I. and C.I. Engines. Rating of Fuels.

UNIT – II

Engine Fuels: Types of Hydrocarbon, Gasoline, Diesel specifications, Emission and air pollution: Automotive emissions and their role in air pollution, photochemical smog, Chemistry of smog formation. Combustion in homogeneous mixtures, emission formation, Incomplete combustion. Formation of hydrocarbons (HC), carbon monoxide and oxides of nitrogen. Aldehyde. Emissions of unregulated toxic pollutants such as benzene; 1,3-butadiene etc. Influence of engine design and operating parameters on S.I. engine exhaust emissions. Hydrocarbon Evaporation Emissions: Various sources and method of their control, canisters for controlling evaporative emission control system for S.I. engines, blow-by control closed PCV system, reduction of exhaust emissions, various methods. Fuel system design.

UNIT – III

Exhaust Treatment devices: Air injection into exhaust system. Thermal reactors, Catalytic converters- construction, efficiency, effect of equivalence ratio, additives on efficiency of 3-Way converter.; Advances in Converter design, plasma Catalyst Stratified charged engines. Gasoline Direct injection, Various Methods for stratification; Honda CVCC engine.

Diesel engine emissions: Source of emissions during combustion, effect of Air injector timing on performance and formation. D.I and I.D.I. engines emissions. Diesel smoke, PM and RSPM emission. Methods of reducing emission, Exhaust gas re-circulation, smoke emission from diesel engines, Particulate Traps, Continuous Regeneration Traps (CRT). Methods for control of NOx

UNIT – IV

Emission from CNG and LPG engines. Emission Instruments: Non – dispersive infrared analyzer. Gas chromatography. Flame Ionisation Detector. Chemiluminescent analyzer. Emission Standards: Ambient Air Quality Standards, Mass emission standards, Air pollution cost benefit analysis.

Text Books:

1. R.P. Sharma and M.L. Mathur, “Internal Combustion Engine”, Dhanpat Rai Publications
2. V. Ganeshan, “Internal Combustion Engine”, Tata McGraw Hill

Reference Books:

1. Angli M Course., “Automotive Engines”, CBS Publications
2. Harper, “Fuel Systems Emission Control”, CBS Publications

B. Tech. (Sixth Semester) Mechanical Engineering (Auto)
Refrigeration and Air Conditioning (Practical)
ME 312 E

L	T	P/D	Total
-	-	2	2

Sessional : 25Marks
Practical : 25 Marks
Total : 50 Marks
Duration of Exam: 03 Hrs

List of Experiments

1. Study & Performance of basic vapour compression Refrigeration Cycle.
2. To find COP of water cooler.
3. To study the walk in cooler.
4. To study and perform experiment on vapour absorption apparatus.
5. Perform the experiment & calculate various. Performance parameters on a blower apparatus.
6. To find the performance parameter of cooling tower.
7. To study various components in room air conditioner.
8. To find RH of atmosphere air by using sling Psychometric and Psychometric.
9. To find performance of a refrigeration test rig system by using different expansion devices.
10. To study different control devices of a refrigeration system.
11. To study various compressor.
12. To find the performance parameters of Ice Plant.

Note: Total Ten experiments must be performed. At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or outside the list.

B. Tech. (Sixth Semester) Mechanical Engineering (Auto)
Computer Aided Design & Manufacturing Lab
ME 316 E

L	T	P/D	Total
-	-	2	2

Sessional : 50Marks
Practical : 25 Marks
Total : 75 Marks
Duration of Exam: 03 Hrs

List of Experiments

Note: Practical will base on course no. ME 308 E

B. Tech. (Sixth Semester) Mechanical Engineering (Auto)
Automotive Electricals & Systems Lab
MEA 318 E

L	T	P/D	Total
-	-	2	2

Sessional : 25Marks
Practical : 25 Marks
Total : 50 Marks
Duration of Exam: 03 Hrs

List of Experiments

1. To understand the layout of complete wiring system of an automobile.
2. Perform the various tests for checking the battery condition.
3. To understand and test the charging circuit and charging motor.
4. To conduct performance test on a dynamo, alternator & starter motor.
5. To understand & test the starting circuit and trouble shooting in it.
6. Understand and test the conventional ignition system, setting of contact breaker points and spark plug gap.
7. Understand the working and testing of an Electronic Ignition system
8. Understand and test the lighting circuit of a car.
9. Conduct headlamp focusing as per the procedure.
10. Study the working of different accessories of a modern car
11. To study the layout / working of a Fuel Cell powered electric car.

Note: Total Ten experiments must be performed. At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or outside the list.