



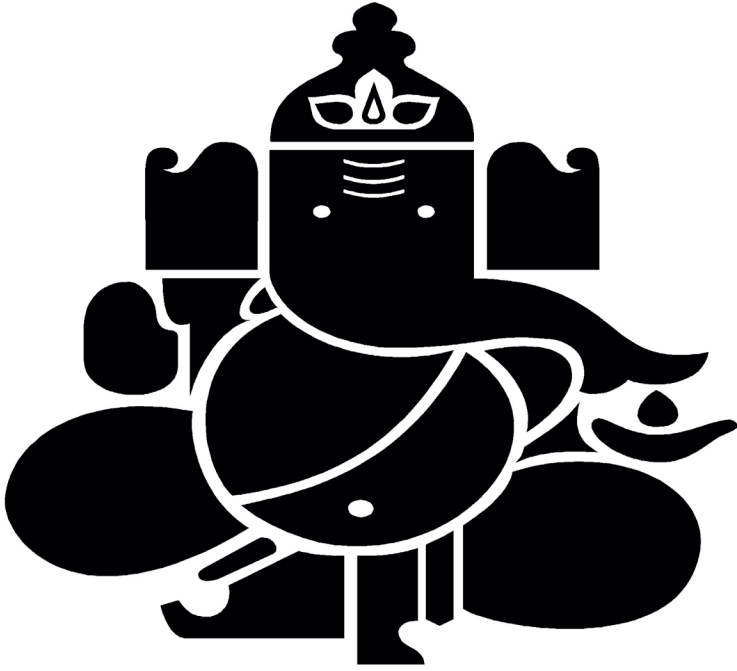
NEW HORIZON COLLEGE OF ENGINEERING

Autonomous College Permanently Affiliated to VTU, Approved by AICTE & UGC
Accredited by NAAC with 'A' Grade, Accredited by NBA

The Trust is a Recipient of Prestigious Rajyotsava State Award 2012 Conferred by the Government of Karnataka
Awarded Outstanding Technical Education Institute in Karnataka-2016
Ring Road, Bellandur Post, Near Marathalli, Bangalore -560 103, INDIA



Academic Year 2017-18
Automobile Engineering
Fifth and Sixth Semesters
Scheme and Syllabus



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Vision

To be a centre of excellence in the field of Automobile Engineering by providing quality education meeting the ever changing requirements of the industry.

Mission

- To promote Research, Consultancy and Innovation leading to research publications & patents.
- To strengthen Industry Institute Interaction by collaborating with industries for training, internships, and industry expert talks.
- To inculcate Ethical, Social values and Environment awareness by participation in Co-curricular and Extra-curricular activities.

Program Educational Objectives (PEO)

Graduates of BE program in Automobile Engineering will be able to

PEO1

Engage in design of Automobile systems, tools and application in the field of Automobile Engineering and allied engineering industries.

PEO2

Apply the knowledge of Automobile Engineering to solve the problems of social, environmental relevance and pursue higher Education and Research.

PEO3

Work effectively as individuals and as team members in multi-disciplinary projects abiding professional practices.

PEO4

Engage in life- long learning, career enhancement and adopt to change in professional and societal needs.

MAPPING OF PEOs TO DEPARTMENT MISSION

Program Educational Outcomes	M1(Research & Consultancy)	M2(Industry Institute Interaction)	M3(Ethics)
PEO1: Engage in design of Automobile systems, tools and application in the field of Automobile Engineering and allied engineering industries	3	3	1
PEO2 Apply the knowledge of Automobile Engineering to solve the problems of social, environmental relevance and pursue higher Education and Research.	3	1	3
PEO3 Work effectively as individuals and as team members in multi-disciplinary projects abiding professional practices.	2	2	3
PEO4 Engage in life- long learning, career enhancement and adopt to change in professional and societal needs	3	2	2

PROGRAM OUTCOMES (POs)

Graduate Attributes	PO#	Program Outcomes
Engineering knowledge	01	Apply the knowledge of mathematics, science, engineering fundamentals, and engg. specialization to the solution of complex engineering problems
Problem analysis	02	Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences
Design / Development of Solutions	03	Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.
Conduct Investigations of Complex Problems	04	Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
Modern tool usage	05	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations, and servicing of automobiles.
The Engineer and society	06	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
Environment and sustainability	07	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
Ethics	08	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Individual & team work	09	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
Communication	10	Communicate effectively on complex engineering activities with the engineering community and with society at large. Some of them are, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
Project management and finance	11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in Multidisciplinary environments.
Lifelong learning	12	Recognise the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

After successful completion of Automobile Engineering Program, the graduates will be able to:

PSO1	Analyse, design and evaluate Automobile components and systems using conventional and/or CAD/CAM tools.
PSO2	Plan, process automation and quality assurance system for manufacturing of given Automobile components and systems.

NEW HORIZON COLLEGE OF ENGINEERING
DEPARTMENT OF AUTOMOBILE ENGINEERING

SCHEME OF FIFTH SEMESTER

Sl.No.	Course Code	Course Name	Subject Area	Credit Distribution				Overall Credits	Contact Hrs Weekly Theory	Contact Hrs Weekly Lab	Marks		
				L	P	T	S				CIE	SEE	Total
1.	AUT51	Automotive Engines & Components Design + Lab	PCC	3	2	0	0	5	3	4	75	75	150
2.	AUT52	Automotive Thermodynamics + Lab	PCC	3	2	0	0	5	3	4	75	75	150
3.	AUT53	Vehicle Auxiliary Systems	PCC	3	0	0	0	3	3	0	50	50	100
4.	AUT54	Design of Machine Elements	PCC	2	0	1	0	3	2	0	50	50	100
5.	AUT55	Theory of Machines	PCC	3	0	0	0	3	3	0	50	50	100
6.	AUT56X	Professional Elective-I	PE	3	0	0	1	4	3	-	50	50	100
7.	AUT57	Mini Project-1	PRJ	0	2	0	0	2	0	4	25	25	50
Total				17	6	1	1	25	17	12	375	375	750

Professional Electives – Group 1

Course Code	Course Name
AUT561	Engineering Economics and Automotive Cost Estimation
AUT562	Management and Entrepreneurship
AUT563	Statistical Quality Control (SQC)
AUT564	Total Quality Management (TQM)
AUT565	Vehicle Transport Management

NEW HORIZON COLLEGE OF ENGINEERING
DEPARTMENT OF AUTOMOBILE ENGINEERING

SCHEME OF SIXTH SEMESTER

Sl.No.	Course Code	Course Name	Subject Area	Credit Distribution				Overall Credits	Contact Hrs Weekly Theory	Contact Hrs Weekly Lab	Marks		
				L	P	T	S				CIE	SEE	Total
1.	AUT61	Finite Element Method + Lab	PCC	3	2	0	0	5	3	4	75	75	150
2.	AUT62	Automotive Transmission + Lab	PCC	2	1	0	0	3	2	2	75	75	150
3.	AUT63	Automotive Chassis & Suspension + Lab	PCC	3	2	0	0	5	3	4	75	75	150
4.	AUT64	Automotive Electricals & Electronic Systems	PCC	2	0	0	0	2	2	0	25	25	50
5.	AUT65X	Professional Elective-II	PE	3	0	0	1	4	3	0	50	50	100
6.	NHOPXX	Open Elective**	OE	3	0	0	1	4	3	0	50	50	100
7.	AUT67	Mini Project-2	PRJ	0	2	0	0	2	0	4	25	25	50
Total				16	7	0	2	25	17	14	375	375	750

Professional Elective - 2 (Thermal)	
Course	Course Name
AUT651	Hydraulics and Pneumatics
AUT652	Alternative Fuels and Energy System
AUT653	Vehicle Air Conditioning
AUT654	Advanced IC Engines
AUT655	Automotive Air Pollution and Control

Open Elective	
Course	Course Name
NHOP01	Big Data Analytics using HP Vertica- 1
NHOP02	VM Ware virtualization Essentials - 1
NHOP03	Adobe Experience Manager – 1
NHOP04	Big Data Analytics using HP Vertica – 2
NHOP05	VM Ware virtualization Essentials – 2
NHOP06	Adobe Experience Manager – 2
NHOP07	SAP
NHOP08	Schneider – Industry Automation
NHOP09	Cisco – Routing and Switching – 1
NHOP10	Data Analytics

FIFTH SEMESTER SYLLABUS

AUTOMOTIVE ENGINES AND COMPONENTS DESIGN

Course Code : AUT51
L:P:T:S :3:2:0:0
Exam Hours :03+03

Credits :05
CIE Marks :50+25
SEE Marks :50+25

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

CO1	Understand the working of four stroke and two stroke engines.
CO2	Design cylinder block and cylinder head parts based on the engine specification.
CO3	Identify different piston failures and design piston, piston pin based on the engine specification.
CO4	Design connecting rod based on the engine specification.
CO5	Design crankshaft based on the engine specification.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	1	1	1	1	2	2	1
CO2	3	3	3	3	1	1	1	1	1	2	2	1
CO3	3	3	3	3	1	1	1	1	1	2	2	1
CO4	3	3	3	3	1	1	1	1	1	2	2	1
CO5	3	3	3	3	1	1	1	1	1	2	2	1

Module	Contents	Hrs	COs
01	<p>Introduction: Historical development of automobiles, Heat Engines & their classification. Reciprocating IC Engines – Basic Engine Components & Nomenclature, Principle of engine operation, Comparison of SI & CI Engines, Comparison of Two Stroke & Four Stroke Engines, Classification of I C engines, applications of IC Engines</p> <p>Four stroke engines: Principles of engine operation (SI & CI), Theoretical and Actual Valve timing diagrams, Relative merits & demerits of petrol & diesel engines.</p> <p>Two stroke engines: Principles of engine operation (SI & CI), Port timing diagrams. Scavenging systems, Theoretical Scavenging processes, Scavenging parameters, Scavenging pumps. Relative merits & demerits of petrol & diesel engines.</p> <p>List of Experiments:</p> <ol style="list-style-type: none"> Study of hand tools for disassembling and assembling. Writing technical specification and description of types of automobile engines. Disassembly and assembly of simple carburettor. 	09	CO1
02	<p>Design of Cylinder heads & Cylinder Block: Cylinder heads, Gaskets, cylinder wear, water jacket, Cylinder liners, Production of engine block, Design- Bore and length of cylinder, Thickness of cylinder wall, Stresses in cylinder wall, Thickness of cylinder head, Studs for cylinder head.</p> <p>List of Experiments:</p>	09	CO2

	<p>1. Disassembly of assembly engine, inspection of cylinder head and bore, measurement of dimensions.</p> <p>2. Determining the fuel pressure of single point and multi point fuel injector.</p> <p>3. Disassembly and assembly of fuel injection pump.</p>		
03	<p>Design of Piston: Parts of IC engine piston, Piston materials, Piston slap, Compensation of thermal expansion in pistons, Piston Rings. Piston pin, locking of piston pins. Design- Thickness of piston head by strength basis and heat basis. Piston ribs and caps, piston rings groove width and thickness, piston pin, piston barrel and skirt.</p> <p>List of Experiments:</p> <p>1. Disassembly and assembly of piston assembly, inspection of piston, measurement of dimension of piston.</p> <p>2. Disassembly and assembly of silencer.</p> <p>3. Disassembly and assembly of turbocharger.</p>	09	CO3
04	<p>Design of Connecting rod: Connecting rod materials, Cross section, Buckling, Drilled connecting rods, offset connecting rods, effects of whipping. Design- determining minimum length of connecting rod, small end and big end design, shank design, big end cap bolts.</p> <p>List of Experiments:</p> <p>1. Disassembly and assembly of connecting rod, inspection of connecting rod, measurement of dimension of connecting rod.</p> <p>2. Determine connecting rod alignment.</p>	09	CO4
05	<p>Design of Crankshaft: Types of crankshaft, Balancing of I.C. Engines, significance of firing order, Material for crankshaft, Design- Crankshaft under bending and twisting, Balancing weight calculations.</p> <p>List of Experiments:</p> <p>1. Disassembly and assembly of crankshaft bearings, assembly, inspection of crankshaft, measurement of dimension of crankshaft and crankcase.</p> <p>2. Compression test of petrol and diesel engine.</p>	09	CO5

Text Books:

1. V.B. Bhandari, "*Machine Design*", Tata McGraw Hill, 4th Edition, 2016.
2. V Ganesan, "*Internal Combustion Engines*", Tata McGraw Hill, 4th Edition, 2012.

Reference Books:

1. Mathur&Sharma, "*A course in I.C. Engine*", DhanpatRai& Sons, Delhi, 1994.
2. Kirpal Singh, "*Automobile Engineering*", Vol. II, Standard publications, 2011.
3. J.B. Heywood, "*Fundamentals of I.C. Engines*" McGraw Hill, International Edition, 2011.
4. S.N. Trikha, "*Machine design exercises*", Khanna publications, 1983.
5. P.C. Sharma & D.K. Aggarwal "*Machine design*", S.KKataria& sons, 1997
6. William H. Crouse "*Automotive mechanics*", Tata McGraw Hill, Special Indian Edition, 2006.

MOOCs:

1. <http://nptel.ac.in/courses/112104033/>
2. <http://nptel.ac.in/courses/103105110/>

Assessment Pattern:

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Co-Curricular
Marks (out of 50)	25	10	05	10
Remember	05		05	
Understand	05	05		
Apply	05			10
Analyze	05	05		
Evaluate	05			
Create				

CIE- Continuous Internal Evaluation for lab (25 Marks)

Bloom's Category	Tests	Record	Viva
Marks (out of 50)	10	10	05
Remember	02	02	02
Understand	02	02	02
Apply	02	02	01
Analyze	02	02	
Evaluate	02	02	
Create			

SEE – Semester End Examination (50 Marks – Theory)

Bloom's Category	SEE (Theory)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	

SEE – Semester End Examination (25 Marks- Lab)

Bloom's Category	SEE(Lab)
Remember	05
Understand	05
Apply	05
Analyze	05
Evaluate	02
Create	03

AUTOMOTIVE THERMODYNAMICS

Course Code	: AUT52	Credits	:05
L:P:T:S	:3:2:0:0	CIE Marks	:50+25
Exam Hours	:03+03	SEE Marks	:50+25

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

CO1	Classify physical and chemical properties of convectional fuels.
CO2	Understand the combustion thermodynamics of the fuels and their combustion properties.
CO3	Calculate the performance parameters of I C Engine and efficiency of air standard cycles.
CO4	Calculate the efficiency of reciprocating air compressors.
CO5	Explain vapour absorption and vapour compression refrigeration system.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	2	1	2	1	1	3	2	2
CO2	3	3	1	1	2	1	2	1	1	3	2	2
CO3	3	3	1	1	2	1	2	1	1	3	2	2
CO4	3	3	1	1	2	1	2	1	1	3	2	2
CO5	3	3	1	1	2	1	2	1	1	3	2	2

Module	Contents	Hrs	COs
01	<p>Introduction to Fuels: Origin of petroleum, its chemistry, normal paraffin's, isoparaffins, olefins, naphthalene and aromatics. Refining of petroleum: Fractional distillation, racking, Reforming process, Thermal reforming, polymerization, alkylation, and isomerisation. Properties and tests : Specific Gravity, viscosity, flash and fire points, calorific value, rating of fuels, vapour pressure, cloud and pour point, annealing point, diesel index, carbon residue and ash content determination.</p> <p>Combustion of Fuels: Combustion equation, conversion of gravimetric to volumetric analysis. Determination of theoretical minimum quantity of air for complete combustion. Determination of air fuel ratio for a given fuel. Numerical problems, flue gas analysis, gas chromatograph.</p> <p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Determination of Flash and Fire Points of fuels and lubricants 2. Determination of calorific values of solid, liquid and gaseous fuels 3. Determination of viscosity of oils using Redwood, Say bolts & Torsion viscometer. 	09	CO1
02	<p>Combustion in SI Engine: Initiation of combustion, flame velocities, effect of variables on flame propagation, normal and abnormal combustion, knocking combustion, pre-ignition, knock and engine variables, detonation, effects of engine variables on combustion, control of detonation, CFR engine, features and design consideration of combustion chambers, stratified charge combustion.</p> <p>Combustion in CI Engine: Various stages of combustion, vaporization of fuel droplets and spray formation, air motion, swirl, squish, tumble flow, velocities, swirl measurement, and delay period correlations, diesel knock and engine variables, features and design considerations of</p>	09	CO2

	combustion chambers, types. List of Experiments:(For Demonstration only) 1. Determination of Carbon residue and Moisture content in a fuel 2. Determination of Cloud and Pour points of light, medium and heavy oils.		
03	IC Engines: Testing of Two and Four stroke SI and CI engines for performance, related numerical problems, heat balance, and Morse test. Air standard Cycles: Carnot cycle, Otto cycle, Diesel cycle, Dual and sterling cycle, p-v diagrams. Description, efficiencies and mean effective pressures. Comparison of Otto and Diesel cycles. Numerical problems. List of Experiments: (Individual Experiment) 1. Drawing of Valve and port timing diagram for a given engine. 2. Measurement of areas of irregular figure Using of Planimeter.	09	CO3
04	Reciprocating compressors: Operation of a single stage reciprocating compressors, work in put through p v diagram and steady state steady flow analysis, effect of clearance and volumetric efficiency. Adiabatic, isothermal and mechanical efficiencies, multi stage compressors, optimum intermediate pressure, inter cooling, minimum work for compression, Numerical problems. List of Experiments: (Group experiment) Performance tests on I.C. Engines, Calculations of IP, BP, Thermal efficiencies SFC, FP and heat balance sheet for: a) Four stroke Diesel Engine b) Four stroke Petrol Engine. c) Variable Compression Ratio I.C.Engine.	09	CO4
05	Refrigeration: Vapour compression refrigeration system; description, analysis, refrigerating effect, capacity, power required, units of refrigeration, COP, Refrigerants and their desirable properties. Air cycle refrigeration; reversed Carnot cycle, reversed Brayton cycle, Vapour absorption refrigeration system, steam jet refrigeration. List of Experiments: (Group experiment) 1. Multi-cylinder Diesel / Petrol Engine (Morse test). 2. Emission testing of engines.	09	CO5

Text Books:

1. Mathur. M. L., and Sharma. R. P. "A Course in Internal Combustion Engines", Dhanpat Rai Publications (P) Ltd. 25th Edition, 2014
2. P.K. Nag, "Basic and applied Thermodynamics", Tata McGraw Hill Pub. Co., 2nd Edition, 2009
3. B.K. Venkanna, "Applied Thermodynamics", PHI, New Delhi
4. S.P. Sharma & Chandra Mohan, " Fuels & Combustion", Tata McGraw-Hill, New Delhi, 1987

Reference Books:

1. Ganesan V, "Internal combustion engines", 4th edition, Tata McGraw Hill Education, 2012
2. John B. Heywood, " Internal Combustion Engine Fundamentals", McGraw Hill Book, 1998
3. Yunus, "A. Cenegal and Michael A. Boies, Thermodynamics", An engineering approach, Tata McGraw Hill pub. Co., 2002,

MOOC: <http://nptel.ac.in/courses/112104033/>

Assessment Pattern:

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Co-Curricular
Marks (out of 50)	25	10	05	10
Remember	05		05	
Understand	05	05		
Apply	05			10
Analyze	05	05		
Evaluate	05			
Create				

CIE- Continuous Internal Evaluation for lab (25 Marks)

Bloom's Category	Tests	Record	Viva
Marks (out of 50)	10	10	05
Remember	02	02	01
Understand	02	02	01
Apply	02	02	01
Analyze	02	02	01
Evaluate	02	02	01
Create			

SEE – Semester End Examination (50 Marks – Theory)

Bloom's Category	SEE (Theory)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	

SEE– Semester End Examination(25 Marks- Lab)

Bloom's Category	SEE (Lab)
Remember	05
Understand	05
Apply	05
Analyze	05
Evaluate	02
Create	03

VEHICLE AUXILIARY SYSTEMS

Course Code : AUT53

Credits :03

L:P:T:S :3:0:0:0

CIE Marks :50

Exam Hours :03

SEE Marks :50

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

CO1	Identify the properties of air- petrol mixture, mixture requirement, classify carburettors, injection system.
CO2	Explain various types of diesel injectors, along with spray characteristics.
CO3	Understand air filters, fuel filters, exhaust muffler and manifold.
CO4	Describe the different types of lubrication and cooling.
CO5	Understand concept of super charger and turbocharger.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	2	1	2	1	1	1	2	1
CO2	2	3	3	3	2	1	2	1	1	1	2	1
CO3	2	3	3	3	2	1	2	1	1	1	2	1
CO4	2	3	3	3	2	1	2	1	1	1	2	1
CO5	2	3	3	3	2	1	2	1	1	1	2	1

Module	Contents	Hrs	COs
01	Carburetion And Gasoline Injection: Carburettor principal, Properties of air-petrol mixtures. Mixture requirements for steady state and transient operation, Mixture formation studies of volatile fuels, Effects of altitude on carburetion – simple carburettor Petrol Injection - Open loop and closed loop systems, single point, multi point and direct injection systems - Principles and Features, Bosch injection systems, MPFI.	09	CO1
02	Diesel Injection: Requirements - Function of components – Jerk and distributor type pumps- pump calibration. Injection lag – Unit injector - Mechanical and pneumatic governors - Fuel injector - Types of injection nozzle - Nozzle tests - Spray characteristics - Injection timing - Factors influencing fuel spray atomization, penetration and dispersion of diesel. CRDI	09	CO2
03	Intake And Exhaust Systems: Intake system components – Airfilter, intake manifold, Exhaust system components – Exhaust manifold and exhaust pipe - Spark arresters - Exhaust mufflers, Types, operation.	09	CO3
04	Lubrication And Cooling: Need for cooling system, Types of cooling system - Liquid cooled system, Thermosyphon system, Forced circulation system, pressure cooling system, properties of coolant, additives for coolants. Need for lubrication system, Mistlubrication system, wet sump any dry sump lubrication, Properties of lubricants, consumption of oil.	09	CO4

05	Supercharging And Turbocharging: Objectives, Effects on engine performance, Thermodynamics of supercharging and Turbocharging, Turbo lag, Turbo charging methods, Engine exhaust manifold arrangements. Classification of scavenging systems Turbocharging: Turbo charging types, Turbocharger for 2 stroke engine and 4 stroke engines	09	CO5
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Text Books:

1. Ganesan V, "*Internal combustion engines*", 4th edition, Tata McGraw Hill Education, 2012. ISBN: 1259006190
2. Rajput R. K, "*A textbook of Internal Combustion Engines*", 2nd edition, Laxmi Publications (P) Ltd.,
3. Mathur, M.L., and Sharma, R.P., "*A Course in Internal Combustion Engines*", Dhanpat Rai Publications (P) Ltd. 25th Edition, 2014 ISBN: 9788189928469

Reference Books:

1. Ramalingam K. K, "*Internal Combustion Engine*", Scitech Publication (India) Pvt.Ltd. 2011. ISBN: 9788188429486
2. Duffy Smith, "*Auto Fuel Systems*", The Good Heart Willcox Company Inc., Publishers, 1987.
3. Crouse W.H, Anglin D.L, "*Automotive Transmission and Power Trains construction*", McGraw Hill, 10th Edition, 2008, ISBN: 9780070634350
4. Dr. Kirpal Singh. "*Automobile Engineering Vol-1*" Standard Publications, 13th Edition, 2013, ISBN: 9788180141966

Assessment Pattern:

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Co-Curricular
Marks (out of 50)	25	10	05	10
Remember	05		05	
Understand	05	05		
Apply	10	05		10
Analyze	05			
Evaluate				
Create				

SEE – Semester End Examination (50 Marks – Theory)

Bloom's Category	SEE (Theory)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	

DESIGN OF MACHINE ELEMENTS

Course Code : AUT54
L:P:T:S :2:0:1:0
Exam Hours :03

Credits :03
CIE Marks :50
SEE Marks :50

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

CO1	Understand design concepts (strength consideration) and properties of engineering materials.
CO2	Design machine elements for fatigue strength.
CO3	Design knuckle, cotter joint, keys and couplings.
CO4	Design shafts, clutches and brakes.
CO5	Design spur and helical gears.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	2	1	1	2	1	1	1	2	1
CO2	3	1	1	2	1	1	2	1	1	1	2	1
CO3	3	1	1	2	1	1	2	1	1	1	2	1
CO4	3	1	1	2	1	1	2	1	1	1	2	1
CO5	3	1	1	2	1	1	2	1	1	1	2	1

Module	Contents	Hrs	COs
01	Introduction: Introduction: Definitions: normal, shear, biaxial and tri axial stresses, Stress tensor, Principal Stresses. Engineering Materials and their mechanical properties, Stress-Strain diagrams, Stress Analysis, Design considerations: Codes and Standards. Design For Static Strength: Static loads and factor of safety, Theories of failure. Maximum normal stress theory, Maximum shear stress theory, Maximum strain theory, Strain energy theory, and Distortion energy theory, failure of brittle and ductile materials.	09	CO1
02	Stress Concentration: Stress concentration factor, design of simple elements with stress raisers. Design For Fatigue Strength: Introduction, S-N Diagram, Low cycle fatigue, High cycle fatigue, Endurance limit, Modifying factors: size effect, surface effect, Stress concentration effects, Fluctuating stresses, Goodman and Soderberg relationship, stresses due to combined loading, cumulative fatigue damage.	09	CO2
03	Design of Simple Machine Elements Design of Cotter joint (socket and spigot type, sleeve and cotter type) and Knuckle joints, Keys: Types of keys, Design of keys, Couplings: classification, Design of Muff and Flange coupling	09	CO3

	(protected and unprotected type). Design of Clutches: Introduction, types of clutches, design of clutches (single plate, multi plate and cone clutches)		
04	Design of Shafts: Introduction, types of shafts, shafts subjected to combined bending and twisting, shaft design (including hollow shafts) based on strength, shaft design based on torsional rigidity, ASME code for shaft design. Design of Brakes: Introduction, energy absorbed by a brake, heat dissipated during braking, single block brakes and simple band brakes.	09	CO4
05	Design of Spur & Helical gears: Spur gear: Introduction, spur gears, standard proportions of gear systems, stresses in gear tooth, Lewis equation and form factor, design for strength, dynamic load and wear load. Helical gears: Definitions, formative number of teeth, design based on strength, dynamic and wear loads.	09	CO5

Design Data Hand Books:

1. K. Mahadevan and K. Balaveera Reddy, "*Design Data Hand Book*": CBS Publication, 4th Revised Edition, 2013.
2. K. Lingaiah, "*Machine Design Data Hand Book*" –Vol I, Suma Publishers, 4th Edition, 2006.
3. K. Lingaiah "*Machine Design Data Hand Book*" –Vol II; Suma Publishers, 8th Edition, 2006.

Text Books:

1. R.S. Khurmi and J.K. Gupta "*A text book of Machine Design*", S. Chand & co, 25th Revised Edition, 2005.
2. V.B. Bhandari, "*Design of Machine Elements*", Tata McGraw Hill Publishing Company, 4th Edition, 2016.

Reference Books:

1. Robert L. Norton, "*Machine Design*", Pearson Education India, 5th Edition, 2013.
2. Shigley, "*Mechanical Engineering Design*", McGraw Hill Education, 10th Edition, 2016.
3. J.B.K. Das, "*Design of Machine design-I*", Sapna book house, 2nd Edition, 2015.
4. J.B.K. Das, "*Design Of Machine design-II*", Sapna book house, 3rd Edition, 2016.

MOOCs:

1. <http://nptel.iitg.ernet.in/>
2. <http://www.nptelvideos.in/2012/12/design-of-machine-elements.html>

Assessment Pattern:

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Co-Curricular
Marks (out of 50)	25	10	05	10
Remember	05		05	
Understand	05	05		
Apply	05			10
Analyze	05	05		
Evaluate	05			
Create				

SEE – Semester End Examination (50 Marks – Theory)

Bloom's Category	SEE (Theory)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	05
Create	05

THEORY OF MACHINES

Course Code : AUT55	Credits :03
L:P:T:S :3:0:0:0	CIE Marks :50
Exam Hours :03	SEE Marks :50

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

CO1	Understand the fundamentals of kinematics, primary and secondary mechanisms.
CO2	Calculate spur gear profiles and various parameters of gear teeth and determine the velocity ratios of simple, compound, epicyclic gear trains.
CO3	Analyse the velocity and acceleration of four bar chain and single slider crank mechanisms
CO4	Determine the size of flywheel using turning moment diagrams, stability of an automobile using Gyroscope.
CO5	Determine the balancing of several rotating and reciprocating masses.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	1	1	1	1	1	1	2	1
CO2	3	2	3	2	1	1	1	1	1	1	2	1
CO3	3	2	3	2	1	1	1	1	1	1	2	1
CO4	3	2	3	2	1	1	1	1	1	1	2	1
CO5	3	2	3	2	1	1	1	1	1	1	2	1

Module	Contents	Hrs	COs
01	Introduction: Mechanism and machines, kinematics links, kinematic pairs, kinematic chains, degrees of freedom, Grubler's criterion Inversions of Four bar chain; Single slider crank chain and Double slider crank chain, Quick return motion mechanisms- Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism, straight line motion mechanisms, Intermittent Motion mechanisms- Ratchet and Pawl mechanism, pantograph	09	CO1
02	Spur Gears: Gear terminology, law of gearing, Characteristics of involute action, Path of contact, Arc of contact, Contact ratio, Interference in involute gears, Methods of avoiding interference, Back lash, Comparison of involute and cycloidal teeth. Gear Trains: Simple gear trains, Compound gear trains for large speed reduction, Epicyclic gear trains tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains	09	CO2
03	Velocity and Acceleration Analysis of Mechanisms: Velocity and acceleration analysis of Four Bar mechanism, single slider crank mechanism and Simple Mechanisms by vector polygons: Relative velocity and acceleration of particles .in a common link, coincident Particles on separate links (graphical method)	09	CO3
04	Flywheels: Introduction, Turning moment diagrams, Fluctuation of Energy and speed, energy stored in a flywheel, determination of size of flywheels. Gyroscope: Vectorial representation of angular motion, gyroscopic	09	CO4

	couple. stability of a two wheeler and four wheelertaking a turn		
05	<p>Balancing Of Rotating Masses: Static and dynamic balancing, Balancing of single rotating and many rotating masses by another mass in one plane. Effect of transferring rotating mass from one plane to another. Balancing of several rotating masses by balancing masses in different plane.</p> <p>Balancing of reciprocating masses: Introduction, primary balancing, secondary balancing, Inertia effect of crank and connecting rod, balancing of single cylinder engine, balancing of multi cylinder-inline engine, balancing of radial engines, balancing of V - engines.</p>	09	CO5

Text Books:

1. Rattan S.S. *"Theory of Machines" Tata McGraw Hill Publishing Company Ltd"*., NewDelhi, 4th Edition, 2014, ISBN: 9789351343479
2. V.P. Singh *"Theory of Machines"* , DhanpatRai& Co., 4th Edition, 2014, ISBN:9788177000665
3. Sadhu Singh *"Theory of Machines"*, Pearson Publications, 2nd Edition, 2012, ISBN:9788177581270

Reference Books:

1. R.S.Khurmi and J.K.Gupta *"Theory of Machines"*, S.Chand and Co., 33rd Edition, 2014,ISBN: 9788121925242
2. P.L. Ballaney *"Theory of Machines"*, Khanna Publishers,26th Edition, 2011,ISBN: 9788174091222
3. Dr. J.S. Brar and Dr. R.K. Bansal *"Theory of Machines"*, Laxmi Publications, 4th Edition, ISBN: 9788131808054

MOOCs:

1. Dynamics (<https://www.edx.org/course/dynamics-mitx-2-03x>)
2. NPTEL Course: "Dynamics of Machines" (<http://nptel.ac.in/courses/112104114>)

Assessment Pattern:

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Co-Curricular
Marks (out of 50)	25	10	05	10
Remember	05			
Understand	05	05	05	
Apply	05			10
Analyze	05			
Evaluate	05	05		
Create				

SEE – Semester End Examination (50 Marks – Theory)

Bloom's Category	SEE (Theory)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	05
Create	05

PROFESSIONAL ELECTIVES- GROUP 1

ENGINEERING ECONOMICS AND AUTOMOTIVE COST ESTIMATION

Course Code :AUT561	Credits :04
L:P:T:S :3:0:0:1	CIE Marks :50
Exam Hours :03	SEE Marks :50

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

CO1	Understand the basic concept and terminology used in engineering economics.
CO2	Evaluate Depreciation based on different economic methods.
CO3	Evaluate the cost and breakeven analysis on one or more economic alternatives.
CO4	Acquire knowledge of book keeping, Journal, Ledger, Balance sheet and theory of interest
CO5	Prepare a cost estimate for automotive components.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	3	1	2	1	3	2	2	1	3
CO2	2	1	1	3	1	2	1	3	2	2	1	3
CO3	2	1	1	3	1	2	1	3	2	2	1	3
CO4	2	1	1	3	1	2	1	3	2	2	1	3
CO5	2	1	1	3	1	2	1	3	2	2	1	3

Module	Contents	Hrs	COs
01	Introduction: Definition of various economic terms such as economic goods, utility, value, price, wealth, Attributes of wealth and its classification, wants and their characteristics, Classification of wants, standard of living, rent and profit, Factors of Production: Land, Labour, Capital, Organization. Demand and Supply: Law of diminishing utility, marginal and total utility, Demand, Demand Schedule, Law of demand, Elasticity of demand, Factors governing the elasticity of demand, Law of substitution and its application, Supply, Law of supply, supply schedule, elasticity of supply, theory of value, equilibrium price, Laws of returns. Wages: Nominal and real wages, Factors affecting real wages, Wages, efficiency and standard of living, theory of wages, difference in wages, methods of wage payment.	09	CO1
02	Depreciation: Need for depreciation, Causes of depreciation, Life and salvage value, Methods of calculating depreciation and their merits and demerits, Numerical problems.	09	CO2
03	Costs and Cost Accounting: Standard cost, estimated cost, First cost, Fixed cost, Variable cost, Incremental cost, Differential cost, Sunk and marginal cost, Breakeven, EOQ and minimum cost analysis. Objectives of cost accounting, Elements of cost: material cost, labour cost, and expenses, total cost, allocation of overheads by different methods, Numerical problems.	09	CO3

04	Book Keeping and accounts: Introduction, Necessity of book keeping, single entry and double entry system, Classification of assets, Journal, Ledger, Trial balance, Final accounts, trading, profit and loss account, Balance sheet, Numerical problems. Interest: Introduction, theory of interest, interest rate, interest rate from lender's and borrower's view point, simple and compound interest, Cash Flow Diagram, Interest formulas (discrete compounding, discrete payments), Nominal and effective interest rates, Numerical problems.	09	CO4
05	Cost Estimation: Introduction, importance, objectives and functions of estimating, principle factors in estimating, Functions and qualities of an estimator, estimating procedure. Estimation of material cost and manufacturing cost of simple automotive components, Estimation of cost of overhauling and servicing of automotive components-cylinder, valves, valve seats, crankshaft, FIP, Brake drum, body building, different types of repairs, Numerical problems.	09	CO5

SELF STUDY:

Student has to do Case study on Depreciation value of different types of vehicle

Text Books:

1. Tara Chand, Nem Chand and Brothers, "Engineering Economics", Roorkee, 14th Edition, 2012
2. Thuesen, G. J. and Fabrycky, W. J., "Engineering Economy", Prentice Hall of India Pvt. Ltd, 5th Edition, 2009
3. T. R. Banga and S. C. Sharma, "Mechanical Estimating and Costing", Khanna Publishers, Delhi, 7th Edition, 2015

Reference Books:

1. T. R. Banga and S. C. Sharma, "Industrial Organization and Engineering Economics", Khanna Publishers, New Delhi- 2015.
2. D. Kannappan et al, "Mechanical Estimating and Costing", Tata McGraw Hill Publishing Company Ltd., New Delhi
3. O. P. Khanna, ". "A Text Book of Mechanical Estimating and Costing", DhanpatRai Publications Pvt. Ltd., New Delhi-2013
4. O. P. Khanna, " Industrial Engineering and Management", DhanpatRai and Sons, New Delhi,
5. 13th Edition, 2010 I. M. Pandey "Financial Management", Vikas Publishing House Pvt. Ltd., New Delhi, 9th Edition, 2008
6. Riggs, David D. Bedworth and Sabah U. Randhawa "Engineering Economics", James L., Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 4th Edition, 2009

MOOCs:

1. <http://nptel.ac.in/courses/112107209/>

Assessment Pattern:

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self-Study
Marks (out of 50)	25	10	05	10
Remember	05			
Understand	05	05		
Apply	05	05	05	
Analyze	10			05
Evaluate				05
Create				

SEE – Semester End Examination (50 Marks – Theory)

Bloom's Category	SEE (Theory)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	

MANAGEMENT AND ENTREPRENEURSHIP

Course Code : AUT562
 L:P:T:S :3:0:0:1
 Exam Hours :03

Credits :04
 CIE Marks :50
 SEE Marks :50

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

CO1	Understand the basic knowledge of management and staffing.
CO2	Understand the importance and purpose of planning.
CO3	Describe the organization and its types and controlling
CO4	Describe the development of Entrepreneurship.
CO5	Describe the importance of Small Scale Industries and Institutional Support.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	2	1	3	3	2	1	2
CO2	1	1	1	1	1	2	1	3	3	2	1	2
CO3	1	1	1	1	1	2	1	3	3	2	1	2
CO4	1	1	1	1	1	2	1	3	3	2	1	2
CO5	1	1	1	1	1	2	1	3	3	2	1	2

Module	Contents	Hrs	COs
01	Management: Introduction, Meaning, nature and characteristics of Management, Scope and Functional areas of management - Management as a science, art of profession - Management & Administration, Roles of Management, Levels of Management, Development of Management Thought, Early management approaches, Modern management approaches. Staffing: Nature and importance of staffing, Process of Selection & Recruitment.	09	CO1
02	Planning: Nature, importance and purpose of planning process Objectives, Types of plans - Decision making Importance of planning, steps in planning & planning premises - Hierarchy of plans.	09	CO2
03	Organizing: Nature and purpose of organization Principles of organization, Types of organization, Departmentation Committees- Centralization Vs Decentralization of authority and responsibility, Span of control - MBO and MBE. Controlling: Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control.	09	CO3
04	Entrepreneur: Meaning of Entrepreneur, Evolution of the Concept, Functions of an Entrepreneur, Types of Entrepreneur, Entrepreneur - an emerging class. Concept of Entrepreneurship, Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process, Role of entrepreneurs in Economic Development, Entrepreneurship in India, Entrepreneurship – its Barriers.	09	CO4

05	<p>Small Scale Industries: Definition, Characteristics, Need and rationale, Objectives, Scope, role of SSI in Economic Development. Advantages of SSI Steps to start and SSI, Government policy towards SSI, Different Policies of SSI, Government Support for SSI during 5 year plans. Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GA TT Supporting Agencies of Government for SSI, Meaning, Nature of support, Objectives, Functions, Types of Help, Ancillary Industry and Tiny Industry</p> <p>Institutional Support: Different Schemes, TECKSOK, KIADB, KSSIDC, KSIMC, DIC Single Window Agency, SISI, NSIC, SIDBI, KSFC.</p>	09	CO5
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SELF STUDY:

Student has to do case study on the various government policies towards small scale industries

Text Books:

1. P. C. Tripathi, P.N. Reddy, *“Principles of Management”*, – Tata McGraw Hill
2. Vasant Desai, *“Dynamics of Entrepreneurial Development & Management”*, Himalaya Publishing House
3. Poornima. M. Charantimath, *“Entrepreneurship Development”*, Small Business Enterprises – Pearson Education - 2006

Reference Books:

1. Robert L. Stuebs – Thomson, *“Management Fundamentals”*, Concepts, Application, Skill Development
2. S.S. Khanka, *“Entrepreneurship Development”* – S. Chand & Co.
3. Stephen Robbins *“Management”*, Pearson Education/PHI - 17th Edition, 2003.

Assessment Pattern:

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self-Study
Marks (out of 50)	25	10	05	10
Remember	05		05	
Understand	10	05		
Apply	05	05		05
Analyze	05			
Evaluate				05
Create				

SEE SEMESTER END EXAMINATION (50 Marks – Theory)

Bloom's Category	SEE (Theory)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	

STATISTICAL QUALITY CONTROL

Course Code: AUT563

Credits:04

L:P:T:S:3:0:0:1

CIE Marks:50

Exam Hours:03

SEE Marks: 50

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

CO1	Understand the quality control and basic statistical concepts used in companies.
CO2	Understand the probability and probability distributions like binomial and poisson's for the process and plot the control charts for variables for the process.
CO3	Understand the process capabilities and control charts for attributes.
CO4	Select an appropriate sampling process for the quality control in particularly for manufacturing automotive components.
CO5	Plot the graph of failure statistics.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	2	2	1	2	1	1	2
CO2	3	3	3	3	2	2	2	1	2	1	1	2
CO3	3	3	3	3	2	2	2	1	2	1	1	2
CO4	3	3	3	3	2	2	2	1	2	1	1	2
CO5	3	3	3	3	2	2	2	1	2	2	1	2

Module	Contents	Hrs	COs
01	Introduction: Basic concepts of Quality, Meaning and definition of quality, Quality control, objectives of quality control, Quality Characteristics, Quality costs, Quality of Design, Quality of conformance, Concepts in quality management, quality planning, quality measurement, trouble shooting, diagnostic techniques, System approach to quality management. Basic Statistical Concepts: Concept of variation and its types, Variables and Attributes, Frequency distribution and its graphical representation (Frequency Polygon, Histogram, and O give), Central tendency and Measures of dispersion (Mean, Median, Mode, Range, and Standard deviation), Numerical Problems.	09	CO1
02	Probability and Probability Distributions: Theory of Probability, Types of Probability distributions: Hyper geometric, Bi-nominal, Poisson and Normal distributions, Numerical Problems. Control Charts for Variables: Theory and definition of control chart, Control charts for X - Bar and R charts, Type I and Type II errors, Numerical Problems.	09	CO2
03	Process Capability: Methods of calculating process capability, Natural Tolerance limits, Numerical problems. Control Charts for Attributes: Control charts for defects and defectives - p, np, c, and u charts and their applications, Numerical problems.	09	CO3
04	Acceptance Sampling: Basis concepts, Sampling by attributes, single, double and multiple sampling plans, use of sampling table, Sequential sampling plan, construction and use of Operating Characteristic curves, Numerical problems.	09	CO4
05	Failure statistics and Reliability: Failure density, Failure rate, Mean failure rate, Mean time to failure, Mean time between failure,	09	CO5

	maintainability, Availability, Concepts and meaning of reliability, Reliability prediction, Bath tub curve, component and system reliability, redundancy and its uses, interaction between reliability and maintenance, Numerical problems.		
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SELF STUDY:

Case study on quality control technique used in any small or mid Cap Company

Text Books:

1. E. L. Grant and R.S.Leavenworth, "*Statistical Quality Control*", Tata McGraw- Hill publishing Co.Ltd., New Delhi, 7th edition, 2014, ISBN: 9780070435551
2. L.S. Srinath "*Concepts in Reliability Engineering*", East-west press pvt ltd, 2nd edition, 2007, isbn:9788176710480

Reference Books:

1. R. C. Gupta, "*Statistical Quality Control*", Khanna Publishers, Delhi, 1st edition, 2013, ISBN EBK0029239
2. Gerald M. Smith, "*Statistical Process Control and Quality Improvement*", Pearson Prentice Hall, 5th edition, 2013, ISBN:978013049036
3. Manohar Mahajan, "*Statistical Quality Control*", Dhanpat Rai and Sons, New Delhi, 1st edition, 2012, 9788177000399
4. Montgomery Douglas C, "*Introduction to Statistical Quality Control*", John Wiley and Sons, Inc, Hoboken, 7th edition, 2013, 9781118146811

Assessment Pattern:

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self-Study
Marks (out of 50)	25	10	05	10
Remember	05	05		
Understand	05			
Apply	05	05	05	05
Analyze	05			
Evaluate	05			05
Create				

SEE- SEMESTER END EXAMINATION (50 Marks- Theory)

Bloom's Category	SEE (Theory)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	

TOTAL QUALITY MANAGEMENT

Course Code : AUT564

Credits :04

L:P:T:S :3:0:0:1

CIE Marks :50

Exam Hours :03

SEE Marks :50

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

CO1	Acquire the knowledge of basic concepts of TQM.
CO2	Describe the importance of TQM principles.
CO3	Gain the knowledge of TQM tools and Techniques.
CO4	Describe the concepts of Taguchi techniques.
CO5	Acquire the knowledge of Quality Management System.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	2	1	2	1	2	2	2	2	1
CO2	2	2	1	2	1	2	1	2	2	2	2	1
CO3	2	2	1	2	1	2	1	2	2	2	2	1
CO4	2	2	1	2	1	2	1	2	2	2	2	1
CO5	2	2	1	2	1	2	1	2	2	2	2	1

Module	Contents	Hrs	COs
01	Introduction: Introduction, Need for quality, Evolution of quality, Definition of quality, Dimensions of product and service quality, Definition of TQM, Basic concepts of TQM, Gurus of TQM (Brief introduction), TQM Framework- Barriers to TQM, Benefits of TQM.	09	CO1
02	TQM Principles: Leadership, The Deming Philosophy, Quality council, Quality statements and Strategic planning, Customer Satisfaction, Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention, Employee involvement, Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal, Continuous process improvement, Juran Trilogy, PDSA cycle, 5s and Kaizen - Supplier partnership, Partnering, Supplier selection, Supplier Rating and Relationship development.	09	CO2
03	TQM Tools & Techniques-I: The seven traditional tools of quality, New management tool, Six-sigma Process Capability, Bench marking – Reasons to bench mark, Bench marking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Bench Marking	09	CO3
04	TQM Tools & Techniques-II: Quality circles, Quality Function Deployment (QFD), Taguchi quality loss function, TPM – Concepts, improvement needs, Performance measures, Cost of Quality, BPR.	09	CO4
05	Quality Management System: Introduction, Benefits of ISO Registration, ISO 9000 Series of Standard, Sector-Specific Standards— AS 9100, TS16949 and TL 9000, ISO 9001 Requirements, Implementation, Documentation, Internal Audits, Registration.	09	CO5

	Environmental Management System: Introduction, ISO 14000 Series Standards, Concepts of ISO 14001, Requirements of ISO 14001, Benefits of EMS.		
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SELF STUDY:

Case study on TQM applied to automotive industry

Text Books:

1. Dale H.Besterfield, Carol B.Michna,Glen H. Besterfield,MaryB.Sacre,HemantUrdhwareshe and RashmiUrdhwareshe, *“Total Quality Management”*,PearsonEducation Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.

Reference Books:

1. R. Evans and William M. Lindsay, *“The Management and Control of Quality”*, South Western (Thomson Learning) (6th Edition),2005.
2. Oakland, J.S.*“TQM – Text with Cases”*,Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
3. Suganthi,L and Anand Samuel, *“Total Quality Management”*, Prentice Hall (India) Pvt. Ltd., 2006 .
4. Janakiraman,B and Gopal, R.K,*“Total Quality Management – Text and Cases”*,Prentice Hall (India) Pvt. Ltd., 2006.

Assessment Pattern:

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom’s Category	Tests	Assignments	Quizzes	Self-Study
Marks (out of 50)	25	10	05	10
Remember	05	05		
Understand	05	05		
Apply	05		05	05
Analyze	10			
Evaluate				05
Create				

SEE – Semester End Examination (50 Marks – Theory)

Bloom’s Category	SEE (Theory)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	

VEHICLE TRANSPORT MANAGEMENT

Course Code : AUT565
 L:P:T:S :3:0:0:1
 Exam Hours :03

Credits :04
 CIE Marks :50
 SEE Marks :50

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

CO1	Acquire the knowledge of basic concepts of Vehicle transport management.
CO2	Describe the importance of organization and management of transport.
CO3	Gain the knowledge of route planning.
CO4	Describe the concepts of fare collections and fare structure.
CO5	Acquire the knowledge of public relation division.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	2	1	3	1	1	1	2	1	1
CO2	2	2	1	2	1	3	1	1	1	2	1	1
CO3	2	2	1	2	1	3	1	1	1	2	1	1
CO4	2	2	1	2	1	3	1	1	1	2	1	1
CO5	2	2	1	2	1	3	1	1	1	2	1	1

Module	Contents	Hrs	COs
01	Introduction: Historical background, the growth of a network, trams, trolley buses, buses, private cars, subsidies. Motor vehicle act 1988. The Infrastructure: Road, Highway network, traffic control, Bus priorities, pedestrianization, out town shopping centres, Bus-stops, shelters, Bus stations-drive through type, head on type, facilities for passengers, bus garages, requirement, layout of premises, size, function, location, design, equipment, use of machinery, garage organization, large scale overhaul conveyance of staff, requirement of facilities at depot., legal provisions for depot. Layouts.	09	CO1
02	Organization and Management: Forms of ownership, municipal undertaking, company undertaking, traffic, secretarial and engineering departments, management, principle of transport, - internal organization-centralized control, de-centralized control, staff administration: industrial relation, administration, recruitment and training, drivers and conductors duties, training of drivers and conductors, factors affecting punctuality, welfare, health and safety.	09	CO2
03	Route planning: Source of traffic, town planning, turning points, stopping places, shelters, survey of route, preliminary schedule test runs, elimination of hazards, factors affecting frequency, direction of traffic flow, community of interest, estimating, traffic volume, probable weekday travellers, passengers during various periods of the day, estimated number of passengers, estimated traffic, possibility of single verses double deck and frequency timing, Bus working and Schedules: Time table layout, uses of flat graph method of presentation, preparation of vehicle and crew schedule	09	CO3

	preparation of the duty roster, co-operation with employers, use of the vehicle running numbering determination of vehicle efficiency checking efficiency of crew, duty arrangements		
04	Fare collections & Fare structure: Need, Principles of collection, tickets, the way bill, stage by stage, bell punch system, bellgraphic system, reduced ticket stocks will brew system, mechanical ticket machines, T.I.M and straight machines, Vero meter, one-man operation, two stream boarding, pre paid tickets, lensonparason coach tickets exchanges, the fare box, electronic ticket machines, box system personal and common stock flat fare platform control. Fare structure: Basis of fares, historical background, effects of competition and control, calculating average zone system, concession fares, straight and tapered scale elastic and inelastic demand co-ordination of fares concessions fares changes for workman, standard layout of fare table, anomalies double booking inter availability through booking and summation, private hire charges.	09	CO4
05	Public relations divisions: Dissemination of information, maintaining goodwill- handling complaints, traffic advisory committees- local contractors co-operation with the press news and articles- facilities for visitors- forms of publicity – importance of quality – inter departmental liaison advertisements, signs, notice and directions general appearance of premises, specialized publicity. Prevention of accidents: Emphasis of safe driving, annual awards, bonus encouragement, vehicle design, platform layout, location of stops, scheduled speed, route hazards, records, elimination of accident prone drivers.	09	CO5

SELF STUDY:

Case Study on different bus layouts in the city

Text Books:

1. L.D.Kitchen, Iliffe&Sons, “Bus operation”, London
2. Rex W. Faulks, “Bus & coach operation Butterworth”, Version Of 1987, London

Reference Books:

1. “Compendium of transport terms” – Cirt, Pune.
2. “M.V. Act 1988” - Central Law Agency, Allahabad.
3. R.J. Eaton - “The elements of transportation”.
4. C.S. Dubbar- “Goods vehicle operation”.
5. L.D. Kitchen - “Road transport law”.
6. G B S Narang, “Automobile engineering”, Khanna Publications.
7. H B Keshwani, “Automobile engineering”.
8. R B Gupta, “Automobile engineering”, satyaprakashan, New Delhi.

Assessment Pattern:

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self-Study
Marks (out of 50)	25	10	05	10
Remember	05	05		
Understand	05	05		
Apply	05		05	
Analyze	10			05
Evaluate				05
Create				

SEE – Semester End Examination (50 Marks – Theory)

Bloom's Category	SEE (Theory)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	

SIXTH SEMESTER SYLLABUS

FINITE ELEMENT METHOD

Course Code : AUT61
L:P:T:S :3:2:0:0
Exam Hours :03+03

Credits :05
CIE Marks :50+25
SEE Marks :50+25

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

CO1	Apply basics of theory of elasticity to continuum problems.
CO2	Formulate finite elements like bar, truss and beam elements for linear static structural analysis.
CO3	Solve problems of limited complexity in structural and heat transfer domain (1D & 2D).
CO4	Apply finite element software to simulate practical problems.
CO5	Identify the degree of freedom of elements to be modelled and boundary conditions to be incorporated.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	2	2	1	2	1	2	2	2	1
CO2	2	3	2	2	2	1	2	1	2	2	2	1
CO3	2	3	2	2	2	1	2	1	2	2	2	1
CO4	2	3	2	2	2	1	2	1	2	2	2	1
CO5	2	3	2	2	2	1	2	1	2	2	2	1

Module	Contents	Hrs	COs
01	<p>Introduction: Equilibrium equations in elasticity subjected to body force, traction forces, and stress-strain relations for plane stress and plane strains. General description of Finite Element Method, Application and limitations. Types of elements based on geometry. Node numbering, Half band width.</p> <p>Basic Procedure (Theory Only): Euler - Lagrange equation for bar, beam (cantilever / simply supported fixed) Principle of virtual work, principle of minimum potential energy, Raleigh's Ritz method. Direct approach for stiffness matrix formulation of bar element. Galerkin's method.</p> <p>List of Experiments: Study of a FEA package and modelling stress analysis of bars of constant cross section area, tapered cross section area and stepped bar.</p>	09	CO1
02	<p>Interpolation Models: Interpolation polynomials- Linear, quadratic and cubic. Simplex complex and multiplex elements. 2D PASCAL's triangle. CST elements-Shape functions and Nodal load vector, Strain displacement matrix and Jacobian for triangular and rectangular element.</p> <p>Higher Order Elements: Langrange's interpolation, Higher order one dimensional elements-Quadratic and cubic element and their shape functions. Shape function of 2-D quadrilateral element-linear, quadric element Isoparametric, Sub parametric and Super parametric elements. Numerical integration: 1, 2 and 3 gauge point for 1D and 2D cases. (Derivations& Theory)</p> <p>List of Experiments: Stress analysis of a rectangular plate with a circular hole, axisymmetric problems.</p>	09	CO2

03	Solution of 1-D Bars: Solutions of bars and stepped bars for displacements, reactions and stresses by using penalty approach and elimination approach. Gauss-elimination technique. List of Experiments: Modelling stress analysis of a) Trusses b) Beams -Simply supported and cantilever beams with UDL, UVL and point loads.	09	CO3
04	Trusses: Stiffness matrix of Truss element. Numerical problems. Beams: Hermite shape functions for beam element, Derivation of stiffness matrix. Numerical problems of beams carrying concentrated, UDL and linearly varying loads. List of Experiments: Dynamic Analysis a) Fixed -fixed beam for natural frequency determination. b) Bar subjected to forcing function. c) Fixed -fixed beam subjected to forcing function.	09	CO4
05	Heat Transfer: Steady state heat transfer, 1D heat conduction governing equations. Functional approach for heat conduction. Galerkin's approach for heat conduction. 1D heat transfer in thin fins. List of Experiments: Thermal Analysis -2D problem with conduction and convection boundary conditions.	09	CO5

Text Books:

1. T. R. Chandrupatla and A. D. Belegundu, "Introduction to Finite Elements in Engineering ", 4th Edition, Pearson Education, 2011.
2. S.S. Rao "The Finite Element Method in Engineering", Elsevier, 5th Edition, 2010.

References Books:

1. Bathe, K. J" *Finite Element Procedures*", Cambridge, 2007. ISBN: 9780979004902.
2. Robert D. Cook, David S. Malkus and Michael E. Plesha, "Concepts and Applications of Finite Element Analysis", John Wiley & Sons.2003
3. J.N.Reddy" *Finite Element Method*", McGraw –Hill International Edition.
4. Daryl. L. Logon " *Finite Element Methods*", Thomson Learning 3rd edition, 2001.
5. C.S.Krishnamurthy, " *Finite Element Analysis*", Tata McGraw Hill Publishing Co.Ltd, New Delhi, 1995.
6. P.Seshu " *Text book of Finite Element analysis*", Prentice Hall of India.

MOOCs:

1. Finite Element Method (FEM) Analysis and Applications
<https://www.edx.org/course/finite-element-method-fem-analysis-tsinghuax-70120073x>
2. A Hands-on Introduction to Engineering Simulations
3. <https://www.edx.org/course/hands-introduction-engineering-cornellx-engr2000x>
4. <http://nptel.ac.in/courses/112104115/>
5. <https://www.coursetalk.com/providers/mit/courses/finite-element-analysis-ofsolids-and-fluids-i>
6. <https://online-learning.tudelft.nl/courses/linear-modeling-fem/>

Assessment Pattern:**CIE- Continuous Internal Evaluation (50 Marks)**

Bloom's Category	Tests	Assignments	Quizzes	Co-Curricular
Marks (out of 50)	25	10	05	10
Remember	05			
Understand	05			
Apply	05			10
Analyze	05	05	05	
Evaluate	05	05		
Create				

CIE- Continuous Internal Evaluation for lab (25 Marks)

Bloom's Category	Tests	Record	Viva
Marks (out of 50)	10	10	05
Remember	02	02	01
Understand	02	02	02
Apply	02	02	
Analyze	02	02	01
Evaluate	02	02	01
Create			

SEE – Semester End Examination (50 Marks – Theory)

Bloom's Category	SEE (Theory)
Remember	10
Understand	15
Apply	05
Analyze	10
Evaluate	05
Create	05

SEE– Semester End Examination (25 Marks- Lab)

Bloom's Category	SEE (Lab)
Remember	05
Understand	05
Apply	05
Analyze	05
Evaluate	03
Create	02

AUTOMOTIVE TRANSMISSION

Course Code : AUT62
L:P:T:S :2:1:0:0
Exam Hours :03+03

Credits :03
CIE Marks :50+25
SEE Marks :50+25

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

CO1	Explain various types of Clutches and modes of operation.
CO2	Understand the operation of sliding, constant, synchro mesh gear boxes and calculate the gear ratios.
CO3	Explain Overdrive operations and gear shifting mechanism.
CO4	Compare between the fluid coupling and torque converter.
CO5	Explain about the automatic transmission and electric transmission.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	2	2	1	2	1	2	2	2	1
CO2	2	3	3	2	2	1	2	1	2	2	2	1
CO3	2	3	3	2	2	1	2	1	2	2	2	1
CO4	2	3	3	2	2	1	2	1	2	2	2	1
CO5	2	3	3	2	2	1	2	1	2	2	2	1

Module	Contents	Hrs	COs
01	<p>Clutch: Principle of operation, Constructional details, torque capacity and design aspects. Different types of clutches. Operation of single plate and multi plate clutch. Centrifugal, Dry and Wet type of clutch. Modes of operating a clutch – mechanical, hydraulic, electric and vacuum.</p> <p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Study of hand tools. 2. Dismantle and assembly of single plate clutch. 3. Identifying the components and troubleshooting the single plate clutch. 	09	CO1
02	<p>Gear Box: Objective of the Gear Box - Setting top, bottom and intermediate gear ratios. Performance characteristics at different speeds - Construction and operations of Sliding-mesh gear box - Constant-mesh gear box - Synchro-mesh gear box. Numerical problems.</p> <p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Dismantle and assembly of Constant mesh gear box. 2. Identifying the components and troubleshooting the gear box. 	09	CO2
03	<p>Epicyclic Transmission: Principle of operation, types of planetary transmission, Wilson planetary transmission, Over drives, Transfer box. Gear shifting mechanisms, Calculation of gear ratio in different speeds.</p> <p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Dismantle and assembly of Differential (Planetary Gear Box). 2. Identifying the components and troubleshooting the Differential. 	09	CO3
04	<p>Fluid Coupling, Torque Converters: Fluid coupling - Principle of operation - Construction details - Torque capacity – Performance characteristics - Reduction of drag torque. Torque converter - Principle of operation -</p>	09	CO4

	<p>Constructional details – Performance characteristics. Free wheel – Characteristic performance.</p> <p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Writing technical specifications and description of all types of chassis and transmission components of automobiles, including body and interiors (two wheeler, four wheeler and heavy vehicle – Five each). 2. Draw sketch of seating arrangements, seats for commercial vehicle and study the comfort levels provided for driver and passengers. 		
05	<p>Automatic & Electric Transmissions: Automatic transmission - Principle, general description and Working of representative types like Borgewarner and general arrangement & description of electric transmission, their working principle & control mechanisms, limitations.</p> <p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Dismantle and assembly of Automatic Transmission. 2. Identifying and troubleshooting of Automatic transmission. 	09	C05

Text Books:

1. N.K Giri, “*Automotive Mechanics*”, Khanna Publication, New Delhi, 2015, ISBN: 8184092161
2. “*Automotive Transmissions: Fundamentals, Selection, Design and Application*”, 2nd Edition, Springer, 2011.

Reference Books:

1. Heldt P. M, “*Torque converters*”, Chilton Book Co., 1992. SAE Transactions 900550 & 930910.
2. Crouse W.H, Anglin D.L, “*Automotive Transmission and Power Trains construction*”, McGraw Hill, 10th Edition, 2008, ISBN: 9780070634350
3. R.B.Gupta, “*Automobile Engineering*” Satya Publications, 9th Edition, 2015, ISBN: 8176848581
4. Dr.Kirpal Singh. “*Automobile Engineering*”

Assessment Pattern:

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom’s Category	Tests	Assignments	Quizzes	Co-Curricular
Marks (out of 50)	25	10	05	10
Remember	05		05	
Understand	05	05		
Apply	05			10
Analyze	05	05		
Evaluate	05			
Create				

CIE- Continuous Internal Evaluation for lab (25 Marks)

Bloom's Category	Tests	Record	Viva
Marks (out of 50)	10	10	05
Remember	02	02	01
Understand	02	02	01
Apply	02	02	
Analyze	02	02	01
Evaluate	02	02	01
Create			01

SEE – Semester End Examination (50 Marks – Theory)

Bloom's Category	SEE (Theory)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	

SEE– Semester End Examination (25 Marks- Lab)

Bloom's Category	SEE (Lab)
Remember	05
Understand	05
Apply	05
Analyze	05
Evaluate	05
Create	

AUTOMOTIVE CHASSIS AND SUSPENSION

Course Code : AUT63

Credits :05

L:P:T:S :3:2:0:0

CIE Marks :50+25

Exam Hours :03+03

SEE Marks :50+25

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

CO1	Understand the types of automobiles, different layouts, frames and materials used for the manufacturing.
CO2	Explain the function of front axle, types of stub axle, types of steering gear box and propeller shaft.
CO3	Explain different types of braking systems and their applications.
CO4	Classify different types of suspension system and applications along with the final drive and rear axle.
CO5	Classify the different types of tyres, wheels, factors affecting tyre life.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	1	2	2	2	1	2	2	2	1
CO2	2	1	2	1	2	2	2	1	2	2	2	1
CO3	2	1	2	1	2	2	2	1	2	2	2	1
CO4	2	1	2	1	2	2	2	1	2	2	2	1
CO5	2	1	2	1	2	2	2	1	2	2	2	1

Module	Contents	Hrs	COs
01	<p>Introduction: General consideration relating to chassis layout, power location, types of automobiles, layout of an automobile with reference to power plant, weight distribution, stability, Numerical problems.</p> <p>Frames: Types of frames – Two, Three, four wheelers & HV, general form & dimensions, materials, frame stresses, frame sections, cross members, proportions of channel sections, constructional details, loading points, sub frames, passenger car frames, X member type frame, Box section type frame, testing of frames, bending and torsion test, effect of brake application of frame stresses, truck frames, defects, Numerical problems.</p> <p>List of Experiments:</p> <ol style="list-style-type: none"> Determination of straightness of frame and repairing the defected places by means of denting. Inspection of vehicle and preparation of test charts. Testing of two wheeled vehicles on chassis dynamometer. 	09	CO1
02	<p>Front axle and steering systems: Axle parts and materials, loads and stresses, centre sections, section near steering head, spring pads, front axle loads, steering heads, factors of wheel alignment, wheel balancing, centre point steering, correct steering angle, steering mechanisms, cornering force, self-righting torque, under steer and over steer, Steering linkages, steering gears, special steering columns, power steering, trouble shooting, Numerical problems.</p> <p>Propeller shaft: Construction & types of propeller shafts, whirling of propeller shaft, universal joints, analysis of Hooke's joint- ratio of shafts velocities, maximum & minimum speeds of driven shaft, condition for equal</p>	09	CO2

	<p>speeds of the driving & driven shafts, angular acceleration of the driven shaft, maximum fluctuation of speed, double Hooke's joint, Numerical problems.</p> <p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Study and practice of wheel alignment (computerized). 2. Study and practice of wheel balancing. 		
03	<p>Brakes 1: Necessity, stopping distance and time, brake efficiency, weight transfer, brake shoe theory, determination of braking torque, classification of brakes, types, construction, function, operation, braking systems - mechanical, hydraulic, disc, drum, details of hydraulic system, mechanical system and components, types of master & wheel cylinders, bleeding of brakes, brake drums, brake linings, brake fluid, factors influencing operation of brakes</p> <p>such as operating temperature, lining, brake clearance, pedal pressure, linkages etc, Numerical problems.</p> <p>Brakes 2: Brake compensation, Parking and emergency brakes, hill holder, automatic adjustment, servo brakes, Power brakes-Air brakes, vacuum brakes and electric brakes and components brake valve, unloaded valve, diaphragm, air-hydraulic brakes, vacuum boosted hydraulic brakes, trouble shooting</p> <p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Study and practice on brake drum skimming machine. 2. Headlight focusing test. 	09	CO3
04	<p>Suspension Systems: Objects, basic considerations, Types of suspension springs, construction, operation & materials, leaf springs, coil springs, torsion bar, rubber springs, plastic springs, air bellows or pneumatic suspension, hydraulic suspension, constructional details of telescopic shock absorbers, independent suspension, front wheel independent suspension, rear wheel independent suspension, types, stabilizer, trouble shooting, Numerical problems. Final drive – construction details, types, Differential-Principle, types</p> <p>of differential gears, conventional and non-slip differentials, backlash, differential lock, inter-axle differential, transaxle types. Rear axle - Torque reaction, driving thrust, Hotchkiss drive, torque tube drive, construction of rear axle shaft supporting- fully floating and semi floating arrangements axle housings, trouble shooting, numerical problems</p> <p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Servicing of shock absorber. 2. Preparation of chart on trouble shooting suspension system. 	09	CO4
05	<p>Wheels and Tyres: Types of wheels, construction, structure and function, wheel dimensions, structure and function of tyres, static and dynamic properties of pneumatic tyres, types of tyres, materials, tyre section & designation, factors affecting tyre life, quick change wheels, special wheels, trouble shooting, Case study of the commercial vehicle Case study of the heavy weight vehicles</p> <p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Study of tyre retreading and vulcanizing. 2. Study of tyre changer machine. 	09	CO5

Text Books:

1. Kirpal Singh “Automobile Engineering VOL-1”, Standard Publications, 13th edition, 2013, ISBN :9788180141966
2. N.K Giri, ‘Automotive Mechanics’, Khanna Publication, New Delhi, 2015, ISBN:81- 8409-216-1

Reference Books:

1. Heldt.P.M, “Automotive Chassis”, Chilton Co., New York, 2nd edition, 1990.
2. Tim Gilles, “Automotive Chassis-Brakes, Steering and Suspension”, Thomson DelmerLearning, 2005.
3. JoransenReimpell, Helmut Stoll, “Automotive Chassis: Engineering Principles”, Elsevier, 2nd edition, 2001.
4. Crouse W.H, Anglin D.L, “Automotive Mechanics”, McGraw Hill, 10th edition, 2015. ISBN: 9780070634350
5. R.B.Gupta, “Automobile Engineering” Satya Publications, 9th Edition, 2015, ISBN: 81-7684-858-1
6. G.B.S. Narang “Automobile Engineering”, Khanna Publishers, 5th edition, 1995, ISBN: 8174092161.
7. Joseph Heitner, “Automotive Mechanics”, CBS Publishers, 1st edition, 2004, ISBN: 81-239-08911

Assessment Pattern:**CIE- Continuous Internal Evaluation for theory (50 Marks)**

Bloom’s Category	Tests	Assignments	Quizzes	Co-Curricular
Marks (out of 50)	25	10	05	10
Remember	05		05	
Understand	05	05		
Apply	05			10
Analyze	05	05		
Evaluate	05			
Create				

CIE- Continuous Internal Evaluation for lab (25 Marks)

Bloom’s Category	Tests	Record	Quizzes/ Viva
Marks (out of 50)	10	10	05
Remember	02	02	01
Understand	02	02	01
Apply	02	02	01
Analyze	02	02	01
Evaluate	02	02	01
Create			

SEE – Semester End Examination (50 Marks – Theory)

Bloom's Category	SEE (Theory)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	

SEE – Semester End Examination (25 Marks – Lab)

Bloom's Category	SEE (Lab)
Remember	05
Understand	05
Apply	05
Analyze	05
Evaluate	05
Create	

AUTOMOTIVE ELECTRICALS AND ELECTRONIC SYSTEMS

Course Code : AUT64

L:P:T:S :2:0:0:0

Exam Hours :02

Credits :02

CIE Marks :25

SEE Marks :25

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

CO1	Explain about lead acid battery, recent developments in battery, applications and starter motors, drives.
CO2	Classify alternators, and ignition system with hands on experience for trouble shooting.
CO3	Explain electrical systems and accessories used in automotive vehicles
CO4	Understand heating and air conditioning, chassis electrical system, ABS and seat belts.
CO5	Explain engine management system.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2	3	2	1	2	2	2	2
CO2	2	2	2	1	2	3	2	1	2	2	2	2
CO3	2	2	2	1	2	3	2	1	2	2	2	2
CO4	2	2	2	1	2	3	2	1	2	2	2	2
CO5	2	2	2	1	2	3	2	1	2	2	2	2

Module	Contents	Hrs	COs
01	Storage Battery: Principle of lead acid cells, plates and their characteristics containers and separators, electrolyte and their preparation, voltmeter, effect of temperature on electrolyte, its specific gravity, capacity and efficiency, methods of charging from D.C. mains, defects and remedies of batteries, care of idle and new batteries. Recent development in batteries. Starter Motor & Drives: Battery motor starting system, condition at starting, behaviour of starter during starting series motor and its characteristics, consideration affecting size of motor, types of drives, starting circuit.	09	CO1
02	Generator/ Alternator: Principle of generation of direct current, generator details, shunt, dynamos, armature reaction, action of three brush generator and battery in parallel, setting of third brush, voltage and current regulators, cut out -construction, working and adjustment. Construction of A.C. systems. Ignition systems: Ignition fundamentals, Types of solid state ignition systems, components, construction And operating parameters high energy ignition distributors, Electronic spark timing and control.	09	CO2
03	Wiring and lighting system: Earth return and insulated systems, 6volts and 12 volts system, fusing of circuits, low and high voltage automobile cables, diagram of typical wiring system. Principle of automobile illumination, head lamp mounting and construction, sealed beam auxiliary lightings, horn, windscreen-wipers, signalling devices, electrical fuel pump, fuel, oil and temperature gauge(Dash board instruments)	09	CO3
04	Heating and Air conditioning: Conventional heating and ventilation, Air conditioning theory and systems, seat heaters	09	CO4

	Chassis Electrical systems: Antilock brakes (ABS), Active suspension, Traction control, Electronic control of automatic transmission, other chassis electrical systems, Central locking, Air bags and seat belt tensioners.		
05	Engine Management System: Combined ignition and fuelmanagement systems. Exhaust emission control, Digital control techniques –Dwell angle calculation, Ignition timing calculation and Injection duration calculation. Complete vehicle control systems, Artificial intelligence and engine management. Motronic, other aspect of engine management- variable valve timing, lean burn engines, transonic combustion, combustion control system, formula 1 engine technology.	09	CO5

Text Books:

1. Tom Denton, “*Automobile Electrical and Electronic systems*” Routledge publication, 4th edition, 2012.
2. P.M. Kohli, “*Automotive Electrical Equipment*”, Tata McGraw Hill, New Delhi.

Reference Books:

1. Heinz Heisler, “*Advanced Engine Technology*” SAE Publications, 1995.
2. Ulrich Adler, “*Automotive Electronic Systems*”, Robert Bosch, GMBH, 1995
3. Bosch Technical Instruction Booklets
4. A.P. Young & Griffiths, “*Automobile Electrical Equipment*”, ELBS & Newnes Butterworths, London
5. W. Judge, “*Modern Electrical Equipment*”
6. Parker and Smith S, “*Electrical Equipment for Automobiles*”.

Assessment Pattern:

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom’s Category	Tests	Assignments	Quizzes	Co-Curricular
Marks (out of 50)	25	10	05	10
Remember	05		05	
Understand	05	05		
Apply	05			10
Analyze	05	05		
Evaluate	05			
Create				

SEE – Semester End Examination (50 Marks – Theory)

1.

Bloom’s Category	SEE (Theory)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	

Professional Electives-Group 2
HYDRAULICS AND PNEUMATICS

Course Code : AUT651
L:P:T:S :3:0:0:1
Exam Hours :03

Credits :04
CIE Marks :50
SEE Marks :50

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

CO1	Identify hydraulic components such as DCV, PRV, single and double actuating cylinder.
CO2	Understand control components in hydraulics systems
CO3	Design and analyze the hydraulic circuit based on the application.
CO4	Understand concept of pneumatic actuators and control system.
CO5	Gain knowledge on electro- pneumatics in multi cylinder applications and also the concept of pneumatic control.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	2	2	2	1	1	1	1	1
CO2	1	2	1	1	2	2	2	1	1	1	1	1
CO3	1	2	1	1	2	2	2	1	1	1	1	1
CO4	1	2	1	1	2	2	2	1	1	1	1	1
CO5	1	2	1	1	2	2	2	1	1	1	1	1

Module	Contents	Hrs	COs
01	Introduction to Hydraulic Power: Structure of Hydraulic Control System. The Source of Hydraulic Power: Pumps, Pumping theory, pump classification, gear pumps, vane pumps, piston pumps, pump performance, pump selection. Variable displacement pumps. Hydraulic Pumps, Motors and Actuators: Construction, working principle and operation of rotary & reciprocating pumps like Gear, Vane, Generated-Rotor, Screw, Axial Piston, Radial Piston, Pump characteristics, Linear and Rotary Actuators, Hydrostatic Transmission Systems. Selection of components for applications.	09	CO1
02	Hydraulic Circuit Design and Analysis: Control of single and Double – acting Hydraulic cylinder, regenerative circuit, pump unloading circuit, Double pump Hydraulic system, Counter Balance Valve application, Hydraulic cylinder sequencing circuit. Control Components in Hydraulic Systems Directional Control Valves – Symbolic representation, Constructional features, pressure control valves – direct and pilot operated types, flow control valves.	09	CO2, CO3
03	Introduction to Pneumatic control: Choice of working medium, characteristics of compressed air. Structure of Pneumatic control system. Pneumatic Actuators: Linear cylinders – Types, conventional type of cylinder working, end position cushioning, seals, mounting arrangements applications. Rod less cylinders – types, working advantages. Rotary cylinder types construction and application. Design parameters – selection.	09	CO4
04	Directional Control valves: Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, use of memory valve. Flow control valves and	09	CO1, CO4

	<p>speed control of cylinders supply air throttling and exhaust air throttling use of quick exhaust valve.</p> <p>Signal processing elements: Use of Logic gates – OR and AND gates pneumatic applications. Practical examples involving the use of logic gates. Pressure dependent controls types construction –practical applications. Time dependent controls – Principle, construction, practical applications.</p>		
05	<p>Electro-Pneumatic control: Principles-signal input and output pilotassisted solenoid control of directional control valves, use of relay and contactors. Control circuitry for simple single cylinder applications.</p> <p>Compressed air: Production of compressed air – compressors, preparation of compressed air- Driers, Filters, Regulators, Lubricators, Distribution of compressed air- Piping layout.</p>	09	COS

SELF STUDY:

Visit a nearby earth moving equipment's service centre and prepare a summary of hydropneumatic devices used along with specifications.

Text Books:

1. Anthony Esposito "*Fluid Power with applications*", pearson education, 5th edition.
2. Andrew Parr "*Pneumatics and Hydraulics*". Jaico Publishing Co. 2000.

Reference Books:

1. Majumdar," *Oil Hydraulic Systems – Principles and Maintenance*". 2002, Tata McGraw Hill publishing company Ltd. 2001.
2. S.R.Majumdar "*Pneumatic systems* ", Tata McGraw Hill publishing Co., 1995.
3. Pippenger, Hicks," *Industrial Hydraulics*", McGraw Hill, New York

Assessment Pattern:

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self-Study
Marks (out of 50)	25	10	05	10
Remember	05	05		
Understand	05	05		
Apply	05		05	
Analyze	05			05
Evaluate	05			05
Create				

SEE – Semester End Examination (50 Marks – Theory)

Bloom's Category	SEE (Theory)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	

ALTERNATIVE FUELS AND ENERGY SYSTEMS

Course Code : AUT652	Credits :04
L:P:T:S :3:0:0:1	CIE Marks :50
Exam Hours :03	SEE Marks :50

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

CO1	Explain properties of alcohol, and understand the performance, combustion and emission characteristics.
CO2	Explain properties of hydrogen, and understand the performance, combustion and emission characteristics.
CO3	Understand properties of vegetable oil, and its performance, combustion and emission characteristics.
CO4	Understand properties of gaseous fuels, and its performance, combustion and emission characteristics.
CO5	Understand properties of fuel cells, and its performance, combustion and emission characteristics.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	1	1	1	3	1	1	1	1	1
CO2	2	1	2	1	1	1	3	1	1	1	1	1
CO3	2	1	2	1	1	1	3	1	1	1	1	1
CO4	2	1	2	1	1	1	3	1	1	1	1	1
CO5	2	1	2	1	1	1	3	1	1	1	1	1

Module	Contents	Hrs	COs
01	Alcohols as Fuels: Introduction to alternative fuels. - Need for alternative fuels - Availability of different alternative fuels for SI and CI engines. Alcohols as fuels. Production methods of alcohols. Properties of alcohols as fuels. Methods of using alcohols in CI and SI engines. Blending, dual fuel operation, surface ignition and oxygenated additives. Performance emission and combustion characteristics in CI and SI engines.	09	CO1
02	Hydrogen as an Alternate Fuel: Hydrogen, properties and production of hydrogen. Storage, Advantages and disadvantages of hydrogen. Hydrogen used in SI and CI engines. Hazards and safety systems for hydrogen, hydrogen combustion. Emission from hydrogen.	09	CO2
03	Vegetable Oils as Fuels: Various vegetable oils and their important properties. Different methods of using vegetable oils engines – Blending, preheating Transesterification and emulsification of Vegetable oils - Performance in engines – Performance, Emission and Combustion Characteristics in diesel engines.	09	CO3
04	Biogas, Natural Gas and LPG As Fuels: Production methods of Biogas, Natural gas and LPG. Properties studies. CO2 and H2S scrubbing in Biogas., Modification required to use in SI and CI Engines- Performance and emission	09	CO4

	characteristics of Biogas, NG and LPG in SI and CI engines.		
05	Electric, Hybrid and Fuel Cell Vehicles: Layout of Electric vehicle and Hybrid vehicles – Advantages and drawbacks of electric and hybrid vehicles. System components, Electronic control system – Different configurations of Hybrid vehicles. Power split device. High energy and power density batteries – Basics of Fuel cell vehicles.	09	CO5

SELF STUDY:

Comparison on the use of alternative fuels with conventional fuels

Text Books:

1. AyhanDemirbas, "*Biodiesel A Realistic Fuel Alternative for Diesel Engines*", Springer- Verlag London Limited 2008, ISBN-13: 9781846289941

Reference Books:

1. Gerhard Knothe, Jon Van Gerpen, Jargon Krahl, "*The Biodiesel Handbook*", AOCs Press Champaign, Illinois 2005.
2. Richard L Bechtold P.E., "*Alternative Fuels Guide book*", Society of Automotive Engineers, 1997, ISBN 0-76-80-0052-1.
3. Transactions of SAE on Biofuels (Alcohols, vegetable oils, CNG, LPG, Hydrogen, Biogas etc.).
4. Nagpal, "*Power Plant Engineering*", Khanna Publishers
5. Devaradjane. Dr. G., Kumaresan. Dr. M., "*Automobile Engineering*", AMK Publishers, 2013.

Assessment Pattern:

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self-Study
Marks (out of 50)	25	10	05	10
Remember	05	05		
Understand	05	05		
Apply	05		05	05
Analyze	05			
Evaluate	05			05
Create				

SEE – Semester End Examination(50 Marks – Theory)

Bloom's Category	SEE (Theory)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	

VEHICLE AIR CONDITIONING

Course Code : AUT653
 L:P:T:S :3:0:0:1
 Exam Hours :03

Credits :04
 CIE Marks :50
 SEE Marks :50

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

CO1	Understand the fundamental principles and operation of the heating, cooling, ventilation and air-conditioning system.
CO2	Understand the operation of the individual components of the A/C System.
CO3	Understand the operation of the individual components of the A/C System.
CO4	Understand the operation of sensors, actuators and electronic control unit.
CO5	Acquire knowledge in safe working practice and correct procedures for A/C service and repair.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	3	1	2	2	2	2	2	2
CO2	2	2	1	1	3	1	2	2	2	2	2	2
CO3	2	2	1	1	3	1	2	2	2	2	2	2
CO4	2	2	1	1	3	1	2	2	2	2	2	2
CO5	2	2	1	1	3	1	2	2	2	2	2	2

Module	Contents	Hrs	COs
01	Automotive air conditioning fundamentals: Purposes of Heating, Ventilation and Air Conditioning, Environmental Concerns, Ozone layer depletion, Location of air conditioning components in a car, Schematic layout of a vehicle refrigeration system. Psychrometry –Basic terminology and Psychrometric mixtures, Psychrometric Chart, Related problems.	09	CO1
02	Automotive cooling and heating system: Vehicle Refrigeration System and related problems- Fixed thermostatic and Orifice tube system- Variable displacement thermostatic and Orifice tube system- Vehicle air conditioning operation, Types of compressor, Compressor Clutches, Compressor Clutch electrical circuit, Compressor lubrication, Condensers, Evaporators, Expansion devices, Evaporator temperature and pressure controls, receiver, drier, Accumulators, refrigerant hoses, Connections and other assemblies, Heating system.	09	CO2
03	Air-conditioning controls, delivery system and refrigerants: Types of Control devices- Preventing Compressor damage, Preventing damage to other systems, Maintaining drive ability, Preventing Overheating Ram air	09	CO3

	ventilation, Air delivery Components, Control devices, Vacuum Controls Containers, Handling refrigerants, Discharging, Charging & Leak detection, Refrigeration system diagnosis, Diagnostic procedure, Ambient conditions affecting system pressures.		
04	Automatic temperature control: Different types of sensors and actuators used in automatic temperature control, Fixed and variable displacement temperature control, Semi-Automatic, Controller design for Fixed and variable displacement type air conditioning system.	09	CO4
05	System servicing and testing: Special tools for servicing vehicle air conditioning, Diagnosing components and air conditioning systems, Diagnosing cooling system, Air delivery system, Automatic temperature Control system diagnosis and service.	09	CO5

SELF STUDY:

To study about various refrigerants

Text Books:

1. Warren Farnell and James D.Halderman, "*Automotive Heating, Ventilation, and Air Conditioning Systems*", Classroom Manual, Pearson Prentice Hall ,2004
2. William H Crouse and Donald L Anglin, "*Automotive Air conditioning*", McGraw Hill Inc., 1990.

Reference Books:

1. Mitchell "*Automatic Heating and Air Conditioning Systems*", Mitchell Information Services, Inc., Prentice Hall Inc., 1989.
2. Paul Weisler, "*Automotive Air Conditioning*", Reston Publishing Co. Inc., 1990.
3. McDonald,K.L., "*Automotive Air Conditioning*", Theodore Audel series, 1978.
4. Goings,L.F., "*Automotive Air Conditioning*", American Technical services, 1974.

Assessment Pattern:**CIE- Continuous Internal Evaluation for theory (50 Marks)**

Bloom's Category	Tests	Assignments	Quizzes	Self-Study
Marks (out of 50)	25	10	05	10
Remember	05	05		
Understand	05	05		
Apply	05		05	05
Analyze	05			
Evaluate	05			05
Create				

SEE – Semester End Examination (50 Marks- Theory)

Bloom's Category	SEE (Theory)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	

ADVANCED IC ENGINES

Course Code : AUT654

Credits :04

L:P:T:S :3:0:0:1

CIE Marks :50

Exam Hours :03

SEE Marks :50

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

CO1	Understand combustion on spark ignition engines.
CO2	Acquire Knowledge on combustion of compression ignition engines.
CO3	Understand the engine emissions formation, effects and various methods to reduce emissions and their measuring equipments.
CO4	Understand the combustion and emission characteristics of an alternative energy sources such as bio diesels, natural gas, LPG, hydrogen and their Engine modifications for using these fuels.
CO5	Acquire Knowledge on the recent IC engine techniques such as HCCL, CRDI, GDI, etc.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	2	2	1	1	1	1	1
CO2	1	1	3	1	1	2	2	1	1	1	1	1
CO3	1	1	3	1	1	2	2	1	1	1	1	1
CO4	1	1	3	1	1	2	2	1	1	1	1	1
CO5	1	1	3	1	1	2	2	1	1	1	1	1

Module	Contents	Hrs	COs
01	SI Engines: Air-fuel ratio requirements, Monopoint, Multipoint & Direct injection Design of carburettor –fuel jet size and venture size, Stages of combustion -normal and abnormal combustion, Factors affecting knock, Combustion Chambers.	09	CO1
02	CI Engines: Diesel Fuel Injection Systems, Stages of combustion Knocking, Factors affecting knock, Direct and Indirect injection systems, Combustion chambers, Fuel Spray behaviour, Spray structure and spray penetration, Air motion, Introduction to Turbo charging.	09	CO2
03	Engine Exhaust Emission Control: Formation of NO _x , HC/CO mechanism, Smoke and Particulate emissions, Greenhouse Effect, Methods of controlling emissions, Three way catalytic converter and Particulate Trap, Emission (HC, CO, NO and NO _x) measuring equipments, Smoke and Particulate measurement, Indian Driving Cycles and emission norms.	09	CO3
04	Alternate Fuels: Alcohols, Vegetable oils and bio-diesel, Bio-gas, Natural Gas, Liquefied Petroleum Gas, Hydrogen, Properties, Suitability, Merits and Demerits, Engine Modifications, Performance, Combustion and Emission Characteristics of SI and CI Engines using these alternate Fuels.	09	CO4
05	Recent Trends: Homogeneous Charge Compression Ignition Engine, Lean	09	CO5

	Burn Engine, Stratified Charge Engine, Surface Ignition Engine, Common Rail Direct Injection Diesel Engine, Gasoline Direct Injection Engine, Hybrid electrical vehicles.		
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SELF STUDY:

A case study on the performance of different engines using different alternate fuels.

Text Books:

1. John B Heywood," *Internal Combustion Engine Fundamentals*", Tata McGraw-Hill, 1st edition, ISBN:978-1259002076
2. Ganesan V." *Internal Combustion Engines*", Tata McGraw-Hill, 4th edition,2012, ISBN:978-1-25-900619-7
3. Mathur. R.B. and R.P. Sharma, "*Internal Combustion Engines*".,DhanpatRai& Sons. 8th edition,2014.ISBN:978-8189928-46-9

References Books:

1. S.S.Thipse "*Alternate Fuels* ", 2010 ISBN-13: 978-8184950786
2. Heinz Heisler, "*Advanced Engine Technology*," SAE International Publications, USA
3. Samir Sarkar, "*Fuels and Combustion*", Third Edition,2012 ISBN-13: 978-8173716690
4. Patterson D.J. and Henein N.A, "*Emissions from combustion engines and their Control*," Ann Arbor Science publishers Inc, USA

Assessment Pattern:

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self-Study
Marks (out of 50)	25	10	05	10
Remember	05	05		
Understand	05	05		
Apply	05		05	
Analyze	05			05
Evaluate	05			05
Create				

SEE – Semester End Examination (50 Marks – Theory)

Bloom's Category	SEE (Theory)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	

AUTOMOTIVE AIR POLLUTION AND CONTROL

Course Code : AUT655 **Credits** :04
L:P:T:S :3:0:0:1 **CIE Marks** :50
Exam Hours :03 **SEE Marks** :50

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

CO1	Acquire knowledge of emission norms, standards
CO2	Understand the formation of various pollutants like HC, CO, CO ₂ , NO _x .
CO3	Gain knowledge of control techniques, design changes for minimizing pollution.
CO4	Understand the influence of fuel properties on emissions and various post combustion treatments in automobile.
CO5	Understand the sampling methods and test procedures.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3	1	2	3	3	1	1	2	1	1
CO2	1	2	3	1	2	3	3	1	1	2	1	1
CO3	1	2	3	1	2	3	3	1	1	2	1	1
CO4	1	2	3	1	2	3	3	1	1	2	1	1
CO5	1	2	3	1	2	3	3	1	1	2	1	1

Module	Contents	Hrs	COs
01	Introduction: Historical background, regulatory test procedure (European cycles), Exhaust gas pollutants (European rail road limits), particulate pollutants, European statutory values, inspection of vehicle in circulation-influence of actual traffic conditions and influence of vehicle maintenance.	09	CO1
02	Pollutant formation in Engines: Nitrogen Oxides: Formation of nitrogen oxides, kinetics of NO formation, formation of NO ₂ , NO formation in spark ignition engines, NO _x formation, in compression ignition engines. Carbonmonoxide: Formation, CO emissions in SI engine, CI engine. Unburned Hydrocarbon Emissions: Factors affecting HC emission, HC emissions from spark ignition engines, HC emission mechanisms in diesel engines Particulate Emissions: Spark ignition engine particulates, characteristics of diesel particulates, soot formation fundamentals, soot oxidation. Crankcase emissions, piston ring blow by, evaporative emissions.	09	CO2
03	Pollution control techniques: Pollution control measures inside SIEngines &	09	CO3

	lean burn strategies, measures in engines to control Diesel Emissions. Pollution control in SI & CI Engines, Design changes, optimization of operating factors and Exhaust gas recirculation, fuel additives to reduce smoke & particulates. Road draught crankcase ventilation system, positive crankcase ventilation system, fuel evaporation control.		
04	Influence of Fuel Properties: Effect of petrol, Diesel Fuel, Alternative Fuels and lubricants on emissions. Post combustion Treatments: Exhaust gas compositions before treatment, Catalytic mechanism, Thermal Reactions, Installation of catalyst in exhaust lines, catalyst poisoning, catalyst light-off, particulate traps, and Diesel Trap oxidizer.	09	CO4
05	Sampling and Testing: Sampling: Combustion gas sampling: continuous combustion, combustion in a cylinder Particulate sampling: soot particles in a cylinder, soot in exhaust tube, Sampling Methods sedimentations, and filtration, and impinge methods- electrostatic precipitation, thermal precipitation, centrifugal methods Determination of mass concentration, analytical methods- volumetric, gravimetric, calorimetric methods. Testing: NDIR analyzers, Gas chromatograph, Thermal conductivity and flame ionization detectors, Analyzers for NOx, Orsat apparatus, Smoke measurement, obscuration method, Continuous filter type smoke meter, Bosch smoke meter, Hart ridge smoke meter.	09	CO5

SELF STUDY:

1. **Testing and analysis of automotive emissions for two and four wheelers.**
2. **Study on the effect of automotive air pollution in Bengaluru on human health, plants and animals.**

Textbooks:

1. John B. Heywood ,*"Internal combustion engine fundamentals"*, McGraw Hill Education; 1 edition, 2011
2. Pundir B P ,*"Engine Emissions: Pollutant Formation and Advances in Control Technology"*, Narosa Publishing House Pvt. Ltd., Delhi, 2007.
3. Paul degobert ,*"Automobiles and pollution "* (SAE), 1995

References Books:

1. James D. Halderman, *"Automotive Fuel and Emissions Control Systems"*, Prentice Hall, Pearson Education, 2012
2. V. Ganesan, *"Internal combustion engines"* McGraw Hill Education , 4th Edition, 2012
3. Crouse William, *" Automotive Emission Control, McGraw-Hill"* 3rd revised edition, 1983
4. George, Springer and Donald J.Patterson, *"Engine emissions, Pollutant Formation and Measurement"*, Plenum press, 1972.
5. Springer and Patterson, *"Engine Emission"*, Plenum Press, 1990.

MOOCs:

1. <http://nptel.ac.in/courses/112104033/>
2. <http://www.princeton.edu/engineering/video/player/?id=8251>

Assessment Pattern:**CIE- Continuous Internal Evaluation for theory (50 Marks)**

Bloom's Category	Tests	Assignments	Quizzes	Self-Study
Marks (out of 50)	25	10	05	10
Remember	05	05		
Understand	05	05		
Apply	05		05	05
Analyze	05			
Evaluate	05			05
Create				

SEE – Semester End Examination (50 Marks – Theory)

Bloom's Category	SEE (Theory)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	

Syllabus for Open Electives

Big Data Analytics Using HP Vertica- 1

Code : NHOP01

L:P:T:S : 3:0:0:1

Exam Hours : 3

Credits: 04

CIE Marks: 50

SEE Marks: 50

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

CO1	Demonstrate SQL command in Oracle and Vertica Databases
CO2	Apply the features of Vertica in running database designer.
CO3	Creation of projection , partition of table manually in Vertica
CO4	Apply Copy, Delete, Merge, Purge concepts in Vertica database.
CO5	Apply the concepts of HDFS in designing multi node clustering in Hadoop
CO6	Demonstrate Hadoop ecosystem tools like Pig, HBase.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	1	-	-	2	-	2	2
CO2	3	3	3	2	3	1	-	-	2	-	2	2
CO3	3	3	3	2	3	1	-	-	2	-	2	2
CO4	3	3	3	2	3	1	-	-	2	-	2	2
CO5	3	3	3	2	3	1	-	-	2	-	2	2
CO6	3	3	3	2	3	1	-	-	2	-	2	2

Mapping of Course Outcomes to Program Specific Outcomes (PSOs):

	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	3	3
CO6	3	3

Module No.	Module Contents	Hours	COS
1	<p>Introduction to SQL and HP Vertica: Types of SQL, Data Types, Constrains, JOINS, Types of JOINS, Clause, Group by, Having, Order by, Where Clause with examples, SQL Alias, Views, Union, Union all, aggregate functions, Operators, SQL exists,</p> <p>Introduction to HP-Vertica Database, Vertica Analytics Platform, Columnar Orientation, Advanced Compression, High Availability, Automatic Database design, Massively Parallel Processing, Application Integration.</p> <p>Hands on sessions</p> <ol style="list-style-type: none"> Creation of tables with constrains and insertion of values into tables Hands-on DML commands to apply different aggregate function, Group by-Having-Order by clause, Operators. Creation of views and working with joins 	9	CO1, CO2
2	<p>HP Vertica- 1 Projections, Query Execution ,Vertica Transactions, Hybrid data store – WOS & ROS,</p> <p>Projection Design: Projection fundamentals, Projection types, Projection properties, Replication and Segmentation Database Designer, Comprehensive mode, Incremental mode, Sample data, Sample queries, DBD Advantages</p> <p>Hands on sessions</p> <ol style="list-style-type: none"> Creation of schema, tables and execution of SQL statements on Vertica Database, Running Database designer Hands-on projections 	9	CO2, CO3
3	<p>HP Vertica -2 Loading data via INSERT-COPY-MERGE, Deleting data in Vertica- delete vector, design for delete, process of deleting Truncate, Purge, Update, Partitioning, Tuple Mover- MoveOut Parameter, MergeOut Parameter, Working with Vertica Management Console.</p> <p>Hands on sessions</p> <ol style="list-style-type: none"> Loading data files from different sources to Vertica database. Verifying the log files after loading the data into Vertica database. 	9	CO3, CO4
4	<p>Big Data Analytics with Hadoop Big data overview, Introduction to Hadoop, Overview of Hadoop Distribution File Systems[HDFS] and Map reduce Operations Clustering types in Hadoop- Standalone mode, Pseudo distributed mode, Fully distributed mode.</p> <p>Hands on Sessions : Verifying Hadoop installation (Pseudo distributed mode) Java path, Hadoop location, Hadoop configuration files, Name Node</p>	9	CO5

	setup, Job Tracker, Metadata files, Accessing Hadoop on browser		
5	<p>Hadoop Ecosystem Introduction to SQOOP, Overview of PIG – modes of pig, when to use PIG latin, Introduction to HIVE- data types, architecture, Introduction to HBASE- comparison of Hadoophdfs and HBASE, how data stored in HBASE .</p> <p>Hands on Sessions :</p> <ol style="list-style-type: none"> Moving data from local file system to Hadoop file system Performing MAP Reduction operation in Hadoop Verification of operation results through terminal and browser 	9	CO6

REFERENCES

1. Boris lublinsky, Kevin t. Smith, AlexeyYakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2016.
2. Chris Eaton,Dirkderooset al. , “Understanding Big data ”, McGraw Hill, 2016.
3. Tom White, “HADOOP: The definitive Guide”, O Reilly 2015.
4. Efraim Turban , Jay E. Aronson , Ting-Peng Liang, “Decision Support Systems & Intelligent Systems”, 9th edition, Prentice Hall, 2014.

EVALUATION

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

VM ware Virtualization Essentials-1

Course Code: NHOP02

Credits: 04

L:P:T:S : 3:0:0:1

CIE Marks: 50

Exam Hours: 3

SEE Marks: 50

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

CO1	Understand the common terms and definitions of Operating System, Cloud Computing and Virtualization.
CO2	Learning the business benefits and considerations of VMware virtualization.
CO3	Knowing various approaches to server virtualization, its relevance to the modern data center, available platforms and important features.
CO4	Analyzing the implications of virtualization on Data Center Challenges.
CO5	Enable to configure the VMware vSphere storage and network virtualization.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	-	1	1	1	1	2	-	1
CO2	2	2	2	2	2	1	-	-	1	2	-	1
CO3	2	2	2	2	2	1	-	-	1	2	1	1
CO4	2	2	2	2	2	1	-	-	1	2	1	1
CO5	2	2	2	2	2	1	-	-	1	2	1	1

Mapping of Course Outcomes to Program Specific Outcomes(PSOs):

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	3	2	1
CO3	3	2	1
CO4	3	2	1
CO5	3	2	1

Module No	Module Contents	Hours	COs
1	Understanding Virtualization: Operating Systems Essentials: Process Management, Memory Management, Storage Management. Cloud Computing Essentials: Introduction to Cloud Computing, Cloud Deployment Models, Challenges. Virtualization Essentials: Importance of Virtualization, Examining today's trends, Virtualization Software Operations: Virtualizing	8	CO1

	Servers, Virtualizing Desktop, Virtualizing Applications.		
	List of programs: <ol style="list-style-type: none"> Using vSphere Web Client. Creating a Virtual Machine. 	4	
2	VMware vSphere Virtualization Overview: Introduction to Data Center Virtualization: Traditional Architecture, Virtual Architecture, Types of Virtualization. Understanding Hypervisors: Describing hypervisor, Type-1 Hypervisor, Type-2 Hypervisor. vSphere Products & Features: vSpherevMotion, vSphere HA, vSphere DRS, vSphere FT, vSphere replication, vSphere data protection.	9	CO2
	List of programs: <ol style="list-style-type: none"> Deploying Virtual Machines Using Cloning, Templates, and a Content Library Modifying Virtual Machine Settings 	4	
3	Creating & Managing Virtual Machines: Creating, Managing,Monitoring & Configuring VM: vSphere Client and vSphere Web Client, vSphere Web Client UI, Creating VM: VM Components, Installing Guest OS, ManagingVM: Startup and Shutdown of VM's, Creating and	9	CO3
	Managing Snapshots, RDM, Configuring VM: Memory/CPU Hot Plug, Swap Files. Creating Clones, Templates & Content Libraries Cloning VM, Creating Templates, OVF Templates, Types of Content Library.	4	
4	vSphere Solutions to Data Center Challenges: Data Center Challenges: Availability, Scalability, Optimization, Management, Application Upgrade & Cloud Challenges. vSphere for Scalability and Business Continuity: vSpherevMotion, vSphere HA, vSphere DRS, vSphere FT, vSphere replication, vSphere data protection.	9	CO4
	List of programs: <ol style="list-style-type: none"> Managing Tasks, Events, and Alarms Using vSpherevApps, Managing Multitiered Applications 	4	
5	Understanding VMware vSphere Storage & Network Virtualization Storage Virtualization: Storage Concepts, iSCSI Concepts, NFS Data stores, VMFS Data stores, Virtual SAN Data stores, Virtual Volume Network Virtualization: Introduction to vSphere Standard Switch,Configuring Standard Switch Policies, Introduction to vSphere Distributed Switch	9	CO5
	List of programs: <ol style="list-style-type: none"> Using vSpherevMotion and Storage vMotion to Migrate VirtualMachines Implementing a vSphere DRS Cluster 	4	

TEXT BOOKS:

1. Nick Marshall, Scott Lowe (Foreword by) with Grant Orchard, Josh Atwell, **Mastering VMwarevSphere 6** ,Publisher:Sybex; 1 edition (24 March 2015).
2. Matthew Portnoy, **Virtualization Essentials** , 2nd Edition, Wiley India Pvt. Ltd.

REFERENCES:

1. Thomas Kraus, KamauWanguhu, Jason Karnes , VMware Network Virtualization: Connectivity for the Software-Designed Data Center , VMwarePressTechnology 1st Edition.
2. Bill Ferguson ,vSphere 6 Foundations Exam Official Cert Guide (Exam #2V0-620): VMware Certified Professional 6 VMware Press , 1st Edition.

EVALUATION

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

Adobe Experience Manager - 1

Course Code: NHOP03

L:P:T:S : 3:0:0:1

Exam Hours: 3

Credits: 04

CIE Marks: 50

SEE Marks: 50

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

CO1	Gain a fresh perspective on online marketing in a global scenario. Understand the concepts of object oriented programming in JAVA.
CO2	Understand the programming concepts in Web scripting languages and will be able develop web pages using scripting languages.
CO3	Understand the architecture, technologies and frameworks in Adobe Experience Manager.
CO4	Create online webpages, Digital asset management and campaigning using AEM Integrate new digital marketing techniques into the strategic marketing plan using AEM.
CO5	Drive change and foster innovation in Digital Marketing with AEM

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	3	1	2	-	-	-	2	2	1
CO2	2	3	2	3	1	2	-	-	-	2	2	1
CO3	2	3	2	3	1	2	-	-	-	2	2	1
CO4	2	3	2	3	1	2	-	-	-	2	2	1
CO5	2	3	2	3	1	2	-	-	-	2	2	1

Mapping of Course Outcomes to Program Specific Outcomes(PSOs):

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2
CO5	3	2

Module No	Module Contents	Hours	COs
	Introduction to DM & AEM Getting started with DM: What is online marketing? Characteristics of good domain name? What is digital marketing? Different methods of	8	CO1

	<p>digital Marketing, Main methods of DM, Search engine optimization, pay per click & display advertising, email marketing, content marketing, social media marketing.</p> <p>Introduction Object Oriented Programming with JAVA</p> <p>Fundamentals: Class Objects, Methods, Constructor, this reference, inheritance, and polymorphism, Introduction to JSP</p>		
	<p>Hands on :</p> <p>1. Write a program to calculate and area of four different geometric shapes: triangles, squares, rectangles, and circles. Use Method overriding.</p> <p>2. Employee program to create n object to find gross salary. Data: empid, empname, gender, basic, hra = 25% of basic, DA = 125% of basic, CCA = Rs 300, IT = 10% if gross > 1L.</p> <ul style="list-style-type: none"> • Display all information. • Use constructors • Implement required methods. <p>3. Student program to create n objects to find Grade.</p> <p>Data: usn, studname, sem, sub name [], sub marks [], percentage, Grade. 90 - 100 = S 80 - 89 = A 70 - 79 = B 60 - 69 = C 50 - 59 = D 40 - 49 = E < 40 = F</p>	4	
2	<p>Introduction to Scripting Languages:</p> <p>Web and XHTML: Internet, WWW, Web Browsers and Web Servers, URLs, HTTP, XHTML: Basic syntax, Standard structure, Basic text markup, Images, Hypertext Links, Lists, Tables, Forms, Frames</p> <p>CSS: Introduction, Levels of style sheets, formats, selector forms, The box model, conflict resolution</p> <p>Javascript: Overview, Object orientation and Javascript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Arrays, Functions, Pattern matching using regular expressions, Errors in scripts. Introduction to Slightly</p>	9	CO2
	<p>Hands on:</p> <ol style="list-style-type: none"> 1. Create a web page using HTML forms for email registration. 2. Create a web page using HTML frames. 3. Develop a XHTML file that includes Javascript script for that accepts a number n using prompt and outputs the first n Fibonacci numbers 4. Develop a XHTML file that includes Javascript script for that accepts a number n using prompt and outputs a table of numbers from 1 to n and their squares using alert 5. Develop a web page using HTML and apply the various CSS styles. 	4	

	6. Develop a web page usingHTML and apply selector forms.		
3	<p>Getting started with AEM: Introduction to Web content management, History of AEM ,The adobe marketing cloud, Install & deploy AEM, Author Instance, Publish Instance,AEM Consoles: Authoring in AEM, work with user interfaces: Classic UI, Touch optimized UI, AEM web console: OSGi management console, CRX Explorer, CRXDE Lite</p> <p>AEM Architecture</p> <p>OSGi framework: Introduction ,AEM functional building blocks, Architecture stack, OSGi framework.</p> <p>Content Repository: JCR, Jackrabbit Oak, Adobe CRXWeb Framework: REST, Apache Sling.</p>	9	CO3
	<p>Hands on:</p> <ol style="list-style-type: none"> 1. AEM installation & deployment. 2. Working in AEM Environment 3. Familiarize yourself with a Repository structure. 4. Create a Node and add properties. 	4	
4	<p>Managing Content</p> <p>AEM Authoring Framework —Templates, Create Templates, Components and Design ,components ,Create a Page-Rendering Component ,Modularize the Page Component ,Inheriting Foundation Components , Design , Adding a design to a page ,Creating Components and Include them in Scripts, Create a Top Navigation Component, Dialog Boxes ,Create Dialog Boxes for Components, Dialog Box -Classic-UI, touch-optimized UI ,Use Design Dialog Boxes for Global Content , Create a logo component.</p>	9	CO4
	<p>Hands On</p> <ol style="list-style-type: none"> 1. Create the Structure of Your Website 2. 2. Create a Template for Your Website 3. Create a Page-Rendering Component 4. Create a Website Structure 5. Modularize the Page Component 6. Inherit the Sightly Foundation Component Page 7. Add a Design to the Page 8. Create a Top Navigation Component and Include it in a Script 9. Create a Training Title Component 10. Create a Logo Component 	4	
5	<p>Digital Asset Management, Mobile pages, Managing Campaign :</p> <p>Introduction to DAM, Basic DAM functions, DAM Metadata, DAM Components, Finding Assets, Asset Management, Adding New content, Authoring Responsive& Mobile Pages,Managing Campaigns& Content Targeting.</p>	9	CO5
	<p>Hands on:</p> <ol style="list-style-type: none"> 1. Create and customize asset share page 2. Add a predicate to the asset share page 	4	

	<ol style="list-style-type: none"> 3. Add an asset editor page 4. Versioning for assets 5. Create folders 6. Add CUG properties to folders 7. Use tags to organize assets 8. Edit images 9. Upload thumbnail 10. View references to assets 11. Edit metadata of an asset 12. Create a Page 13. Insert a New Paragraph 14. Edit the next Paragraph 15. Add an image from the content finder 16. Insert an image from your file system 17. Add more Components 18. Annotate a component 19. Move or delete a component 20. Working with responsive page Layout 21. Create a Mobile page 22. Add content to Mobile Page 23. Creating brand 24. Creating campaign 25. Defining a new segment 26. Create experiences 27. Turn a component into targeted component 28. Test the campaign 		
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Text Books:

1. Ryan D Lunka,—**Adobe Experience Manager: Classroom in a Book**—, 2014, Adobe Press .
2. Shane closser ,**Adobe Experience Manager: Quick Reference Guide** , 2014, Adobe Press .
3. Shivanikarwal , **Digital Marketing Handbook** , 2015 , CreateSpace Independent PublishingPlatform.
4. RobertW.Sebesta , **Programming the World Wide Web** ,4th Edition, PearsonEductaion2008
5. M.Deitel,P.JDeitel,A.B.Goldberg, **Internet and World Wide Web How to Program**,4thEdition,PearsonEductaion , 2004
6. Shivanikarwal , **Digital Marketing Handbook:A Guide to Search Engine Optimization,Pay Per Click Marketing, Email Marketing, Social Media Marketing and ContentMarketing** , 2015 , CreateSpace Independent Publishing Platform
7. HerbertSchild ,—**Java:The Complete Reference** , 9th Edition,OraclePress,Tata McGraw Hill.

EVALUATION

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

Big Data Analytics Using HP Vertica- 2

Code : NHOP04

Credits: 04

L:P:T:S : 3:0:0:1

CIE Marks: 50

Exam Hours : 3

SEE Marks: 50

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

CO1	Demonstrate Hadoopfilesystem and mapreduce programs
CO2	Demonstrate the working of SQOOP tool
CO3	Apply Pig shell commands and operators
CO4	Creating and running Pig Latin scripts
CO5	Demonstrate HIVE commands and creating tables in HIVE
CO6	Perform handson practice on HBase commands

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	2	-	-	1	-	3	2
CO2	3	3	3	2	3	2	-	-	1	-	3	2
CO3	3	3	3	2	3	2	-	-	1	-	3	2
CO4	3	3	3	2	3	2	-	-	1	-	3	2
CO5	3	3	3	2	3	2	--	-	1	-	3	2
CO6	3	3	3	2	3	2	-	-	1	-	3	2

Mapping of Course Outcomes to Program Specific Outcomes(PSOs):

	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	3	3
CO6	3	3

Module No.	Module Contents	Hours	COS
01	<p>VERTICA &Hadoop Review</p> <p>Vertica Cluster Management: Adding nodes to an existing cluster, Removing nodes from a cluster, Replacing nodes, Node recovery in vertica, Rebalancing data across nodes</p> <p>Hands on sessions</p> <p>Check hadoop configuration file</p> <p>Load a .csv file from local file system to hadoopfile system</p> <p>Perform analysis on loaded files using hadoopmapreduce programs and verify the output using hadoop commands as well as browser</p> <ul style="list-style-type: none"> • Count • Grep <p>SQOOP</p> <p>Verifying Sqoop status through clouderamanager</p> <p>Hand-on Practice on various Sqoop basic commands</p> <ul style="list-style-type: none"> • List-database • List-table • Eval <p>Import of tables from Mysql database to hdfs</p> <ul style="list-style-type: none"> • Import of all tables • Import of specific tables to default directory /target directory • Import of subset of tables using “where” clause • Import table as sequence file • Incremental import <p>Export files from hdfs to mysql database</p>	09	CO1, CO2
02	<p>Apache Pig Architecture: -Apache Pig components, PigLatin Data Model: atom, tuple, bag, relation, map.</p> <p>Basic grunt shell commands, Running local mode - mapreduce mode,</p> <p>Pig Latin 1: Pig Latin Statements: Data types- simple &Complex Data Types</p> <p>Hands on sessions:</p> <p>Operators (Part 1) :</p> <p>Loading and storing - from/to local file system, from/to hdfs</p> <p>Diagnostic operator – Dump, Describe, Explain, illustrate</p> <ul style="list-style-type: none"> • Filtering – filter operator; For Each Generate <p>operator: projection, nested projection, schema; Distinct Operator</p> <p>Arthematic operators</p> <p>Comparison operator</p> <p>Boolean Operators</p>	09	CO3
03	<p>Hands on Sessions:</p> <p>Operators (Part 2) :</p>	09	CO4

	<p>Grouping & Joining Operator – GROUP, COGROUP, JOIN(INNER, SELF JOIN) Combining & splitting – UNION, SPLIT Sorting – ORDER BY, LIMIT Pig Latin Built-in functions: Eval functions: AVG, SUM, MIN, MAX, COUNT, SIZE, CONCAT, DIFF, SUBTRACT, ISEMPTY, TOKENIZE Bag&Tuple Functions: TOTUPLE, TOBAG, TOMAP String Functions: ENDSWITH, STARTSWITH, SUBSTRING, EQUALSIGNORECASE, INDEXOF, LCFIRST(), UCFIRST(), UPPER(), LOWER(), REPLACE() Math Functions: ABS, CBRT, SQRT, COS, SIN, TAN, CEIL, FLOOR, EXP, LOG, LOG10, ROUND Apache Pig - Running Scripts: Creating pig script Commenting pig script Executing –running pig script – with/without parameters Sample examples: word count program using pig script, count of similar events from a log file, simple twitter case study example.</p>		
04	<p>HIVE Hive: Why hive? , components of hive, simple architecture of hive, data-model of hive(database, table, partition, bucket) Hands on Session: Hive Commands : Data Definition Language (DDL) CREATE database/ table/ external table , DROP, TRUNCATE, ALTER, SHOW, DESCRIBE Statements. Create table with partition by, clustering by commands Data Manipulation Language (DML) LOAD, INSERT Statements- INSERT INTO, INSERT OVERWRITE Built-in Operators- Relational Operators- Arithmetic Operators- Logical Operators - Complex Operatorsexample: simple queries on these operators Order by clause- Group by clause- aggregate functions(sum, avg, count, min, max) Joins, Create and drop of views , index</p>	09	CO5
05	<p>HBASE : Various types of No SqlDatabases – when HBASEis used? - HBase Data Model(Table, Rowkey, Columnfamilies, Column qualifiers, Cell, Timestamp) Hands on Sessions: HBase shell Command: Create table with /without version – put command get command with / without version Scan command</p>	09	CO6

	delete column – column family disable – enable drop table		
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EVALUATION

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

VMware Virtualization Essentials -2

Course Code : NHOP05

Credits: 04

L:P:T:S: 3:0:0:1

CIE Marks: 50

Exam Hours : 3

SEE Marks: 50

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

CO1	Learn the common terms and definitions of data center, vSphere Virtual infrastructure
CO2	Learning the vCenter Server architecture, virtual machine and importance of VMware tools
CO3	Analyze virtual machine management, resource management and monitoring.
CO4	Learning vSphere products and solutions for protecting data
CO5	Enable to configure the VMware vSphere products and solutions

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	-	-	-	2	1	-	2
CO2	3	3	2	2	2	-	-	-	2	1	-	2
CO3	3	3	2	2	2	-	-	-	2	1	-	2
CO4	3	3	2	2	2	-	-	-	2	1	-	2
CO5	3	3	2	2	2	-	-	-	2	1	-	2

Module No	Module Contents	Hours	COs
1	<p>Introduction to vSphere and the Software-Defined Data Center: Describe the topology of a physical data center, Explain the vSphere virtual infrastructure, Define the files and components of virtual Machines, Describe the benefits of using virtual machines, Explain the similarities and differences between physical architectures and virtual architectures, Define the purpose of ESXi, Define the purpose of vCenter Server, Explain the software-defined data center, Describe private, public, and hybrid clouds.</p> <p>List of programs: 1. Using vSphere Web Client.</p>	8	CO1
2	<p>vCenter Server: Introduce the vCenter Server architecture, Deploy and configure vCenter Server Appliance, Use vSphere Web Client Backup and restore vCenter Server, Examine vCenter Server permissions and roles Explain the vSphere HA architectures and features, Examine the new vSphere authentication proxy, Manage vCenter Server inventory objects and licenses, Access and navigate the new vSphere clients.</p> <p>Creating Virtual Machines: Introduce virtual machines, virtual machine hardware, and virtual machine files Identify the files that make up a virtual</p>	9	CO2

	<p>machine, Discuss the latest virtual machine hardware and its features, Describe virtual machine CPU, memory, disk, and network resource usage, Explain the importance of VMware Tools™, Discuss PCI pass-through, Direct I/O, remote direct memory access, and NVMe, Deploy and configure virtual machines and templates, Identify the virtual machine disk format.</p>		
	<p>List of programs:</p> <ol style="list-style-type: none"> 1. Creating a Virtual Machine. 2. Manage vCenter Server inventory objects 		
3	<p>Virtual Machine Management: Use templates and cloning to deploy new virtual machines, Modify and manage virtual machines, Clone a virtual machine, Upgrade virtual machine hardware to version 12, Remove virtual machines from the vCenter Server inventory and datastore, Customize a new virtual machine using customization specification files, Perform vSphere vMotion and vSphere Storage vMotion migrations, Create and manage virtual machine snapshots, Create, clone, and export vApps, Introduce the types of content libraries and how to deploy and use them.</p> <p>List of programs:</p> <ol style="list-style-type: none"> 1. Create clone, templates and manage virtual machines 2. Perform vSphere vMotion migrations. 		
4	<p>Resource Management and Monitoring: Introduce virtual CPU and memory concepts, Explain virtual memory reclamation techniques, Describe virtual machine over-commitment and resource competition, Configure and manage resource pools, Describe methods for optimizing, CPU and memory usage, Use various tools to monitor resource usage, Create and use alarms to report certain conditions or events, Describe and deploy resource pools, Set reservations, limits, and shares, Describe expandable reservations, Schedule changes to resource settings, Create, clone, and export vApps, Use vCenter Server performance charts and esxtop to analyze vSphere performance.</p>	9	CO3
	<p>List of programs:</p> <ol style="list-style-type: none"> 1. Create virtual machine snapshots 2. Manage resource and monitoring of virtual CPU and memory concepts 		
5	<p>vSphere HA, vSphere Fault Tolerance, and Protecting Data: Explain the vSphere HA architecture, Configure and manage a vSphere HA cluster, Use vSphere HA advanced parameters, Define clusterwide restart ordering capabilities, Enforce infrastructural or intra-app dependencies during failover, Describe vSphere HA heartbeat networks and datastore heartbeats, Introduce vSphere Fault Tolerance, Enable vSphere Fault</p>	9	CO4 CO5

	Tolerance on virtual machines, Support vSphere Fault Tolerance interoperability with vSAN, Examine enhanced consolidation of vSphere Fault Tolerance virtual machines, Introduce vSphere Replication, Use vSphere Data Protection to back up and restore data.		
	List of programs: <ol style="list-style-type: none"> 1. Perform vSphere HA 2. Perform vSphere Fault Tolerance 		

TEXT BOOKS:

1. Nick Marshall, Scott Lowe (Foreword by) with Grant Orchard, Josh Atwell, “**Mastering VMware vSphere 6**”, Publisher: Sybex; 1 edition (24 March 2015).
2. Matthew Portnoy, “**Virtualization Essentials**”, 2nd Edition, Wiley India Pvt. Ltd.

REFERENCES:

1. Thomas Kraus, Kamau Wanguhu, Jason Karnes, “**VMware Network Virtualization: Connectivity for the Software-Designed Data Center**”, VMware Press Technology 1st Edition.
2. Bill Ferguson, “**vSphere 6 Foundations Exam Official Cert Guide (Exam #2V0-620): VMware Certified Professional 6 VMware Press**”, 1st Edition.

EVALUATION

CIE - Continuous Internal Evaluation (50 Marks)

Bloom’s Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (50 Marks)

Bloom’s Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

Adobe Experience Manager – 2

Course Code : NHOP06

L:P:T:S: 3:0:0:1

Exam Hours : 3

Credits: 04

CIE Marks: 50

SEE Marks: 50

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

CO1	Learn to write a server side java application called JSP to catch form data sent from client and store it on database.
CO2	Learn to develop a dynamic webpage by the use of java script and HTML5.
CO3	Demonstrate a server side java application called Servlet to catch form data sent from client, process it and store it on database and write scripts using perl
CO4	Building Web applications with PHP
CO5	Gain an understanding of search engine algorithms and how they affect organic search results and websites.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	3	1	2	-	-	-	2	2	1
CO2	2	3	2	3	1	2	-	-	-	2	2	1
CO3	2	3	2	3	1	2	-	-	-	2	2	1
CO4	2	3	2	3	1	2	-	-	-	2	2	1
CO5	2	3	2	3	1	2	--	-	-	2	2	1
CO6	2	3	2	3	1	2	-	-	-	2	2	1

Mapping of Course Outcomes to Program Specific Outcomes(PSOs):

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2
CO5	3	2

Module No.	Module Contents	Hours	COS
1	Java Server Pages (JSP) Introduction, Advantages of JSP, Developing First JSP, JSP Scripting Elements- (Directives, Declaratives, Scriptlets, Expressions, Implicit Variables), Page Directives. <i>Java Server Pages Standard Tag Library: Why you should use the JSTL, JSTL Expression Language, Core tags, custom tag Libraries: why custom Tags, Tag Library basics, how are tags being used, new and old custom tags, Tag library Descriptors (TLDs), simple JSP 2.0 custom tags.</i>	9	CO1
2	Introduction to HTML5 Overview, Browser Support, New features, Backward compatibility, Syntax, The DOCTYPE, Character Encoding, The <script> tag, The <link> tag, HTML5 Elements, HTML5 Document, HTML5 Attributes: Standard Attributes, Custom Attributes, HTML5 EVENTS, Iframes, WEB FORMS 2.0, SVG, MathML, Web Storage, Server Sent Events, WebSockets.	9	CO2
3	Building Web applications with PHPOrigins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, operations and expressions, Output, Control statements, Arrays, Functions, Pattern matching, Form handling. <i>Building Web applications with PHP: File handling, Tracking users, cookies, sessions, Using Databases, Handling XML.</i>	9	CO4
4	Perl for web development: Origins and uses of Perl, Scalars and their operations, Assignment statements and simple input and output, Control statements, Fundamentals of arrays. <i>Advanced concepts of Perl: Hashes, References, Functions, Pattern matching, File input and output; Examples.</i>	9	CO3
5	Planning a powerful Search Engine Strategy-SEOInvestigating Search Engines and Directories, Where Do People Search?, Search Engine Magic, Gathering Your Tools. Understanding the Limitations, Eyeing the Competition, Going Beyond Getting to #1, Controlling Search Engine Variables, Determining Your Plan of Attack, Look Away a Few Minutes. <i>Making Your Site Useful and Visible: Learning from Amazon, Revealing the Secret But Essential Rule of Web Success, Making Your Site Work Well. Panda-Google Endorses Good Design.</i>	9	CO5

TEXT BOOKS:

1. The Art of SEO Mastering Search Engine Optimization by Eric Enge, Stephan Spencer, and Jessie C. Stricchiola, 3rd Edition, O'Really.
2. HTML5 for Masterminds, J.D. Gauchat, Revised 3rd Edition, MinkBooks, 2014, ISBN: 154292331X.

3. Core Servlets and Java Server Pages. Volume 1: Core Technologies, Marty Hall, Larry Brown, Prentice Hall, 2nd Edition, 2013.
4. Web Programming Building Internet Applications, Chris Bates, 3rd Edition, Wiley India, 2012.

EVALUATION

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SAP

Course Code : NHOP07

Credits : 04

L:P:T:S : 3:0:0:1

CIE Marks: 50

Exams Hours : 03

SEE Marks: 50

COURSE OUTCOMES: At the end of the course, the students will be able to:

CO1	Understand the concept of production system and facilities, automation, Computer Aided Process planning (CAPP), Material Requirement Planning (MRP), Master Production Schedule (MPS), capacity planning
CO2	Understand SAP system along with its navigation in the software
CO3	Create master data for new vendor and new trading goods in Materials Management
CO4	Evaluate and create production order for the product group
CO5	Create master data for new customer
CO6	Facilitate the flow of goods between producer and the purchaser for near fail proof logistic operations

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	3	3	1	1	2	2	3	2
CO2	3	2	2	2	3	3	1	1	2	2	3	2
CO3	3	2	2	2	3	3	1	1	2	2	3	2
CO4	3	2	2	2	3	3	1	1	2	2	3	2
CO5	3	2	2	2	3	3	1	1	2	2	3	2
CO6	3	2	2	2	3	3	1	1	2	2	3	2

Module No.	Contents of Module	Hrs	COs
1	<p>Computer Integrated Manufacturing Systems: Introduction, Production system facilities, Manufacturing support system, Automation definition, Types of Automation, Reasons for Automation, limitations of Automation, Automation principles & Strategies, CIM, Information Processing Cycle in Manufacturing, Production concepts</p> <p>Computerized Manufacturing Planning System: Introduction, Computer Aided Process Planning, Retrieval types of process planning, Generative type of process planning, Material requirement Planning, Fundamental Concepts of MRP, Inputs to MRP, Capacity planning.</p>	07	CO1
2	<p>Introduction to SAP: Case study of Global bike group (GBI),</p> <p>Materials Management (MM) Case study: Creation of new vendor, Creation of material master for trading goods, create purchase requisition, creating request for quotation, Create and display purchase order, create and verify goods receipt for purchase order, create invoice receipt from vendor, post payments to vendor, display and review goods ledger account balances</p>	07	CO2,CO3
3	<p>Production Planning and Execution (PP) Case study:</p> <p>Change material master record, change routing, display product group, Creating sales and operation plan, Transfer SOP to demand management, Review demand management, Run MPS with MRP, Review stock and requirement list, convert planned order into production order, receiving goods from inventory, issuing goods to production order, review production order status, confirm production completion, receive goods from production order, review costs assigned to production order, settle costs of production order.</p>	07	CO4
4	<p>Sales and Distribution (SD) Case study:</p> <p>Creation of new customer, create contact person for customer, changing the customer, create customer inquiry and quotation, create sales order referencing for quotation, check stock status, display sales order, start delivery process, pick materials on delivery note, post goods issue, create invoice for customer, display billing document and customer invoice, post receipt of customer payment, review the document flow</p>	06	CO5
5	<p>Warehouse Management (WM) Case study:</p> <p>Create purchase order, display material inventory, display material inventory value, receive the goods, display material inventory and value, run bin status report, create transfer order, confirm transfer order</p>	06	CO6

TEXT BOOKS:

1. **Automation, Production System & Computer Integrated Manufacturing**, M. P. Groover, Person India, 2015, 3rdEdition.
2. **Principles of Computer Integrated Manufacturing**, S. Kant Vajpayee, Prentice Hall India.
3. **A beginner's guide to SAP**, Martin Munzel, SydneyMcConnel
4. **Online course material for SAP**

EVALUATION

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

Schneider - Industrial Automation

Course Code :NHOP08

Credits : 04

L:P:T:S : 3:0:0:1

CIE Marks : 50

Exam Hours : 03

SEE Marks : 50

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

CO1	Understand the architecture of an industrial automation system
CO2	Design a PLC application using ladder diagram language according to a specification
CO3	Design a PLC application using SFC diagram language according to a specification
CO4	Use Unity Pro to program and test an application
CO5	Use Vijeo Designer to program and test an application

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	1	3	-	-	-	-	2	-	-
CO2	2	3	3	1	3	-	-	-	-	2	-	-
CO3	2	3	3	1	3	-	-	-	-	2	-	-
CO4	2	3	3	1	3	-	-	-	-	2	-	-
CO5	2	3	3	1	3	-	-	-	-	2	-	-

Module	Contents of the Module	Hours	COs
1	<p>Basics of Automation: Control Systems and Automation Strategy Evolution of instrumentation and control, role of automation in industries, benefits of automation.</p> <p>Structure of PLC: Introduction, architecture, definition of discrete state process control, PLC Vs PC, PLC Vs DCS.</p> <p>Practical activities: oApplication to Schneider M340 pedagogic bench and wiring of input and output.</p>	8	CO1 CO4

2	<p>Instrumentation Standard Protocols: Definition of protocol, Introduction to Open System Interconnection (OSI) model, Communication standard (RS232, RS485), Modbus (ASCII/RTU), Introduction to third party interface, concept of OPC (Object linking and embedding for Process Control).</p> <p>Practical activities: oAnalysis of a PLC configuration and communication devices</p> <p>Sensors in industrial automation: Types and characteristics of most used sensors in industry. Application to sensors in PLC environment. Practical activities: oAnalysis of several sensors (technologies, performances, ...) and connections to PLC</p>	9	CO1 CO4
3	<p>Ladder and FBD programming languages: Introduction to PLC programming ladder and FBD methods as per IEC 61131.</p> <p>Practical activities: oBasic logic operations under Unity ProEnvironment, oTimers/counters functional bloc, oApplications with M340 Bench, oApplication with surface treatment industrial device.</p>	9	CO1 CO2 CO4
4	<p>SFC programming language: Introduction to PLC programming SFC method as per IEC 61131.</p> <p>Practical activities: oBasics Applications under Unity Pro environment, oApplications with M340 Bench, oApplication with surface treatment industrial device.</p>	9	CO1 CO3 CO4
5	<p>HMI development: Introduction of HMI in Industrial Automation.</p> <p>Practical activities: oApplications with Vijeo Designer Environment, oApplications with M340 Bench, oApplication with surface treatment industrial device.</p>	9	CO1 CO5

Text books:

1. Programming Industrial Control Systems Using IEC 1131-3 (I E E CONTROL ENGINEERING SERIES) Revised Edition,1998 by Robert W. Lewis (Author)
2. Programmable Logic Controllers and Industrial Automation: An Introduction 2nd Edition, 2017 by MadhuchandaMitra and SamarjtSengupta.
3. Industrial Controls and Manufacturing (Engineering) 1st Edition,1999 by Edward W. Kamen

Reference books:

1. Industrial Instrumentation Paperback, 2nd Edition, 2018 by K Krishnaswamy, S. Vijyachitra.
2. Overview of Industrial Process Automation Paperback,2011 by K.L.S. Sharma
3. Industrial Process Automation Systems 1st Edition,2014 by B.R. Mehta Y. Jagannathan Reddy

EVALUATION**CIE - Continuous Internal Evaluation (50 Marks)**

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

Cisco- Routing and Switching - 1

Course Code :NHOP09

Credits : 04

L:P:T:S : 3:0:0:1

CIE Marks : 50

Exam Hours : 03

SEE Marks : 50

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

CO1	Describe the devices and services used to support communications in data networks, Internet and Role of Protocol Network.
CO2	Design, calculate, and apply subnet masks and addresses to fulfill given requirements in IPv4 and IPv6 network
CO3	Build a simple Ethernet network using routers and switches
CO4	Describe enhanced switching technologies such as VLANs, VLAN Trunking Protocol,
CO5	Describe and analyse the operations of Dynamic Host Configuration Protocol and Domain Name
CO6	Configure and troubleshoot basic operations of a small switched network

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	1	-	2	2	-	3
CO2	3	3	3	3	3	1	1	-	2	2	-	3
CO3	3	3	3	3	3	1	1	-	2	2	-	3
CO4	3	3	3	3	3	1	1	-	2	2	-	3
CO5	3	3	3	3	3	1	1	-	2	2	-	3
CO6	3	3	3	3	3	1	1	-	2	2	-	3

Module No	Module Contents	Hours	COs
1	<p>Introduction to Networks Introduction to Networks Networking Types, OSI Reference Model, TCP/IP Model Configuring a Network Operating System ,Physical Layer Protocols ,Data Link Layer Protocols ,Media Access Control, Ethernet Protocol ,Address Resolution Protocol</p> <p>Hands On : CCNA LAB 01 CCNA LAB 02 CCNA LAB 03</p>	9	CO1
2	<p>Connecting Devices and IP Addressing Introduction to Routers, Switches, IOS and Boot Process ,IPv4 Network Address and IPv6 Network Address ,Subnetting , Addressing Schemes ,Design Consideration for IPv6, Routing : Static, Default and Dynamic , Routing Metrics, Classes of Routing Protocol ,Connectivity Verification</p>	9	CO2

	<p>Hands On:</p> <p>Basic Configuration of Router and Switches Use of Command Line Interface Configuring Router Interfaces Gathering Information and Verifying Configuration Saving, Erasing, Restoring and Backing up Configuration & IOS File Troubleshooting IP Address Route Summarization CCNA LAB 04</p>		
3	<p>Introduction to IP Routing Understanding IP Routing, Classes of Routing Protocol, Routing Decision, Router Operation, Static Routing : Implement Static Routes, Dynamic Routing : Dynamic Routing Protocols, RIPv2, RIPv1, Routing table, EIGRP, OSPF</p> <p>Hands On:</p> <p>Routing Initial Configuration Route Redistribution Static and Default Route Lab Configure static and Default Routes Verifying and Troubleshooting RIP Configuring EIGRP Verifying and Troubleshooting EIGRP Open Shortest Path First (OSPF) Configuring OSPF Verifying and Troubleshooting OSPF CCNA LAB 05 :RIP CCNA LAB 06 :EIGRP CCNA LAB 07 :OSPF</p>	9	CO3
4	<p>Switching and Spanning Tree Protocol LAN Design, The Switched Environment Basic Switch Configuration, Switch Security, Understanding Switching and Switches, Types of Switch Ports, Virtual LANs (VLANs) , VLAN Trunking Protocol (VTP) , VLAN Segmentation, VLAN Implementation</p> <p>Hands On:</p> <p>Initial Configuration of a Catalyst Switch Port Security Spanning Tree Protocol VLAN Configuration , Inter-VLAN Routing Configuration VTP Troubleshooting Voice VLAN Configuration</p>	9	CO4
5	<p>Access Control Lists Introduction to Access Lists, Standard Access Lists, Extended Access Lists, ACL Operation, Standard IPv4 ACLs, DHCP : DHCPv4 and DHCPv6, NAT for Ipv4 : Introduction to NAT, , Device Management and Maintenance : Device Discovery, Device Management, Device Maintenance</p>	9	CO5

Hands On:

Initial Setup and Access List Lab
Static NAT Configuration and Verification and Dynamic NAT Configuration
NAT Configuration
NAT Troubleshooting
ACL Troubleshooting
Configuring DNS and DHCP

TEXT BOOKS:

1. CCNA Routing and Switching 200-125 Pearson u Certify Course, Wendell Odom, Sean Wilkins, Published Jan 19, 2017 by Cisco Press.

REFERENCE BOOKS:

1. CCNA v2.0 R&S Lab Workbook 200-120.
2. Computer Networks, Andrew S. Tanenbaum, Fourth Edition Pearson Education
3. Data Communications and Networking, BehrouzA.Forouzan, Tata McGraw Hill, 4th Edition

EVALUATION**CIE - Continuous Internal Evaluation (50 Marks)**

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

DATA ANALYTICS

Course Code : NHOP10
 L:P:T:S : 3:0:0:1
 Exam Hours : 03

Credits : 04
 CIE Marks : 50
 SEE Marks : 50

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

CO1	Learn various types of data warehousing and modeling techniques.
CO2	Understand the basics of various SQL commands and HP Vertica.
CO3	Demonstrate Copy, partitioning, DBD, Analytic functions in Vertica.
CO4	Understand various types of Web Analytics.
CO5	Understand various types of Marketing Analytics.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	1	-	-	2	2	3	2
CO2	3	2	2	2	2	1	-	-	2	2	3	2
CO3	3	2	2	2	2	1	-	-	2	2	3	2
CO4	3	2	2	2	2	1	-	-	2	2	3	2
CO5	3	2	2	2	2	1	-	-	2	2	3	2

Sl. NO	Contents of Module	Hrs	Co's
Module-1	<p>Data Modeling and Introduction to Data Analytics: Overview of the Data Warehouse and Data mart modeling process, Dimensional modeling, Snowflake and Star schema, Aggregate fact tables, Fact Constellation schema, The characteristics of dimension table and fact table. Fundamentals of Data analytics, Phases in Data Analytics, Types of Data Analytics, Challenges in Data Analytics</p>	9	CO1
Module-2	<p>Introduction to basic SQL and HP Vertica: Introduction to Structured Query Language, Types of SQL, Data types, Constraints, Select, Insert, Delete and Update statements in SQL , Aggregate functions. Introduction to HP-Vertica Database, Vertica Analytics Platform, Columnar Orientation, Advanced Compression, High Availability, Automatic Database design, Massively Parallel Processing, Application Integration</p>	9	CO2

	<p>Hands on sessions</p> <p>a) Creation of databases, Creation of schema, Creation of tables</p> <p>b) Inserting values to the table, select operations</p> <p>c) Delete and update operations</p> <p>a) Creation of tables with constrains and insertion of values into tables</p> <p>b) Hands-on DML commands to apply different aggregate function</p>		
Module-3	<p>HP Vertica-2: Projection fundamentals, Replication and Segmentation, Hybrid data store – WOS & ROS. Database Designer, Comprehensive mode, Incremental mode, COPY command, Merge and Partitioning, Basic VERTICA Analytic functions.</p> <p>Hands on sessions</p> <p>a) Hands-on projections</p> <p>b) Running Database designer</p> <p>c) Copying a file to Vertica database and verifying error logs.</p>	9	CO3
Module-4	<p>Web Analytics : Descriptive, Predictive and Prescriptive analytics</p>	9	CO4
Module-5	<p>Marketing Analytics and CASE Studies : Introduction, Market segmentation : Cluster analysis, Using classification trees for segmentation; Advertising : Pay Per Click Online advertising; Internet and Social marketing : Networks, Viral marketing, Text mining</p> <p>CASE Studies : Bristol Myers Squibb, Xerox , Kroger, Weather.com, Pratt and Whitney, AVIS-Budget Car Rental.</p>	9	CO5

Text Books:

1. The Data Warehouse Lifecycle Toolkit Second Edition, by Ralph Kimball, Margy Ross, Warren Thornthwaite, Joy Mundy and Bob Becker, 2008.
2. Marketing Analytics : Data Driven Techniques with Microsoft-Excel, Wayne L. Winston, John Wiley & Sons, Inc. 2014

EVALUATION

CIE - Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

SEE – Semester End Examination (50 Marks)

Bloom's Taxonomy	%
Remember	0
Understand	5
Apply	30
Analyze	5
Evaluate	5
Create	5

APPENDIX A

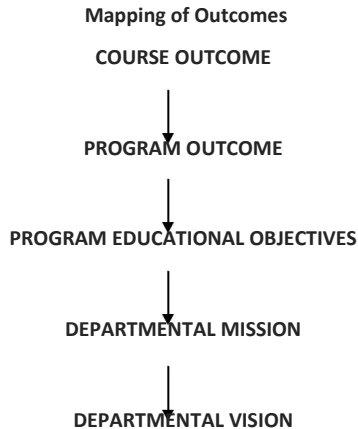
Outcome Based Education

Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead classes, opportunities, and assessments should all help students achieve the specified outcomes. There are three educational Outcomes as defined by the National Board of Accreditation:

Program Educational Objectives: The Educational objectives of an engineering degree program are the statements that describe the expected achievements of graduate in their career and also in particular what the graduates are expected to perform and achieve during the first few years after graduation. [nbaindia.org]

Program Outcomes: What the student would demonstrate upon graduation. Graduate attributes are separately listed in Appendix C

Course Outcome: The specific outcome/s of each course/subject that is a part of the program curriculum. Each subject/course is expected to have a set of Course Outcomes



APPENDIX B

PROGRAM OUTCOMES (POs) defined by NBA

Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems.

Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

Conduct investigations of complex problems: The problems that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions that require consideration of appropriate constraints/requirements not explicitly given in the problem statement (like: cost, power requirement, durability, product life, etc.) which need to be defined (modeled) within appropriate mathematical framework that often require use of modern computational concepts and tools.

Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

APPENDIX C

BLOOM'S TAXONOMY

Bloom's taxonomy is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and other evaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies. [eduglosarry.org]

