SCHEME OF TEACHING AND EXAMINATION

B.E. AUTOMOBILE ENGINEERING

V SEMESTER

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	06AL51	Entrepreneurship and Management	@	04		03	25	100	125
2	06ME52	Design of machine elements – I	Auto	04		03	25	100	125
3	06ME53	Dynamics of machines	Auto	04		03	25	100	125
4	06AU54	Automotive engine & components	Auto	04		03	25	100	125
5	06AU55	Auxiliary systems of Automotive Engines	Auto	04		03	25	100	125
6	06AU56	Automotive fuels & combustion	Auto	04		03	25	100	125
7	06AUL57	Automobile Engineering Lab – 1	Auto		03	03	25	50	75
8	06AUL58	Fuels testing & fluid Mechanics Lab	Auto		03	03	25	50	75
TOTAL				**24**	**06**	**24**	**200**	**700**	**900**

@ Any Engineering department or department of Business Studies

SCHEME OF TEACHING AND EXAMINATION

B.E. AUTOMOBILE ENGINEERING

VI SEMESTER

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	06ME61	Design of Machine Elements-II	Auto	04		03	25	100	125
2	06AU62	Automotive chassis & Suspension	Auto	04		03	25	100	125
3	06AU63	Automotive Transmission	Auto	04		03	25	100	125
4	06ME64	Mechatronics & Microprocessor	Auto	04		03	25	100	125
5	06ME65	Heat & Mass Transfer	Auto	04		03	25	100	125
6	06AU/ME66x	**Elective-I (Group A)**	Auto	04		03	25	100	125
7	06AUL67	Automobile Engineering Lab-II	Auto		03	03	25	50	75
8	06AUL68	CAD/CAM/CAE Lab	Auto		03	03	25	50	75
TOTAL				**24**	**06**	**24**	**200**	**700**	**900**

Elective-I (Group A)

06AU661 - Automotive air conditioning
06AU662 - Composite materials
06AU663 - Mechanical vibration & vehicle Dynamics
06AU664 - CAD/CAM/CAE
06ME665 - Non Traditional Machining
06ME666 - Statistical quality control
06AU667 - Modeling and Finite element analysis

SCHEME OF TEACHING AND EXAMINATION

B.E. AUTOMOBILE ENGINEERING

VII SEMESTER

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	06ME71	Control Engineering	Auto	04		03	25	100	125
2	06AU72	Vehicle Body Engineering & Safety	Auto	04		03	25	100	125
3	06AU73	Automotive Air Pollution & Control	Auto	04		03	25	100	125
4	06ME74	Operation research	Auto	04		03	25	100	125
5	06AU/ME75x	**Elective-II (Group B)**	Auto	04		03	25	100	125
6	06AU/ME76x	**Elective-III (Group C)**	Auto	04		03	25	100	125
7	06AUL77	Service &Reconditioning Lab	Auto		03	03	25	50	75
8	06AUL78	Engine Testing Lab	Auto		03	03	25	50	75
TOTAL				**24**	**06**	**24**	**200**	**700**	**900**

Elective-II (Group B)

06AU751 - Two and Three Wheeled Vehicle
06ME752 - Theory of Plasticity
06AU753 - Advanced I.C Engines
06AU754 - Computer Integrated Manufacturing
06ME755 - Gas dynamics
06ME756 - Management Information Systems
06ME758 - Total Quality Management

Elective-III (Group C)

06ME761 - Experimental Stress analysis
06ME762 - Engineering System Design
06AU763 - Engineering Economics and Automotive Cost Estimation
06ME764 - Smart Materials
06AU765 - Manufacture of Automobile Components
06ME766 - Robotics
06AU767 - Project Management

SCHEME OF TEACHING AND EXAMINATION

B.E. AUTOMOBILE ENGINEERING

VIII SEMESTER

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	06AU81	Vehicle Transport Management	Auto	04		03	25	100	125
2	06AU82	Auto Electrical & Electronics Systems	Auto	04		03	25	100	125
3	06AU/ME83x	**Elective-IV (Group D)**	Auto	04		03	25	100	125
4	06AU/ME84x	**Elective-V (Group E)**	Auto	04		03	25	100	125
5	06AU85	Project Work	Auto		06	03	100	100	200
6	06AU86	Seminar	Auto				50		50
TOTAL				**16**	**06**	**15**	**250**	**500**	**750**

Elective-IV (Group D)

06ME831 - Tribology
06AU832 - Earth moving equipments and Tractors
06AU833 - Simulation of I.C Engine processes
06ME834 - Nano Technology
06AU835 - Hydraulics & Pneumatics
06ME836 - Computer Graphics
06ME838 - Foundry Technology

Elective-V (Group E)

06AU841 - Industrial Management
06AU842 - Alternate Energy Sources for Automobiles
06AU843 - Design of Automotive Engine Components
06AU844 - Hybrid Vehicles
06ME845 - Data Base Management Systems
06ME846 - Artificial Intelligence
06ME847 - Design of Experiments

SCHEME OF TEACHING AND EXAMINATION

B.TECH. TEXTILE TECHNOLOGY

V SEMESTER

Sl. No.	Sub. Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration	I. A.	Theory/ Practical	Total Marks
1	06AL51	Management and Entrepreneurship	Any Dept.	04	--	03	25	100	125
2	06TX52	Woven Cloth Construction & Textile Design	Textile / Silk	04	--	03	25	100	125
3	06TX53	Yarn Manufacture-III	Textile / Silk	04	--	03	25	100	125
4	06TX54	Fabric Manufacture-III	Textile / Silk	04	--	03	25	100	125
5	06TX55	Chemical Processing of Textiles – I	Textile / Silk	04	--	03	25	100	125
6	06TXL56	Yarn Manufacture Lab.-III	Textile / Silk	--	03	03	25	50	75
7	06TXL57	Woven Cloth Construction and Textile Design Lab	Textile / Silk	--	03	03	25	50	75
8	06TXL58	Chemical Processing of Textiles lab.–I	Textile / Silk	--	03	03	25	50	75
TOTAL				**20**	**09**	**24**	**200**	**650**	**850**

SCHEME OF TEACHING AND EXAMINATION

B.TECH. TEXTILE TECHNOLOGY

VI SEMESTER

Sl. No.	Sub. Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration	I. A.	Theory/ Practical	Total Marks
1	06TX61	Statistical Applications to Textiles	Textile / Silk	04	--	03	25	100	125
2	06TX62	Advanced Fabric Structure & Design	Textile / Silk	04	--	03	25	100	125
3	06TX63	Fashion Design & Garment Manufacture	Textile / Silk	04	--	03	25	100	125
4	06TX64	Chemical Processing of Textiles – II	Textile / Silk	04	--	03	25	100	125
5		**Elective-I (Group A)**	Textile / Silk	04	--	03	25	100	125
6	06TXL66	Advanced Fabric Structure & Design Lab	Textile / Silk	-	03	03	25	50	75
7	06TXL67	Fashion Design & Garment Manufacture Lab	Textile / Silk	--	03	03	25	50	75
8	06TXL68	Chemical Processing of Textiles Lab – II	Textile / Silk	--	03	03	25	50	75
TOTAL				**20**	**09**	**24**	**200**	**650**	**850**

Elective-I (Group A)

06TX651 - Garment Surface ornamentation
06TX652 - Smart Textiles
06TX653 - Textile Mechanics & Calculations

SCHEME OF TEACHING AND EXAMINATION

B.TECH. TEXTILE TECHNOLOGY

VII SEMESTER

Sl. No.	Sub. Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration	I. A.	Theory/ Practical	Total Marks
1	06TX71	Apparel Marketing & Merchandising	Textile / Silk	04	--	03	25	100	125
2	06TX72	Sericulture & Silk Technology	Textile / Silk	04	--	03	25	100	125
3	06TX73	Knitting Technology	Textile / Silk	04	--	03	25	100	125
4	06TX74	Chemical Processing of Textiles – III	Textile / Silk	04	--	03	25	100	125
5	06TX75x	**Elective-II (Group B)**	Textile / Silk	04	--	03	25	100	125
6	06TX76x	**Elective-III (Group C)**	Textile / Silk	04	--	03	25	100	125
7	06TXL77	Knitting Technology Lab	Textile / Silk	--	03	03	25	50	75
8	06TXL78	Chemical Processing of Textiles Lab– III	Textile / Silk	--	03	03	25	50	75
TOTAL				**24**	**06**	**24**	**200**	**700**	**900**

Elective-II (Group B)

06TX751 - Non Mulberry Silk Technology
06TX752 - Total Quality Management
06TX753 - Fibre Reinforced Composites

Elective-II (Group C)

06TX761 - Yarn Manufacture - IV
06TX762 - Recycling of Textiles
06TX763 - Erection and Maintenance of TextileMachinery

SCHEME OF TEACHING AND EXAMINATION

B.TECH. TEXTILE TECHNOLOGY

VIII SEMESTER

Sl. No.	Sub. Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration	I. A.	Theory/ Practical	Total Marks
1	06TX81	Industrial Management	Textile / Silk	04	--	03	25	100	125
2	06TX82	Technical Textiles	Textile / Silk	04	--	03	25	100	125
3	06TX83x	**Elective-IV (Group D)**	Textile / Silk	04	--	03	25	100	125
4	06TX84x	**Elective-V (Group E)**	Textile / Silk	04	--	03	25	100	125
5	06TX85	Project Work	Textile / Silk	--	12	03	100	100	200
6	06TX86	Seminar on Project	Textile / Silk	--	03	--	50	--	50
TOTAL				**16**	**15**	**15**	**250**	**500**	**750**

Elective-IV (Group D)

06TX831 - Human Resource Management
06TX832 - Financial Management
06TX833 - Non Woven Technology

Elective-V (Group E)

06TX841 - Pollution Control in Textile Industry
06TX842 - Elementary Mechanics of Textile Structures
06TX843 - Electronic Controls in Textile Machines

SCHEME OF TEACHING AND EXAMINATION

B.E. AUTOMOBILE ENGINEERING

V SEMESTER

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical.	Total
1	06AL51	Entrepreneurship and Management	@	04	-	03	25	100	125
2	06ME52	Design of machine elements – I	Auto	04		03	25	100	125
3	06ME53	Dynamics of machines	Auto	04		03	25	100	125
4	06AU54	Automotive engine & components	Auto	04		03	25	100	125
5	06AU55	Auxiliary systems of Automotive Engines	Auto	04		03	25	100	125
6	06AU56	Automotive fuels & combustion	Auto	04		03	25	100	125
7	06AUL57	Automobile Engineering Lab – 1	Auto		03	03	25	50	75
8	06AUL58	Fuels testing & fluid Mechanics Lab	Auto		03	03	25	50	75
Total				**24**	**06**	**24**	**200**	**700**	**900**

@ Any Engineering department or department of Business Studies

SCHEME OF TEACHING AND EXAMINATION
B.E. AUTOMOBILE ENGINEERING

VI SEMESTER

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical	Total
1	06ME61	Design of Machine Elements-II	Auto	04		03	25	100	125
2	06AU62	Automotive chassis & Suspension	Auto	04		03	25	100	125
3	06AU63	Automotive Transmission	Auto	04		03	25	100	125
4	06ME64	Mechatronics & Microprocessor	Auto	04		03	25	100	125
5	06ME65	Heat & Mass Transfer	Auto	04		03	25	100	125
6	06AU/ME66X	*Elective –I (Group-A)	Auto	04		03	25	100	125
7	06AUL67	Automobile Engineering.Lab-II	Auto		03	03	25	50	75
8	06AUL68	CAD/CAM/CAE Lab	Auto		03	03	25	50	75
Total				**24**	**06**	**24**	**200**	**700**	**900**

Elective – I (Group A)		
Sl. No.	**Subject Code**	**Title of the Subject**
1	06AU661	Automotive air conditioning
2	06AU662	Composite materials
3	06AU663	Mechanical vibration & vehicle Dynamics
4	06AU664	CAD/CAM/CAE
5	06ME665	Non Traditional Machining
6	06ME666	Statistical quality control
7	06AU667	Modeling and Finite element analysis

SCHEME OF TEACHING AND EXAMINATION
B.E. AUTOMOBILE ENGINEERING

VII SEMESTER

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical.	Total
1	06ME71	Control Engineering	Auto	04		03	25	100	125
2	06AU72	Vehicle Body Engineering & Safety	Auto	04		03	25	100	125
3	06AU73	Automotive Air Pollution & Control	Auto	04		03	25	100	125
4	06ME74	Operation research	Auto	04		03	25	100	125
5	06AU/ME75X	*Elective – II (Group – B)	Auto	04		03	25	100	125
6	06AU/ME76X	*Elective – III (Group – C)	Auto	04		03	25	100	125
7	06AUL77	Service &Reconditioning Lab	Auto		03	03	25	50	75
8	06AUL78	Engine Testing Lab	Auto		03	03	25	50	75
Total				**24**	**06**	**24**	**200**	**700**	**900**

Elective – II (Group B)			Elective – III (Group C)		
Sl. No.	**Subject Code**	**Title of the Subject**	**Sl. No.**	**Subject Code**	**Title of the Subject**
1	06AU751	Two and Three Wheeled Vehicle	1	O6ME761	Experimental Stress analysis
2	06ME752	Theory of Plasticity	2	06ME762	Engineering System Design
3	06AU753	Advanced I.C Engines	3	06AU763	Engineering Economics and Automotive Cost Estimation
4	06AU754	Computer Integrated Manufacturing	4	06ME764	Smart Materials
5	06ME755	Gas dynamics	5	06AU765	Manufacture of Automobile Components
6	06ME756	Management Information Systems	6	06ME766	Robotics
7	06ME758	Total Quality Management	7	06AU767	Project Management

SCHEME OF TEACHING AND EXAMINATION
B.E. AUTOMOBILE ENGINEERING

VIII SEMESTER

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination			
				Theory	Practical	Duration (Hrs)	Marks		
							IA	Theory / Practical.	Total
1	06AU81	Vehicle Transport Management	Auto	04		03	25	100	125
2	06AU82	Auto Electrical & Electronics Systems	Auto	04		03	25	100	125
3	06AU/ME83X	***Elective – IV (Group - D)**	Auto	04		03	25	100	125
4	06AU/ME84X	***Elective – V (Group –E)**	Auto	04		03	25	100	125
5	06AU85	Project Work	Auto	-	06	03	100	100	200
6	06AU86	Seminar	Auto	-	-	-	50		50
Total				**16**	**06**	**15**	**250**	**500**	**750**

Elective – IV (Group D)			**Elective – V (Group E)**		
Sl. No.	**Subject Code**	**Title of the Subject**	**Sl. No.**	**Subject Code**	**Title of the Subject**
1	06ME831	Tribology	1	06AU841	Industrial Management
2	06AU832	Earth moving equipments and Tractors	2	06AU842	Alternate Energy Sources for Automobiles
3	06AU833	Simulation of I.C Engine processes	3	06AU843	Design of Automotive Engine Components
4	06ME834	Nano Technology	4	06AU844	Hybrid Vehicles
5	06ME835	Hydraulics & Pneumatics	5	06ME845	Data Base Management Systems
6	06ME836	Computer Graphics	6	06ME846	Artificial Intelligence
7	06ME838	Foundry Technology	7	06ME847	Design of Experiments

V SEMESTER

MANAGEMENT & ENTREPRENEURSHIP

Subject Code	:	**06AL51**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

MANAGEMENT

UNIT - 1

MANAGEMENT: Introduction - Meaning - nature and characteristics of Management, Scope and functional areas of management - Management as an art or science, art or profession Management & Administration - Roles of Management, Levels of Management, Development of Management Thought - early management approaches - Modern management approaches.

7 Hours

UNIT - 2

PLANNING: Nature, importance and purpose of planning process - Objectives - Types of plans (Meaning only) - Decision making - Importance of planning - steps in planning & planning premises - Hierarchy of plans.

6 Hours

UNIT - 3

ORGANISING AND STAFFING: 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 (Meaning only) Nature and importance of Staffing - Process of Selection & Recruitment (in brief).

6 Hours

UNIT - 4

DIRECTING & CONTROLLING: Meaning and nature of directing - Leadership styles, Motivation Theories, Communication - Meaning and importance – Coordination, meaning and importance and Techniques of Co - ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief)

7 Hours

PART - B

ENTREPRENEURSHIP

UNIT - 5

ENTREPRENEUR: Meaning of Entrepreneur; Evolution of the Concept, Functions of an Entrepreneur, Types of Entrepreneur, Intrapreneur - 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; Barriers to entrepreneurship.

6 Hours

UNIT - 6

SMALL SCALE INDUSTRY: Definition; Characteristics; Need and rationale: Objectives; Scope; role of SSI in Economic Development. Advantages of SSI Steps to start an SSI – Government policy towards SSI; Different Policies of S.S.I.; Government Support for S.S.I. during 5 year plans, Impact of Liberalization, Privatisation, Globalization on S.S.I., Effect of WTO/GATT Supporting Agencies of Government for S.S.I., Meaning; Nature of Support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition only)

1 Hour

UNIT - 7

INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency: SISI; NSIC; SIDBI; KSFC.

6 Hours

UNIT - 8

PREPARATION OF PROJECT: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of Business Opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

7 Hours

TEXT BOOKS:

1. **Principles of Management** - P.C. Tripathi, P.N. Reddy; Tata McGraw Hill,
2. **Dynamics of Entrepreneurial Development & Management** - Vasant Desai Himalaya Publishing House **Entrepreneurship Development –**
3. **Small Business Enterprises** - Poornima M Charantimath - Pearson Education - 2006 (2 & 4)

REFERENCE BOOKS:

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

DESIGN OF MACHINE ELEMENTS-I

Subject Code	:	**06ME52**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

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.

5 Hours

UNIT - 2

DESIGN FOR STATIC & IMPACT STRENGTH: STATIC STRENGTH: Static loads and factor of safety, Theories of failure: Maximum normal stress theory, Maximum shear stress theory, Distortion energy theory; Failure of brittle materials, Failure of ductile materials. Stress concentration, Determination of Stress concentration factor. **Impact Strength:** Introduction, Impact stresses due to axial, bending and torsional loads, effect of inertia.

7 Hours

UNIT - 3

DESIGN FOR FATIGUE STRENGTH: Introduction- S-N Diagram, Low cycle fatigue, High cycle fatigue, Endurance limit, 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.

8 Hours

UNIT - 4

THREADED FASTENERS: Stresses in threaded fasteners, Effect of initial tension, Design of threaded fasteners under static, dynamic and impact loads, Design of eccentrically loaded bolted joints.

6 Hours

PART - B

UNIT - 5

DESIGN OF SHAFTS: Torsion of shafts, design for strength and rigidity with steady loading, ASME & BIS codes for power transmission shafting, shafts under fluctuating loads and combined loads.

7 Hours

UNIT - 6

COTTER JOINT AND KNUCKLE JOINTS, KEYS AND COUPLINGS: Design of Cotter and Knuckle joints, Keys: Types of keys, Design of keys and design of splines. Couplings: Rigid and flexible couplings: Flange coupling, Bush and Pin type coupling and Oldham's coupling.

7 Hours

UNIT - 7

RIVETED AND WELDED JOINTS: Types, rivet materials, failures of riveted joints, Joint Efficiency, Boiler Joints, Tank and Structural Joints, Riveted Brackets. Welded Joints – Types, Strength of butt and fillet welds, eccentrically loaded welded joints.

7 Hours

UNIT - 8

POWER SCREWS: Mechanics of power screw, Stresses in power screws, efficiency and self-locking, Design of Power Screw, Design of Screw Jack: (Complete Design).

5 Hours

DESIGN DATA HAND BOOKS:

1. **Design Data Hand Book** – K. Lingaiah, McGraw Hill, 2nd Ed. 2003.
2. **Design Data Hand Book** - K. Mahadevan and Balaveera Reddy, CBS Publication
3. **Machine Design Data Hand Book** by H.G. Patil, Shri Shashi Prakashan, Belgaum.
4. **PSG design data handbook** by PSG College of Technology, Coimbatore.

TEXT BOOKS:

1. **Mechanical Engineering Design:** Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition 2003.
2. **Design of Machine Elements:** V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007.

REFERENCE BOOKS:

1. **Machine Design -** Robert L. Norton, Pearson Education Asia, 2001.
2. **Design of Machine Elements** - M.F.Spotts, T.E. Shoup, L.E. Hornberger, S.R. Jayram and C.V. Venkatesh, Pearson Education, 2006.
3. **Machine Design -** Hall, Holowenko, Laughlin (Schaum's Outlines series) Adapted by S.K. Somani, Tata McGraw Hill Publishing Company Ltd., New Delhi, Special Indian Edition, 2008.
4. **Fundamentals of Machine Component Design -** Robert C. Juvinall and Kurt M Marshek, Wiley India Pvt. Ltd., New Delhi, 3rd Edition, 2007.

DYNAMICS OF MACHINES

Subject Code	:	**06ME53**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

STATIC FORCE ANALYSIS: Static force analysis: Introduction: Static equilibrium. Equilibrium of two and three force members. Members with two forces and torque, Free body diagrams, principle of virtual work. Static force analysis of four bar mechanism and slider-crank mechanism with and without friction.

6 Hours

UNIT - 2

DYNAMIC FORCE ANALYSIS: D'Alembert's principle, Inertia force, inertia torque, Dynamic force analysis of four-bar mechanism and slider crank mechanism. Dynamically equivalent systems. Turning moment diagrams and flywheels, Fluctuation of Energy. Determination of size of flywheels.

8 Hours

UNIT - 3

FRICTION AND BELT DRIVES: Definitions: Types of friction: laws of friction, Friction in pivot and collar bearings. Belt drives: Flat belt drives, ratio of belt tensions, centrifugal tension, power transmitted.

6 Hours

UNIT - 4

BALANCING OF ROTATING MASSES: Static and dynamic balancing, Balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes.

6 Hours

PART - B

UNIT - 5

BALANCING OF RECIPROCATING MASSES: Inertia effect of crank and connecting rod, single cylinder engine, balancing in multi cylinder-inline engine (primary & Secondary forces), V-type engine; Radial engine – Direct and reverse crank method.

8 Hours

UNIT - 6

GOVERNORS: Types of governors; force analysis of Porter and Hartnell governors. Controlling force, stability, sensitiveness, isochronism, effort and power

6 Hours

UNIT - 7

GYROSCOPE: Vectorial representation of angular motion, Gyroscopic couple. Effect of gyroscopic couple on ship, plane disc, aeroplane, stability of two wheelers and four wheelers.

6 Hours

UNIT - 8

ANALYSIS OF CAMS: Analysis of Tangent cam with roller follower and Circular arc cam operating flat faced and roller followers, Undercutting in Cams.

6 Hours

TEXT BOOKS:

1. **Theory of Machines** - Sadhu Singh, Pearson Education, 2nd edition, 2007.
2. **Theory of Machines** - Rattan S.S. Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition, 2006.

REFERENCE BOOKS:

1. **Theory of Machines** by Thomas Bevan, CBS Publication 1984.
2. **Design of Machinery** by Robert L. Norton, McGraw Hill, 2001.
3. **Mechanisms and Dynamics of Machinery** by J. Srinivas, Scitech Publications, Chennai, 2002.

AUTOMOTIVE ENGINE & COMPONENTS

Subject Code	:	**06AU54**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

INTRODUCTION

UNIT - 1

GENERAL: 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

FOUR STROKE ENGINES: Principles of engine operation (SI & CI), Actual Valve timing – mechanical and dynamic factors, Relative merits & demerits of petrol & diesel engines.

7 Hours

UNIT - 2

TWO STROKE ENGINES: Principles of engine operation (SI & CI), Port timing diagrams. *Types* - Three port engine, Separate pumps or blowers, Symmetrical & unsymmetrical timing, Cross flow, loop flow & uniflow type Scavenging systems. *Scavenging Process* – Pre blowdown, Blowdown, Scavenging, Additional Charging. Theoretical Scavenging processes, Scavenging parameters, Comparison of Different Scavenging Systems; port design, Scavenging pumps. Relative merits & demerits of petrol & diesel engines.

ENGINE COMPONENTS

-Classification/types, function, materials, construction details, manufacturing, Troubles & Remedies and Calculation of major dimensions of the following engine components

7 Hours

UNIT - 3

CYLINDER BLOCK, CRANK CASE & CYLINDER HEADS: Cylinder heads, Gaskets, cylinder wear, water jacket, Cylinder liners, valve seats. Crank Case – General form of crank case, oil sumps and cooling features, flywheel mountings, Engine mountings, Front & Rear mountings. Production of engine blocks Manifolds and Mufflers - inlet and exhaust manifolds, mixture distribution, heating by exhaust gas, dual manifolds, General Design of Manifolds, effect of firing order, Mufflers, general design

7 Hours

UNIT - 4

PISTON, PISTON RINGS, PISTON PIN: Piston Temperatures, piston slap, compensation of thermal expansion in pistons. Piston Rings, forms of gap, stresses in piston rings, ring collapse, heat treatment, piston ring selection, shape. Piston pin, Locking of piston pins, length of piston

6 Hours

PART - B

UNIT - 5

CONNECTING ROD: Length of rod, Cross section, Buckling, Drilled connecting rods, piston pin bearing, offset connecting rods, effects of whipping, bearing materials, lubrication

6 Hours

UNIT - 6

CRANK SHAFT: Balance weights, local balance, Crankshaft proportions, oil holes drilled in crank shafts, balancing and torsional vibration analysis, vibration dampers, firing order, bearings, lubrication

6 Hours

UNIT - 7

FLYWHEEL: Necessity, capacity, Mounting of flywheels, Coefficient of fluctuation of speed, fluctuation of energy, Maximum fluctuation of energy, Energy stored in a flywheel, stresses, construction.

6 Hours

UNIT - 8

VALVE AND VALVE MECHANISM: Angle of seat, Operating Conditions, operating temperatures, valve cooling, Sodium cooled valves, Valve rotators, valve seats, valve guides, , valve springs, valve clearance, valve timing, OHV, OHC, dual valves, types of valve operating mechanisms. valve train component details, Camshaft,-drives of cams, cam types, tappets,-automatic zero clearance tappets, push rods, rocker arms & rocker Shaft.

7 Hours

TEXT BOOKS:

1. **High Speed Engines -** P.M.Heldt, Oxford & IBH, 1965
2. **Auto Design** – R.B Gupta, Satya Prakashan, New Delhi 2002

REFERENCE BOOKS:

1. **A course in I.C. Engine** - Mathur & Sharma, Dhanput Rai & Sons, Delhi, 1994
2. **Internal Combustion Engines**-V Ganesan, Tata McGraw Hill, Delhi, 2002
3. **Automobile Engineering Vol. II** - Kirpal Singh, Standard publications, New Delhi, 2004
4. **Modern Petrol Engine** - A.W.Judge, B.I. Publications. 1983
5. **I.C. Engine** - Maleev & Litchy, McGrawHill
6. **I.C.Engines** - H.B.Keshwani, Standard Pub New Delhi., 1982
7. **Fundamentals of I.C.Engines** - J.B.Heywood, Tata McGraw Hill, Delhi,1998
8. **Machine design exercises** - S.N.Trikha, Khanna publications, Delhi
9. **Machine design -** Sharma & Agarwal, S K Kataria & Sons, Delhi
10. **Machine design exercises** - R K Jain, Khanna Publishers, New Delhi
11. **Automotive mechanics** - William H. Crouse, Tata Mc, Graw Hill Publications Co. New Delhi
12. **Theory & practice in I C Engines** (vol. I & II)- C F Taylor

AUXILLARY SYSTEMS OF AUTOMOTIVE ENGINES

Subject Code	:	**06AU55**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

CARBURETION: Carburetor principle, Properties of air-petrol mixtures, Mixture requirements for steady state and transient operation, Mixture formation studies of volatile fuels, design of elementary carburetor, Chokes, Effects of altitude on carburetion, Carburetor for 2-stroke and 4-stroke engines, carburetor systems for emission control.

8 Hours

UNIT - 2

GASOLINE INJECTION AND IGNITION SYSTEMS: Petrol Injection, Pneumatic and Electronic Fuel Injection Systems types. Ignition system requirements, Timing, Ignition Systems, breaker mechanism and spark plugs, Factors affecting energy requirement of the ignition system, factors affecting spark plug operation, Electronic Ignition Systems.

6 Hours

UNIT - 3 & 4

DIESEL FUEL INJECTION: Cleaning systems, transfer pumps, injection pumps, injectors and nozzles – types, functions and necessities, fuel injection pump principle, ratio of piston displacement to fuel charge volume, delivery characteristics, injection lag, pressure waves in fuel lines, fuel pump and governors – types, constructional features and operation, Factors influencing fuel spray atomization, penetration and dispersion of diesel and heavy oils and their properties, rate and duration of injection, fuel line hydraulics.

12 Hours

PART - B

UNIT - 5

MANIFOLDS AND MIXTURE DISTRIBUTION: Intake system components: Air filter, Intake manifold with mixture distribution, Discharge coefficient, Pressure drop, Exhaust system components: Exhaust manifold and exhaust pipe, Spark arresters, Waste heat recovery, Exhaust mufflers, Type of mufflers, exhaust manifold expansion.

6 Hours

UNIT - 6

COOLING SYSTEM: Necessity, variation of gas temperature, Areas of heat flow, heat transfer, piston and cylinder temperature, Heat rejected to

coolant, quantity of water required. Cooling system: air cooling, water cooling, thermodynamics of forced circulation, Water pumps, thermostats, pressurized water cooling, regenerative cooling. Comparison of air and water cooling. Radiators – types, cooling fan – power requirement, antifreeze solution.

8 Hours

UNIT - 7

LUBRICATION SYSTEM: Lubricants, lubricating systems - types, Lubrication of piston rings, bearings, oil consumption, Oil cooling. Heat transfer coefficients, liquid and air cooled engines, coolants, additives and lubricity improvers, concept of adiabatic engines, oil filters, pumps, crankcase ventilation - types.

6 Hours

UNIT - 8

SUPERCHARGING AND TURBOCHARGING: Purpose, thermodynamic cycle, effect on the performance, turbo charging, limits of supercharging for petrol and diesel engines. Modifications of an engine for super charging - methods of super charging – super charging and turbo charging of two stroke and four stroke engines.

6 Hours

TEXT BOOKS:

1. **A Course in Internal Combustion Engines -** Mathur, M.L., and Sharma, R.P., Dhanpat Rai Publications (P) Ltd., 1998.
2. **Automobile Engineering Vol I & II -** Kirpal singh, Standard Pub, New Delhi, 2004
3. **Internal Combustion Engine -** Ramalingam, K.K, Scitech Publication (India) Pvt.Ltd.2000.

REFERENCES BOOKS:

1. **A Course in Internal Combustion Engines** - Domkundwar, V.M, Dhanpat Rai and Co., 1999.
2. **Internal Combustion Engines -** Ganesan, V., Tata McGraw-Hill Book Co., 2002.
3. **Auto Fuel Sytstems -** Duffy Smith, the Good Heart Willcox Company Inc., Publishers, 1987.
4. **Internal Combustion Engines and Air Pollution -** Edward F, Obert, Intext Education Publishers, 1980.
5. **I.C engines -** H.B. Keshwani, Standard publication, New Delhi, 1982
6. **Automobile Engineering -** R.K. Mohanty, Vol. I & II "Standard Book house, New Delhi. 2006
7. **Automotive mechanics -** William H. Crouse, Tata Mc-Graw Hill Publications Co. New Delhi
8. **Automotive Technology -** Jack Erjavec, 3rd Edition, Chennai, Micro Thomson Asia Pvt. Ltd, 2004

AUTOMOTIVE FUELS AND COMBUSTION

Subject Code	:	**06AU56**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

ENERGY SOURCES: Exhaustible sources - crude oil, Natural gas, Inexhaustible sources - Solar energy, Wind power, Tidal Power, Geo-thermal power. Energy from Bio-gas, Synthetic fuels - only a brief introduction.

4 Hours

UNIT - 2

LIQUID FUELS: Origin of petroleum, its chemistry, normal paraffin's, isoparaffins, olefins, napthalean and aromatics. Refining of petroleum: Fractional distillation, Cracking, Reforming process, Thermal reforming, polymerisation, alkylation, 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

6 Hours

UNIT - 3

CYCLE ANALYSIS: Otto, Diesel, Dual, stirling and Brayton cycles, comparison of air standard, fuel air and actual cycles, simple problems on the above topics.

6 Hours

UNIT - 4

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.

6 Hours

UNIT - 5

PETROL AND DIESEL FUELS: Properties and rating of fuels, chemical energy of fuels, Reaction Equation, Properties of A/F mixture, combustion temp, combustion charts, Lead free gasoline's, low and ultra – low sulphur diesels, LPG, CNG, Alcohols, Biodiesels, Gaseous Fuel Injections, Dual Fueling and Controls – CNG and Gasoline, Hydrogen and Diesel, Alcohols and Diesels etc.

ENGINE PERFORMANCE: Performance parameters BHP, FHP, IHP, specific fuel consumption, volumetric efficiency, Thermal efficiency, heat Balance sheet, Testing of Engines, Numerical problems

6 Hours

PART - B

UNIT - 6

COMBUSTION IN S.I ENGINES: 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, concepts of lean burn engines, heat release correlations.

9 Hours

UNIT - 7

COMBUSTION IN C.I. ENGINES: Various stages of combustion, vaporization of fuel droplets and spray formation, air motion, swirl, squish, tumble flow, velocities, swirl measurement, delay period correlations, diesel knock and engine variables, features and design considerations of combustion chambers, types, heat release correlations.

9 Hours

UNIT - 8

DUAL FUEL AND MULTIFUEL ENGINES: Combustion in dual fuel engines, Factor affecting combustion. Main types of gaseous fuels, Supercharge knock control & Performance of diesel fuel engines. Characteristics of multi fuel engines, Modification of fuel system, suitability of various engines as multi fuel unit, performance of multi fuel engines.

6 Hours

TEXT BOOKS:

1. **I.C. Engines** - By Mathur & Sharma, Dhanpat Rai & Sons, New Delhi, 1994
2. **Fuels & Combustion** - by S.P. Sharma & Chandramohan, Tata McGrawHill, New Delhi,1987

REFERENCE BOOKS:

1. **Internal Combustion Engines** - Ganesan, V, Tata McGraw Hill Book Co., 2002.
2. **Internal Combustion Engine Fundamentals** - John B.Heywood, McGraw Hill Book, 1998
3. **Internal Combustion Engine and Air Pollution -** Obert, E.F., International Text Book Publishers, 1983.
4. **Internal Combustion Engines,** Ram lingam, K.K., Scitech Publications (India) Pvt. Ltd., 2000.
5. **Fuels & Combustion -** by Smith & Stinson,
6. **I.C. Engines -** by Lichty
7. **I.C. Engines** - by Maleev, CBS Pub.

AUTOMOBILE ENGINEERING LAB – I

Subject Code	:	**06AUL57**	IA Marks	:	25
No. of Practical Hrs/ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

1. Study of hand tools- sketching, materials used and their applications.

2. Writing technical specifications and description of all types of automobile engines.

3. Study of traffic rules as per M.V. Act 1988 and driving practice of four wheel vehicle.

4. Trouble shooting charts for all engine components.

5. Note the specifications of given engines and component standard dimensions. Dismantle & assemble of engine components of SI and CI engines (Two stroke and four stroke engines) of any commercial vehicles, using special tools needed. Note procedure of dismantling & assembly; identify the major components, noting their functions & materials used. Measurement & comparison of major components dimension with standard specifications. Inspection for wear and tear, crack, breakdown. Identify the service requirements of engine, such as decarburizing, degreasing, sparkplug cleaning, fuel injector cleaning, etc.

6. Compression test, vacuum test on diesel and petrol engines.

7. Study (Dismantling & assembly): Different carburetors, fuel injection pumps, injectors, fuel tanks, fuel filters, fuel pumps, turbo-chargers, cooling systems and lubricating systems. Identify location of above components in a vehicle and note their functions along with the brand names.

FUELS TESTING AND FLUID MECHANICS LAB

Subject Code	:	**06AUL58**	IA Marks	:	25
No. of Practical Hrs/ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

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 and Torsion viscometer.
4. Measurement of areas of irregular figure Using of Planimeters
5. Determination of Carbon residue and Moisture content in a fuel.
6. Determination of cloud and pour points of light, medium and heavy oils.
7. Drawing of Valve and port timing diagram for a given engine.
8. Determination of compression ratio for a given engine.
9. Performance testing of fluid pumps.
10. Performance testing of air blower.
11. Determination of coefficient of discharge of venturi meter, orifice meter.
12. Determination of major and minor losses in pipe flow (bend, sudden expansion, sudden contraction, entry and exit).

VI SEMESTER

DESIGN OF MACHINE ELEMENTS - II

Subject Code	:	**06ME61**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

CURVED BEAMS: Stresses in curved beams of standard cross sections used in crane hook, punching presses & clamps, closed rings and links.

5 Hours

UNIT - 2

CYLINDERS & CYLINDER HEADS: Review of Lame's Equations; compound cylinders, stresses due to different types of fits, cylinder heads, flats.

5 Hours

UNIT - 3

SPRINGS: Types of springs - stresses in Helical coil springs of circular and non-circular cross sections. Tension and compression springs, springs under fluctuating loads, Leaf Springs: Stresses in leaf springs. Equalized stresses, – Energy stored in springs, Torsion, Belleville and Rubber springs.

8 Hours

UNIT - 4

SPUR & HELICAL GEARS: Spur Gears: Definitions, 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.

8 Hours

PART - B

UNIT - 5

BEVEL AND WORM GEARS: Bevel Gears: Definitions, formative number of teeth, Design based on strength, dynamic and wears loads. Worm Gears: Definitions, Design based on strength, dynamic, wear loads and efficiency of worm gear drives.

7 Hours

UNIT - 6

CLUTCHES & BRAKES: Design of Clutches: Single plate, multi plate and cone clutches. Design of Brakes: Block and Band brakes: Self locking of brakes: Heat generation in Brakes.

7 Hours

UNIT - 7

LUBRICATION AND BEARINGS: Lubricants and their properties, Mechanisms of Lubrication bearing modulus, coefficient of friction, minimum oil film thickness, Heat Generated, Heat dissipated, Bearing Materials, Examples of journal bearing and thrust bearing design.

7 Hours

UNIT - 8

BELTS ROPES AND CHAINS: Flat belts: Length & cross section, Selection of V-belts, ropes and chains for different applications.

5 Hours

DESIGN DATA HAND BOOKS:

1. **Design Data Hand Book** – K. Lingaiah, McGraw Hill, 2nd Ed. 2003.
2. **Design Data Hand Book -** K. Mahadevan and K.Balaveera Reddy, CBS Publication
3. **Machine Design Data Hand Book -** H.G. Patil, Shri Shashi Prakashan, Belgaum.

TEXT BOOKS:

1. **Mechanical Engineering Design -** Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition 2003.
2. **Design of Machine Elements -** V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007.

REFERENCE BOOKS:

1. **Machine Design** - Robert L. Norton, Pearson Education Asia, 2001.
2. **Design of Machine Elements -** M.F.Spotts, T.E. Shoup, L.E. Hornberger, S.R. Jayram and C.V. Venkatesh, Pearson Education, 2006.
3. **Machine Design -** Hall, Holowenko, Laughlin (Schaum's Outlines series) Adapted by S.K. Somani, Tata McGraw Hill Publishing Company Ltd., New Delhi, Special Indian Edition, 2008.
4. **Machine Design -** A CAD Approach: Andrew D Dimarogonas, John Wiley Sons, Inc, 2001.

AUTOMOTIVE CHASSIS AND SUSPENSION

Subject Code	:	**06AU62**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

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

6 Hours

UNIT - 2

FRAMES: Types of frames, 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

6 Hours

UNIT - 3

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.

7 Hours

UNIT - 4

PROPELLER SHAFT, DIFFERENTIAL AND REAR AXLE: 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 speeds of thee driving & driven shafts, angular acceleration of the driven shaft, maximum fluctuation of speed, double Hooke's joint, Numerical problems.

Final drive: construction details, types, Differential-Principle, types 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

7 Hours

PART - B

UNIT - 5

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 such as operating temperature, lining, brake clearance, pedal pressure, linkages etc, Numerical problems.

8 Hours

UNIT - 6

BRAKES-2: Brake compensation, Parking and emergency brakes, hill holder, automatic adjustment, servo brakes, Power brakes-Air brakes, wagner air brake, vacuum brakes and electric brakes and components brake valve, unloader valve, diaphragm, air-hydraulic brakes, vacuum boosted hydraulic brakes, trouble shooting, Numerical problems

6 Hours

UNIT - 7

SUSPENSION: 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.

6 Hours

UNIT - 8

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'

6 Hours

TEXT BOOKS:

1. Automotive Chassis – P.M. Heldt, Chilton & Co.
2. Automotive Mechanics – N.K. Giri , Khanna Publications, New Delhi, 2004

REFERENCE BOOKS:

1. Automotive chassis and body – P.L. Kohli, TMH
2. Automobile Engineering Vol. I - Kirpal Singh, Standard publications, New Delhi, 2004.
3. Introduction to automobile engineering – N.R. Khatawate, Khanna pub. New Delhi
4. Automotive mechanics – Joseph I Heintner, Affiliated East West Press, New Delhi/Madras,1967
5. Automobile engineering – G.B.S. Narang, Khanna Publications, New Delhi, 1982
6. Automobile Engineering – T.R. Banga & Nathu Singh, Khanna Publications, 1993

AUTOMOTIVE TRANSMISSION

Subject Code	:	**06AU63**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

POWER REQUIRED FOR PROPULSION: Various Resistances to Motion of the Automobile, Traction, tractive effort Performance curves, acceleration grade ability, drawbar pull, Numerical Problems

6 Hours

UNIT - 2

CLUTCH: Necessity of clutch in an automobile, different types of clutches, friction clutches namely Single plate clutch, multi plate clutch, cone clutch, centrifugal clutch, electromagnetic clutch, hydraulic clutches, Clutch - adjustment, Clutch troubles and their causes, requirements of a clutch, Clutch materials, clutch lining Vacuum operated clutch, Numerical problems

8 Hours

UNIT - 3

FLUID COUPLING & ONE WAY CLUTCHES: Constructional details of various types, percentage slip, one way clutches (Over running clutch) like

sprag clutch, ball and roller one way clutches, necessity and field of application, working fluid requirements, fluid coupling characteristics.

6 Hours

UNIT - 4

HYDRODYNAMIC TORQUE CONVERTERS: Introduction to torque converters, comparisons between fluid coupling and torque converters, performance characteristics, slip, principles of torque multiplication, 3 and 4 phase torque converters, typical hydrodynamic transmission.

6 Hours

PART - B

UNIT - 5

GEAR BOX: The need for transmissions, Necessity of gear box, Calculation of gear ratios for vehicles, Performance characteristics in different gears, Desirable ratios of 3speed & 4speed gear boxes, Constructional details of, Sliding-mesh gear box, Constant-mesh gear box, synchromesh gear box, auxiliary transmissions, compound transmissions, numerical problems

8 Hours

UNIT - 6

EPICYCLIC TRANSMISSION: Principle of operation, types of planetary transmission, Calculation of gear ratio in different speeds, Wilson planetary transmission, Ford-T model gear box, Pre selective mechanism, Vacuum control, pneumatic control, hydraulic control in the planetary gear system, Over drives, Numerical problems.

6 Hours

UNIT - 7

HYDROSTATIC DRIVES: Principles of hydrostatic drives, different systems of hydrostatic drives, constant displacement pump and constant displacement motor, variable displacement pump and constant displacement motor and variable displacement motor, variable displacement pump and variable displacement motor, applications, plunger type pump and plunger type motor, advantages and limitations, typical hydrostatic drives, hydrostatic shunt drives.

6 Hours

UNIT - 8

AUTOMATIC & ELECTRIC TRANSMISSIONS: Automatic transmission - Principle, general description and Working of representative types like Borge-warner and general arrangement & description of electric transmission, their working principle & control mechanisms, limitations.

6 Hours

TEXT BOOKS:

1. **Automotive Mechanics -** N.K Giri, Khanna Publication, New Delhi, 2004
2. **Automatic Vehicle Transmission -** John Wiley Publications 1995

REFERAENCE BOOKS:

1. **Automotive Transmissions and Powertrains -** Crouse W.H. McGraw Hill Co. 5th Edn.
2. **Motor Vehicle -** Newton K and Steeds. W. Butter Worths & Co., Publishers Ltd, 1997
3. **Automobile Engineering** –. Vol.1, Kirpal singh,, Standard Pub. 2004
4. **Automobile Engineering -** G.B.S.Narang Khanna Publication, New Delhi
5. **Automotive Mechanics -** Joseph I Heitner, Affiliated East West Press, New Delhi
6. **Fundamentals of Automatic Transmission -** by William Hasselbee.
7. **Torque Converters -** P.M. Heldt, Oxford & IBH.

MECHATRONICS & MICROPROCESSOR

Subject Code	:	**06ME64**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION TO MECHATRONIC SYSTEMS: Measurement and control systems their elements and functions, Microprocessor based controllers.

6 Hours

UNIT - 2

REVIEW OF TRANSDUCERS AND SENSORS: Definition and classification of transducers. Definition and classification of sensors. Principle of working and applications of light sensors, proximity sensors and Hall effect sensors.

7 Hours

UNIT - 3

ELECTRICAL ACTUATION SYSTEMS: Electrical systems, Mechanical switches, solid-state switches, solenoids, DC & AC motors, Stepper motors and their merits and demerits.

6 Hours

UNIT - 4

SIGNAL CONDITIONING: Introduction to signal conditioning. The operational amplifier, Protection, Filtering, Wheatstone bridge, Digital signals Multiplexers, Data acquisition, Introduction to Digital system processing Pulse-modulation.

7 Hours

PART - B

UNIT - 5

INTRODUCTION TO MICROPROCESSORS: Evolution of Microprocessor, Organization of Microprocessors (Preliminary concepts), basic concepts of programming of microprocessors.

Review of concepts – Boolean algebra, Logic Gates and Gate Networks, Binary & Decimal number systems, memory representation of positive and negative integers, maximum and minimum integers. Conversion of real numbers, floating point notation, representation of floating point numbers, accuracy and range in floating point representation, overflow and underflow, addition of floating point numbers, character representation.

7 Hours

UNIT - 6

LOGIC FUNCTION: Data word representation. Basic elements of control systems 8085A processor architecture terminology such as CPU, memory and address, ALU, assembler data registers, Fetch cycle, write cycle, state, bus, interrupts. Micro Controllers. Difference between microprocessor and micro controllers. Requirements for control and their implementation in microcontrollers. Classification of micro controllers.

7 Hours

UNIT - 7

ORGANIZATION & PROGRAMMING OF MICROPROCESSORS: Introduction to organization of INTEL 8085-Data and Address buses, Instruction set of 8085, programming the 8085, assembly language programming.

6 Hours

UNIT - 8

CENTRAL PROCESSING UNIT OF MICROPROCESSORS: Introduction, timing and control unit basic concepts, Instruction and data

flow, system timing, examples of INTEL 8085 and INTEL 4004 register organization.

6 Hours

TEXT BOOKS:

1. **Mechatronics** – W.Bolton, Longman, 2Ed, Pearson Publications, 2007.
2. **Microprocessor Architecture, Programming and Applications With 8085/8085A** – R.S. Ganokar, Wiley Eastern.

REFERENCE BOOKS:

1. **Mechatronics –** Principles, Concepts and applications – Nitaigour and Premchand Mahilik – Tata McGraw Hill – 2003.
2. **Mechatronics Principles & applications** by Godfrey C.Onwubolu, Elsevier.
3. **Introduction Mechatronics & Measurement systems,** David.G. Aliciatore & Michael.B.Bihistaned, Tata McGraw Hill, 2000.
4. **Intel Microprocessor**: Barry.B.Brey, Pearson Education.

HEAT AND MASS TRANSFER

Subject Code	:	**06ME65**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART -A

UNIT - 1

INTRODUCTORY CONCEPTS AND DEFINITIONS: Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; radiation heat transfer; combined heat transfer mechanism.Boundry conditions of 1^{st}, $2^{nd\ and\ 3rd}$ Kind

CONDUCTION: Derivation of general three dimensional conduction equation in Cartesian coordinate, special cases, discussion on 3-D conduction in cylindrical and spherical coordinate systems. (No derivation). One dimensional conduction equations in rectangular, cylindrical and spherical coordinates for plane and composite walls. Overall heat transfer coefficient. Thermal contact resistance- Numerical problems

7 Hours

UNIT - 2

VARIABLE THERMAL CONDUCTIVITY: Derivation for heat flow and temperature distribution in plane wall. Critical thickness of insulation without heat generation, Thermal resistance concept and its importance, Heat transfer in extended surfaces of uniform cross-section without heat generation, Long fin, short fin with insulated tip and without insulated tip and fin connected between two heat sources. Fin efficiency and effectiveness. Numerical problems.

6 Hours

UNIT - 3

ONE-DIMENSIONAL TRANSIENT CONDUCTION: Conduction in solids with negligible internal temperature gradient (Lumped system analysis), Use of Transient temperature charts (Heisler's charts) for transient conduction in slab, long cylinder and sphere; use of transient temperature charts for transient conduction in semi-infinite solids. Numerical Problems

6 Hours

UNIT - 4

CONCEPTS AND BASIC RELATIONS IN BOUNDARY LAYERS: Flow over a body velocity boundary layer; critical Reynolds number; general expressions for drag coefficient and drag force; thermal boundary layer;general expression for local heat transfer coefficient; Average heat transfer coefficient; Nusselt number. Flow inside a duct- velocity boundary layer, hydrodynamic entrance length and hydro dynamically developed flow; flow through tubes (internal flow)(discussion only). Numericals based on empirical relation given in data handbook

FREE OR NATURAL CONVECTION: Application of dimensional analysis for free convection- physical significance of Grashoff number; use of correlations free convection from or to vertical, horizontal and inclined flat plates, vertical and horizontal cylinders and spheres, Numerical problems.

7 Hours

PART - B

UNIT - 5

FORCED CONVECTIONS: Applications of dimensional analysis for forced convection. Physical significance of Reynolds, Prandtl, Nusselt and Stanton numbers. Use of various correlations for hydro dynamically and thermally developed flows inside a duct use of correlations for flow over a flat plate, over a cylinder and sphere. Numerical problems.

6 Hours

UNIT - 6

HEAT EXCHANGERS: Classification of heat exchangers; overall heat transfer coefficient, fouling and fouling factor; LMTD, Effectiveness-NTU methods of analysis of heat exchangers. Numerical problems.

6 Hours

UNIT - 7

CONDENSATION AND BOILING: Types of condensation (discussion only) Nusselt's theory for laminar condensation on a vertical flat surface; use of correlations for condensation on vertical flat surfaces, horizontal tube and horizontal tube banks; Reynolds number for condensate flow; regimes of pool boiling pool boiling correlations. Numerical problems.

Mass transfer, definition and terms used. Mass transfer analysis, Ficks first Law of diffusion (No numerical)

7 Hours

UNIT - 8

RADIATION HEAT TRANSFER: Thermal radiation; definitions of various terms used in radiation heat transfer; Stefan-Boltzman law, Kirchoff's law, Planck's law and Wein's displacement law. Radiation heat exchange between two parallel infinite black surfaces, between two parallel infinite gray surfaces; effect of radiation shield; intensity of radiation and solid angle; Lambert's law; radiation heat exchange between two finite surfaces-configuration factor or view factor. Numerical problems.

7 Hours

TEXT BOOKS:

1. **Heat & Mass transfer -** by Tirumaleshwar, Pearson education 2006
2. **Heat transfer - A basic approach –** Ozisik, Tata McGraw Hill 2002

REFERENCE BOOKS:

1. **Heat transfer, a practical approach -** Yunus A- Cengel Tata Mc GrawHill
2. **Principles of heat transfer** - Kreith Thomas Learning 2001
3. **Fundamentals of heat and mass transfer -** Frenk P. Incropera and David P. Dewitt, John Wiley and son's.
4. **Heat transfer -** P.K. Nag, Tata McGraw Hill 2002.

AUTOMOBILE ENGINEERING LAB II

Subject Code	:	**06AUL67**	IA Marks	:	25
No. of Practical Hrs/ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

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 – one each)
2. Trouble shooting charts for major parts like clutch, gear box, differential, brakes, wheels with tyres, steering system and suspension.
3. Testing and servicing of electrical components like battery, starting system, ignition system, central locking system, lighting system, alternator. Experiments on microprocessors related to automobiles
4. Dismantle and assemble of major systems (clutch system, Gear boxes, Propellar shaft, Differential, Front and Rear axles, brake system, steering system and suspension system) and identifying remedies (like backlash adjustment, brakes adjustment, bleeding of brakes) for the possible problems based on trouble shooting charts.
5. Draw sketch of seating arrangements, seats for commercial vehicle and study the comfort levels provided for driver and passengers.
6. Draw sketches of different mechanisms of door, seat adjustments mechanisms.

CAD/CAM/CAE LAB

Subject Code	:	**06AUL68**	IA Marks	:	25
No. of Practical Hrs/ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

1. Modeling – Introduction.

Development of 2D and 3D geometric modeling using anyone parametric software.

Exercises on automotive components - 3D modeling (1 – 4 components)
Softwares – Pro-E, CATIA, UNIGRPHICS etc.

2. Analysis – FEA (Preprocessor, solver, post processor)
   a) Exercise involving simple structures.

b) Exercise involving automotive components modeled in chapter 1. (Tensile, Compressive, Torsion or Combined loading, thermal loading) – Static and dynamic loading conditions.
Softwares – Ansys/ Unisys/ Nastran/ Patran and LS Dyna. etc.

c) Validation of result with analytical solution.

3. Introduction to CNC programming(G codes & M codes)

a)Turning b) Milling
Simple Exercises (2 – 4 Nos.) using CNC Simulator.

ELECTIVES-I (Group A)

AUTOMOTIVE AIR CONDITIONING

Subject Code	:	**06ME661**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART -A

UNIT - 1

AIR CONDITIONING FUNDAMENTALS: Basic air conditioning system, Air conditioning principles, Air-conditioning types, temperature and pressure fundamentals, types of compressors and refrigerants.

4 Hours

UNIT - 2

AIR CONDITIONING SYSTEM: Classification, layouts, central *I* unitary air conditioning systems, components like compressors, evaporators, condensers, expansion devices, fan blowers, heating systems, Automotive heaters, Types, Heater Systems, Air conditioning protection, Engine protection.

11 Hours

UNIT - 3

LOAD ANALYSIS: Outside& inside design consideration, factors forming the load on refrigeration & air conditioning systems, cooling & heating load calculations, load calculations for automobiles, effect of air conditioning load on engine performance.

11 Hours

PART - B

UNIT - 4

AIR DISTRIBUTION SYSTEMS: Distribution duct system, sizing, supply *I* return ducts, type of grills, diffusers, ventilation, air noise level, layout of duct systems for automobiles and their impact on load calculations.

8 Hours

UNIT - 5

AIR ROUTING & TEMPERATURE CONTROL: Objectives, evaporator air flow, through the re-circulating unit, automatic temperature control, duct system, controlling flow, vacuum reserve, testing the air control of air handling systems

6 Hours

UNIT - 6

AIR CONDITIONING SERVICE: Air conditioner maintenance & service-causes of air conditioner failure, leak testing guide, discharging the system, Evacuating the system, charging the system, servicing heater system, removing & replacing components, trouble shooting of air conditioning system, compressor service, methods of dehydration, charging & testing.

8 Hours

UNIT - 7

AIR CONDITIONING CONTROL: Common control such *as* thermostats, humidistat, control dampers, pressure cut outs, relays

4 Hours

TEXT BOOKS:

1. **Automotive Heating & Air Conditioning -** Mark Schnubel, Thomson Delmar Learning, 3rd edition, NY.
2. **Automotive Air Conditioning -** William H. Crouse & Donald L. Anglin, McGrawHill, Inc., 1990.
3. ASHRAE Handbook - 1985 Fundamentals

REFERENCE BOOKS:

1. **Automotive Air – conditioning** - Boyace H. Dwiggins,
2. **HVAC Fundamentals -** SamSugarman, Fairmont Press, ISBN0-88173-489-6.
3. **Automotive Air Conditioning -** Paul Weisler, Reston PublishingCo.Inc.1990.
4. **Automotive Air Conditioning -** Paul Lung, C.B, S. Publisher & Distributor, Delhi.
5. **Automotive Air Conditioning -** MacDonald K. L TheodoreAudel series, 1978

COMPOSITE MATERIALS

Subject Code	:	**06AU662**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION TO COMPOSITE MATERIALS: Definition, classification and characteristics of composite materials – fibrous composites, laminated composites, particulate composites. Properties and types of Reinforcement and Matrix materials.

6 Hours

UNIT - 2

FIBRE REINFORCED PLASTIC PROCESSING: Lay up and curing, fabricating process – open and closed mould process – hand lay up techniques – structural laminate bag molding, production procedures for bag molding – filament winding, pultrusion, pulforming, thermo – forming, injection, injection molding, liquid molding, blow molding.

10 Hours

UNIT - 3

FABRICATION OF COMPOSITES: Cutting, machining, drilling, mechanical fasteners and adhesive bonding, joining, computer aided design and manufacturing, tooling, fabrication equipment.

8 Hours

PART - B

UNIT - 4

APPLICATION OF COMPOSITES: Automobile, Aircrafts, missiles, Space hardware, Electrical and electronics, marine, recreational and Sports equipment, future potential of composites.

2 Hours

UNIT - 5

METAL MATRIX COMPOSITES: Reinforcement materials, types, characteristics and selection base metals selection – Need for production MMC's and its application

10 Hours

UNIT - 6

FABRICATION PROCESS FOR MMC'S: Powder metallurgy technique, liquid metallurgy technique and secondary processing, special fabrication techniques

8 Hours

UNIT - 7

STUDY PROPERTIES OF MMC'S: Physical Mechanical, wear, machinability and other properties. Effect of size, shape and distribution of particulate on properties.

6 Hours

UNIT - 8

INTRODUCTION TO SHAPE MEMORY ALLOYS

2 Hours

TEXT BOOKS:

1. **Composite Science and Engineering** - K.K.Chawla Springer Verlag, 1998.
2. **Introduction to composite materials -** Hull and Clyne, Cambridge University Press, 2nd edition, 1990

REFERENCE BOOKS:

1. **Composite materials hand book -** Meing Schwaitz, 1984, McGraw Hill Book Company.
2. **Mechanics of Composite Materials -** Robert M. Jones, McGraw Hill Kogakusha Ltd.
3. **Forming Metal -** Hand Book, 9th edition, ASM Hand book, V15. 1988, P327- 338.
4. **Mechanics of composites** - Artar Kaw, CRC Press. 2002.
5. **Composite Materials -** S.C. Sharma Narora Publishing House, 2000
6. **Principles of Composite Material mechanics -** Ronald. F. Gibron, McGraw Hill International, 1994

MECHANICAL VIBRATION AND VEHICLE DYNAMICS

Subject Code	:	**06AU663**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

UNDAMPED FREE VIBRATION: Introduction, Energy method, Newton's method and D'Alembert's principle Single degree of freedom system, undamped free vibration - Natural frequency of free vibration, Rayleigh's method, stiffness of spring elements, effects of spring mass.

6 Hours

UNIT - 2

DAMPED FREE VIBRATION: Single degree of freedom systems, different types of damping, concept of critical damping and its importance, response study of viscous damped systems for cases of under damping and over damping, logarithmic decrement.

6 Hours

UNIT - 3

FORCED VIBRATION: Single degree of freedom systems, steady state solution with viscous damping due to harmonic force solution by complex algebra, concept of response, reciprocating an rotating unbalance, vibration isolation - transmissibility ratio, energy dissipated by damping equivalent viscous damping, Structural damping, sharpness of resonance, base excitation.

7 Hours

UNIT - 4

VIBRATION MEASURING INSTRUMENTS AND WHIRLING OF SHAFTS: Accelerometers and vibrometers, whirling of shafts with and without air damping, discussion of speeds above and below critical speeds.

6 Hours

PART - B

UNIT - 5

SYSTEMS WITH TWO DEGREE OF FREEDOM: Introduction, principle modes and normal modes, co-ordinate coupling, generalised and principle co-ordinate, free vibrations in terms of initial conditions, Lagrange's equation, semi-definite systems, forced oscillations, harmonic

excitation. Applications: Vehicle suspension, Dynamic vibration absorber, dynamics of reciprocating engines.

6 Hours

UNIT - 6

VEHICLE VIBRATION AND HUMAN COMFORT: Vehicle vibration with single degree of freedom free vibration, forced vibration, vibration due to road roughness, vibration due to engine unbalance, transmissibility of engine mounting vibration with two degree of freedom, free vibration, compensated suspension systems forced vibration. Human comfortable criteria

7 Hours

UNIT - 7

NUMERICAL METHODS FOR MULTI DEGREE OF FREEDOM SYSTEMS: Introduction, influence coefficients, Maxwell's reciprocal theorem, Dunkerley's equation, orthogonality principle, method of matrix iteration- method of determination of all the natural frequencies using sweeping matrix and orthogonality principle, Holzer's method for systems with free, fixed free and fixed ends, stodola method, Rayleigh Ritz method for beam vibration

8 Hours

UNIT - 8

TYRE MECHANICS: Testing and modeling, Vehicle control – low speed cornering and static steering – Ackerman steering geometry, steady –state cornering – steering factors, vehicle control parameters (under steer, neutral steer and over steer), roll steer, compliance steer, ride steer, slip angle steer, steady state handling – lateral acceleration gain, characteristic speed, yaw velocity gain, critical speed.

6 Hours

TEXT BOOKS:

1. Mechanical Vibration - G.K.Grover, Nemchand & Brothers,1989
2. Mechanical Vibration – V.P.Singh, Dhanpat Rai & Company Pvt. Ltd., 3rd Edition, 2006.
3. Fundamentals of vehicle dynamics - Thomas D. Gillespie, SAE USA 1992

REFERENCE BOOKS:

1. Vibration Theory Mechanical Vibrations- S.S.Rao, Pearson Edu.Inc., 4th Edition, 2003
2. Theory & Problems of Mechanical Vibration - William W. Seto, McGrawHill (schaum's outline series)
3. Problems in Automobile Mechanics - N.K.Giri, Khanna Pub.2004

4. Mechanics of Pneumatic Tyre - S.K.Clark, Prentice Hall
5. Mechanical Vibration Analysis- P.Srinivasan, TMH
6. Vibration and Noise for engineers - Kewal Pujara & R.S Pujara, Dhanpat Rai

CAD/CAM/CAE

Subject Code	:	**06AU664**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Role of computers in design and manufacturing. Influence of computers in manufacturing environment. Product cycle in conventional and computerized manufacturing environment. Introduction to CAD, Introduction to CAM. Advantages and disadvantages of CAD and CAM.

3 Hours

UNIT - 2

HARDWARE FOR CAD: Basic Hardware structure, Working principles, usage and types of hardware for CAD – Input devices, output devices, memory, CPU, hardcopy and storage devices.

6 Hours

UNIT - 3

COMPUTER GRAPHICS: Software configuration of a graphic system, function of graphics package, construction of geometry, wire frame and solid modeling, Geometry transformation – two dimensional and three dimensional transformation, translation, scaling, reflection, rotation, CAD/CAM integration. Desirable modeling facilities. Introduction to exchange of modeling data – Basic features of IGES, STEP, DXF, DMIS

7 Hours

UNIT - 4

INTRODUCTION TO FINITE ELEMENT ANALYSIS: Introduction, basic concepts, discretization, element types, nodes and degrees of freedom mesh generation, constraints, loads, preprocessing, application to static analysis.

5 Hours

UNIT - 5

NC, CNC, DNC TECHNOLOGIES: NC, CNC, DNC, modes, NC elements, advantages and limitations of NC, CNC. Functions of computer in DNC

5 Hours

PART - B

UNIT - 6

CNC TOOLING: Turning tool geometry, milling tooling system, tool presetting, ATC, work holding.

4 Hours

UNIT - 7

CAM PROGRAMMING: Overview of different CNC machining centers, CNC turning centers, high speed machine tools.

3 Hours

UNIT - 8

CNC PROGRAMMING: Part program fundamentals-steps involved in development of a part program. Manual part programming, milling, turning, turning center programming.

10 Hours

UNIT - 9

INTRODUCTION TO ROBOTICS: Introduction, robot configuration, robot motion, programming of robots, end effectors work cell, control and interlock, robot sensor, robot applications.

9 Hours

TEXT BOOKS:

1. **CAD/CAM Principles and Application -** by P.N. Rao, Tata McGraw Hill.
2. **CAD/CAM** - by Groover, Tata McGraw Hill.

REFERENCE BOOKS:

1. **Introduction to the Design and Analysis of Algorithms** – S.E. Goodman, S.T. Headetmiemi, McGraw Hill Book Company – 1988.
2. **Principles of Interactive Computer Graphics -** by Newman and Sproull, Tata McGraw Hill, 1995.
3. **NC Machine Programming and Software Design** – Chno-Hwachang, Michel. A. Melkanoff, Prentice Hall, 1989.
4. **Numetical Control and CAM -** Pressman RS and Williams JE, Johnwiley.
5. **Computer Graphics** by Steven Harrington, McGraw Hill Book Co.

5. **CAD-CAM** - by Chris McMahon & Jimmie Browne – Pearson education Asia 2001.
6. **CAD/CAM** – Ibrahim Zeid, Tat McGraw Hill, 1999.
7. **Computer Aided Manufacturing -** by P.N. Rao, N.K. Tewari and T.K. Kundra Tata McGraw Hill 1999.
8. **Introduction to FEM** - T Chandra patta Ashok D Bebgundu.

NON - TRADITIONAL MACHINING

Subject Code	:	**06AU665**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: History, Classification, comparison between conventional and Non-conventional machining process selection.

5 Hours

UNIT - 2

ULTRA SONIC MACHINE (USM): Introduction, equipment, tool materials & tool size, abrasive slurry, cutting tool system design:- Effect of parameter: Effect of amplitude and frequency and vibration, Effect of abrasive grain diameter, effect of applied static load, effect of slurry, tool & work material, USM process characteristics: Material removal rate, tool wear, Accuracy, surface finish, applications, advantages & Disadvantages of USM.

8 Hours

UNIT - 3

ABRASIVE JET MACHINING (AJM): Introduction, Equipment, Variables in AJM: Carrier Gas, Type of abrasive, size of abrasive grain, velocity of the abrasive jet, mean number. abrasive particles per unit volume of the carrier gas, work material, stand off distance (SOD), nozzle design, shape of cut. Process characteristics-Material removal rate, Nozzle wear, Accuracy & surface finish. Applications, advantages & Disadvantages of AJM. Water Jet Machining **:** Principal, Equipment, Operation, Application, Advantages and limitations of water Jet machinery

7 Hours

UNIT - 4

ELECTROCHEMICAL MACHINING (ECM): Introduction, study of ECM machine, elements of ECM process: Cathode tool, Anode work piece,

source of DC power, Electrolyte, chemistry of the process, ECM Process characteristics – Material removal rate, Accuracy, surface finish, ECM Tooling: ECM tooling technique & example, Tool & insulation materials, Tool size Electrolyte flow arrangement, Handling of slug, Economics of ECM, Applications such as Electrochemical turning, Electrochemical Grinding, Electrochemical Honing, deburring, Advantages, Limitations.

6 Hours

PART - B

UNIT - 5

CHEMICAL MACHINING (CHM): Introduction, elements of process, chemical blanking process : Preparation of work piece, preparation of masters, masking with photo resists, etching for blanking, accuracy of chemical blanking, applications of chemical blanking, chemical milling (contour machining): process steps –masking, Etching, process characteristics of CHM: material removal rate accuracy, surface finish, Hydrogen embrittlement, advantages & application of CHM.

6 Hours

UNIT - 6

ELECTRICAL DISCHARGE MACHINING (EDM): Introduction, machine, mechanism of metal removal, dielectric fluid, spark generator, EDM tools (electrodes) Electrode feed control, Electrode manufacture, Electrode wear , EDM tool design choice of machining operation electrode material selection, under sizing and length of electrode , machining time. Flushing; pressure flushing, suction flushing, side flushing, pulsed flushing synchronized with electrode movement, EDM process characteristics: metal removal rate, accuracy surface finish, Heat Affected Zone. Machine tool selection, Application EDM accessories / applications, electrical discharge grinding, Traveling wire EDM.

8 Hours

UNIT - 7

PLASMA ARC MACHINING (PAM): Introduction, equipment non-thermal generation of plasma, selection of gas, Mechanism of metal removal, PAM parameters, process characteristics. Safety precautions, Applications, Advantages and limitations.

5 Hours

UNIT - 8

LASER BEAM MACHINING (LBM): Introduction, equipment of LBM mechanism of metal removal, LBM parameters, Process characteristics, Applications, Advantages & limitations.

ELECTRON BEAM MACHINING (EBM): Principles, equipment, operations, applications, advantages and limitation of EBM.

7 Hours

TEXT BOOKS:

1. **Modern Machining Process -** by Pandey and Shah, TATA McGraw Hill 2000
2. **New Technology -** by Bhattacharya, 2000

REFERENCE BOOKS:

1. **Production Technology –**HMT, TATA McGraw Hill. 2001
2. **Modern Machining Process** – Aditya, 2002
3. **Non-Conventional Machining -** P.K.Mishra, The Institution of Engineers (India) Test book series, Narosa Publishing House – 2005.
4. **Metals Handbook -** Machining volume 16 Joseph R. Davis (Editor), American Society of Metals (ASM)

STATISTICAL QUALITY CONTROL

Subject Code	:	**06ME666**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: The Meaning of Quality and Quality Improvement; Brief History of Quality Methodology; Statistical Methods for Quality Control and Improvement; Total Quality Management (quality philosophy, links between quality and productivity, quality costs legal aspects of quality implementing quality improvement).

6 Hours

UNIT - 2

MODELING PROCESS QUALITY: Mean, Median, Mode, Standard deviation, Calculating area, The Deming funnel experiment, Normal distribution tables, finding the Z score, Central limit theorem.

6 Hours

UNIT - 3

METHODS AND PHILOSOPHY OF STATISTICAL PROCESS CONTROL: Chance and assignable causes, Statistical Basis of the Control

Charts (basic principles, choices of control limits, significance of control limits, sample size and sampling frequency, rational subgroups, analysis of pattern on control charts, warning limits, Average Run Length-ARL)

6 Hours

UNIT - 4

CONTROL CHARTS FOR VARIABLES: Control Charts for X-Bar and R charts, Type I and Type II errors, the probability of Type II error. Simple Numerical Problems

8 Hours

PART - B

UNIT - 5

PROCESS CAPABILITY: The foundation of process capability, Natural Tolerance limits, c_p – process capability index, c_{pk}, p_p – process performance index, summary of process measures. Numerical problems

6 Hours

UNIT - 6

CONTROL CHARTS FOR ATTRIBUTES: Binomial distribution, Poisson distribution (from the point of view of Quality control) Control Chart for Fraction Nonconforming, Control Chart for number Nonconforming, Control Charts for Nonconformities or Defects, Control Chart for Number of non conformities per unit. Numerical problems

7 Hours

UNIT - 7

LOT-BY-LOT ACCEPTANCE SAMPLING FOR ATTRIBUTES: The acceptance sampling problem, single sampling plan for attributes, Double, Multiple, and sequential sampling, AOQL, LTPD, OC curves, Military Standard 105E, the Dodge-Romig sampling plans. Numerical problems

7 Hours

UNIT - 8

CUMULATIVE-SUM (CUSUM) & EXPONENTIALLY WEIGHTED MOVING AVERAGE (EWMA) CONTROL CHARTS: CUSUM Control Chart (basic principles of the chart for monitoring the process mean); EWMA control chart (EWMA control chart for monitoring process mean), design of an EWMA control chart.

6 Hours

TEXT BOOKS:

1. **Statistical Quality Control -** E.L. Grant and R.S. Leavenworth, 7th edition, McGraw- Hill publisher.

2. **Statistical Quality Control -** RC Gupta, Khanna Publishers, New Delhi, 2005

REFERENCE BOOKS:

1. **Statistical Process Control and Quality Improvement -** Gerald M. Smith, Pearson Prentice Hall. ISBN 0 – 13-049036-9.
2. **Statistical Quality Control for Manufacturing Managers -** W S Messina, Wiley & Sons, Inc. New York, 1987
3. **Statistical Quality Control -** Montgomery, Douglas, 5th Edition, John Wiley & Sons, Inc. 2005, Hoboken, NJ (ISBN 0-471-65631-3).
4. **Principles of Quality Control -** Jerry Banks, Wiley & Sons, Inc. New York.

MODELLING AND FINITE ELEMENT ANALYSIS

Subject Code	:	**06AU667**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Equilibrium equations in elasticity subjected to body force, traction forces, stress strain relations for plane stress and plane strain, Boundary conditions, Initial conditions, Euler's Lagrange's equations of bar, beams, Principal of a minimum potential energy, principle of virtual work, Rayleigh-Ritz method, Galerkins method., Guass elimination Numerical integration.

7 Hours

UNIT - 2

BASIC PROCEDURE: General description of Finite Element Method, Engineering applications of finite element method, Discretization process; types of elements 1D, 2D and 3D elements, size of the elements, location of nodes, node numbering scheme, half Bandwidth, Stiffness matrix of bar element by direct method, Properties of stiffness matrix, Preprocessing, post processing.

7 Hours

UNIT - 3

INTERPOLATION MODELS: Introduction, Polynomial form of interpolation functions- linear, quadratic and cubic, Simplex, Complex, Multiplex elements, Selection of the order of the interpolation polynomial,

Convergence requirements, 2D Pascal triangle, Linear interpolation polynomials in terms of global coordinates of bar, triangular (2D simplex) elements, Linear interpolation polynomials in terms of local coordinates of bar, triangular (2D simplex) elements, CST element.

6 Hours

UNIT - 4

HIGHER ORDER AND ISOPARAMETRIC ELEMENTS: Lagrangian interpolation, Higher order one dimensional elements- quadratic, Cubic element and their shape functions, properties of shape functions, Truss element, Shape functions of 2D quadratic triangular element in natural coordinates, 2D quadrilateral element shape functions – linear, quadratic, Biquadric rectangular element(Nodded quad lateral element), Shape function of beam element, Hermite shape function of beam element.

6 Hours

PART - B

UNIT - 5

DERIVATION OF ELEMENT STIFFNESS MATRICES AND LOAD VECTORS: Direct method for bar element under axial loading, trusses, beam element with concentrated and distributed loads, B matrices, Jacobian, Jacobian of 2D triangular element, quad lateral, Consistent load vector, Numerical integration.

7 Hours

UNIT - 6

HEAT TRANSFER PROBLEMS: Steady state heat transfer, 1D heat conduction governing equation, boundary conditions, One dimensional element, Functional approach for heat conduction, Galerkin approach for heat conduction, heat flux boundary condition, 1D heat transfer in thin fins.

6 Hours

UNIT - 7

PPLICATIONS I: Solution of bars, stepped bars, plane trusses by direct stiffness method. Solution for displacements, reactions and stresses by using elimination approach, penalty approach.

6 Hours

UNIT - 8

APPLICATIONS II: Solution of beam problems, heat transfer 1D problems with conduction and convection.

7 Hours

TEXT BOOKS:

1. **Finite Elements in engineering -** Chandrupatla T. R., 2nd Edition, PHI,2000
2. **Finite Element Method in Engineering -** Rao, S. S., the 4th Edition, Elsevier, 2006.

REFERENCE BOOKS:

1. **Textbook of Finite Element Analysis** - P.Seshu, –PHI, 2004.
2. **Finite Element Method, McGraw** - J.N.Reddy, –Hill International Edition.
3. **Finite Element Analysis** - C.S.Krishnamurthy, –Tata McGraw Hill Publishing Co.Ltd, New Delhi, 1995.

VII SEMESTER

CONTROL ENGINEERING

Subject Code	:	**06ME71**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Concept of automatic controls, open and closed loop systems, concepts of feedback, requirement of an ideal control system. Types of controllers– Proportional, Integral, Proportional Integral, Proportional Integral Differential controllers.

6 Hours

UNIT - 2

MATHEMATICAL MODELS: Transfer function models, models of mechanical systems, models of electrical circuits, DC and AC motors in control systems, models of thermal systems, models of hydraulic systems. Pneumatic system. Analogous systems: Force voltage, Force current.

6 Hours

UNIT - 3

BLOCK DIAGRAMS AND SIGNAL FLOW GRAPHS: Transfer Functions definition, function, blocks representation of system elements, reduction of block diagrams, Signal flow graphs: Mason's gain formula.

7 Hours

UNIT - 4

TRANSIENT AND STEADY STATE RESPONSE ANALYSIS: Introduction, first order and second order system response to step, ramp and impulse inputs, concepts of time constant and its importance in speed of response. System stability: Routh's-Hurwitz Criterion.

7 Hours

PART - B

UNIT - 5

FREQUENCY RESPONSE ANALYSIS: Polar plots, Nyquist Stability Criterion, Stability Analysis, Relative stability concepts, phase and gain margin, M & N circles.

7 Hours

UNIT - 6

FREQUENCY RESPONSE ANALYSIS USING BODE PLOTS: Bode attenuation diagrams, Stability Analysis using Bode plots, Simplified Bode Diagrams.

7 Hours

UNIT - 7

ROOT LOCUS PLOTS: Definition of root loci, general rules for constructing root loci, Analysis using root locus plots.

7 Hours

UNIT - 8

CONTROL ACTION AND SYSTEM COMPENSATION: Series and feedback compensation, Physical devices for system compensation.

5 Hours

TEXT BOOKS:

1. **Modern Control Engineering -** Katsuhiko Ogata, Pearson Education, 2004.
2. **Control Systems Principles and Design** - M. Gopal, TMH, 2000

REFERENCE BOOKS:

1. **Feedback Control Systems -** Schaum's series 2001.
2. **Control Systems -** I.J. Nagarath & M. Gopal, New age International publishers 2002.
3. **Automatic Control Systems** – B.C. Kuo, F. Golnaraghi, John Wiley & Sons, 2003.

VEHICLE BODY ENGINEERING AND SAFETY

Subject Code	:	**06AU72**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Classification of coachwork type: styling forms, coach and bus body style, layout of cars, buses and coach with different seating and loading capacity, commercial vehicle types, Vans and Pick ups. Terms used in body building construction, Angle of approach, Angle of departure, Ground clearance, Cross bearers, Floor longitudes, posts, seat rail, waist rail, cant rail, Roof stick, Roof longitude, Rub rail, skirt rail, truss panel, wheel arch structure, wheel arch, post diagonals, gussets

8 Hours

UNIT - 2

VEHICLE BODY MATERIALS: Aluminium alloys, Steel, alloy steels, plastics, Metal matrix composites, structural timbers - properties, glass reinforced plastics and high strength composites, thermoplastics, ABS and styrenes, load bearing plastics, semi rigid PUR foams and sandwich panel construction. Paints adhesives and their properties, corrosion and their prevention.

6 Hours

UNIT - 3

AERODYNAMICS: Basics, Vehicle drag and types, Various types of forces and moments, effects of forces and moments, various body optimization techniques for minimum drag, Principle of wind tunnel technology, flow visualization techniques, tests with scale models, aerodynamic study for heavy vehicles

7 Hours

UNIT - 4

LOAD DISTRIBUTION: Type of body structures, Vehicle body stress analysis, vehicle weight distribution, Calculation of loading for static loading, symmetrical, longitudinal loads, side loads, stress analysis of bus body structure under bending and torsion.

6 Hours

PART - B

UNIT - 5

INTERIOR ERGONOMICS: Introduction, Seating dimensions, Interior ergonomics, ergonomics system design, seat comfort, suspension seats, split frame seating, back passion reducers, dash board instruments, electronic displays, commercial vehicle cabin ergonomics, mechanical package layout, goods vehicle layout. Visibility, regulations, drivers visibility, methods of improving visibility, Window winding and seat adjustment mechanisms.

6 Hours

UNIT - 6

VEHICLE STABILITY: Introduction, Longitudinal, lateral stability, vehicle on a curvilinear path, critical speed for toppling and skidding. Effect of operating factors on lateral stability, steering geometry and stabilization of steerable wheels, mass distribution and engine location on stability.

7 Hours

UNIT - 7

NOISE AND VIBRATION: Noise characteristics, Sources of noise, noise level measurement techniques, Body structural vibrations, chassis bearing vibration, designing against fatigue, methods of noise suppression.

6 Hours

UNIT - 8

SAFETY: Impact protection basics, Physics of impact between deformable bodies, Design for crash worthiness, occupant and cargo restraint, passive restraint systems, side impact analysis, bumper system, energy absorbent foams, laws of mechanisms applied to safety.

6 Hours

TEXT BOOKS:

1. **Body Engineering** - Sydney F Page, Chapman & Hall Ltd, London, 1956
2. Giles J Pawlowski - **Vehicle body engineering Business** books limited, 1989
3. **Vehicle body layout and analysis** - John Fenton, Mechanical Engg. Publication ltd, London.

REFERENCE BOOKS:

1. **Hand book on vehicle body design** – SAE publication
2. **Automotive chassis** - by P.M. Heldt, Chilton & Co, 1970
3. **Vehicle Safety 2002** - Cornwell press, Townbridge, UK, ISBN 1356 -1448.
4. **Redesign of bus bodies** – part I & part II – CIRT pune (Report), 1983
5. **Aerodynamics of Road Vehicles**, Ed W.H. Hucho, 4th Edition, Butter worths 1987
6. **Road Vehicle Aerodynamics** - Scibor-Rylski A.J, Pentech press, London 2nd Edition 1984
7. **Low Speed Wind Tunnel Testing** - Rae W.H & Pope A, Wiley & Sons, USA 1984 out of print
8. When it comes to the Crunch. The Mechanics of the Car Collisions (Body work maintenance and repair), Noel W. Murray, by Paul and Browne

AUTOMOTIVE AIR POLLUTION AND CONTROL

Subject Code	:	**06AU73**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART -A

UNIT - 1

LAWS AND REGULATIONS: 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)

4 Hours

UNIT - 2

MECHANISM OF POLLUTANT FORMATION IN ENGINES

INTRODUCTION: NITROGEN OXIDES, formation of nitrogen oxides, kinetics of NO formation, formation of NO_2, NO formation in spark ignition engines, NOx formation, in compression ignition engines

CORBONMONOXIDE

UNBURNED HYDROCARBON EMISSIONS: Back ground, flame quenching and oxidation fundamentals, 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

10 Hours

UNIT - 3

POLLUTION CONTROL TECHNIQUES: Pollution control measures inside SI Engines & 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

8 Hours

UNIT - 4

INFLUENCE OF FUEL PROPERTIES: Effect of petrol, Diesel Fuel, Alternative Fuels and lubricants on emissions.

5 Hours

PART - B

UNIT - 5

POST COMBUSTION TREATMENTS: Available options, physical conditions & exhaust gas compositions before treatment, Catalytic mechanism, Thermal Reactions, Installation of catalyst in exhaust lines, catalyst poisoning, catalyst light-off, NO_x treatment in Diesel Engines, particulate traps, Diesel Trap oxidizer.

8 Hours

UNIT - 6

EFFECT OF AIR POLLUTION: Effect of air pollution on Human Health, Effect of air pollution on animals, Effect of air pollution on plants

4 Hours

UNIT - 7

SAMPLING PROCEDURES

COMBUSTION GAS SAMPLING: continuous combustion, combustion in a cylinder

PARTICULATE SAMPLING: soot particles in a cylinder, soot in exhaust tube, Sampling Methods- sedimentations, filtration, and impinge methods-electrostatic precipitation thermal precipitation, centrifugal methods Determination of mass concentration analytical methods- volumetric-gravimetric-calorimetric methods etc.

4 Hours

UNIT - 8

INSTRUMENTATION FOR POLLUTION MEASUREMENTS: NDIR analyzers, Gas chromatograph, Thermal conductivity and flame ionization detectors, Analyzers for NO_x, Orsat apparatus, Smoke measurement, comparison method, obscuration method, ringelmann chart, Continuous filter type smokemeter, Bosch smoke meter, Hartridge smoke meter

9 Hours

TEXT BOOKS:

1. **Automobiles and Pollution** - Paul Degobert (SAE)
2. **Internal combustion engine fundamentals** – John B. Heywood, McGraw-Hill, 1998

REFERANCE BOOKS:

1. **Air pollution** – M.N. Rao, and H. V. Rao
2. **Internal Combustion Engines:** V. Ganesan
3. **Automotive Emission Control Division**, Crouse William, McGraw-Hill. 1980
4. **Combustion Generated Air Pollutions,** Ernest, S., Starkman, Plenum Press, 1980.
5. **Engine emissions, Pollutant Formation and Measurement,** George, Springer and Donald J.Patterson, Plenum press, 1972.
6. **Internal Combustion Engines and Air Pollution,** Obert, E.F., Intext Educational Publishers, 1980.

OPERATIONS RESEARCH

Subject Code	:	**06ME74**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Linear programming, Definition, scope of Operations Research (O.R) approach and limitations of OR Models, Characteristics and phases of OR Mathematical formulation of L.P. Problems. Graphical solution methods.

6 Hours

UNIT - 2

LINEAR PROGRAMMING PROBLEMS: The simplex method - slack, surplus and artificial variables. Concept of duality, two phase method, dual simplex method, degeneracy, and procedure for resolving degenerate cases. Revised simplex method

7 Hours

UNIT - 3

TRANSPORTATION PROBLEM: Formulation of transportation model, Basic feasible solution using different methods, Optimality Methods, Unbalanced transportation problem, Degeneracy in transportation problems, Applications of Transportation problems. Assignment Problem: Formulation, unbalanced assignment problem, Traveling salesman problem.

7 Hours

UNIT - 4

SEQUENCING: Johnsons algorithm, n - jobs to 2 machines, n jobs 3machines, n jobs n machines without passing sequence. 2 jobs n machines with passing. Graphical solutions

6 Hours

PART - B

UNIT - 5

QUEUING THEORY: Queuing system and their characteristics. The M/M/1 Queuing system, Steady state performance analyzing of M/M/ 1 and M/M/C queuing model.

6 Hours

UNIT - 6

PERT-CPM TECHNIQUES: Network construction, determining critical path, floats, scheduling by network, project duration, variance under probabilistic models, prediction of date of completion, crashing of simple networks.

7 Hours

UNIT - 7

GAME THEORY: Formulation of games, two person-Zero sum game, games with and without saddle point, Graphical solution (2x n, m x 2 game), dominance property.

7 Hours

UNIT - 8

INTEGER PROGRAMMING: Gommory‘s technique, branch and bound algorithm for integer programming problems, zero one algorithm

6 Hours

TEXT BOOKS:

1. **Operations Research and Introduction -** Taha H. A. Macmillan edition
2. **Operations Research: Principles and practice -** Ravindran, Phillips & Solberg, Wiley India lts, 2nd Edition 2007.

REFERENCE BOOKS:

1. **Operation research -** AM Natarajan, P.Balasubramani, ATamilaravari Pearson 2005
2. **Introduction to operation research -** Hiller and liberman, Mc Grew Hill. 5th edition 2001.
3. **Operations Research -** S. D. Sharma, Kedarnath Ramnath & Co 2002.

SERVICE AND RECONDITIONING LAB

Subject Code	:	**06AUL77**	IA Marks	:	25
No. of Practical Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

SERVICE LAB

1. Maintenance/service charts for different parts of chassis, suspension and transmission.
2. Head light beam testing for two & four wheeler.
3. Braking distance test for four wheeler.
4. Study of tyre retreading, tubeless tyre puncture repairs, painting of vehicles.
5. Sketch the layout of a service station and bus depot mentioning the various equipments required including the space needed.
6. Study and practice on Computerized wheel balancing machine, computerized wheel alignment machine.
7. Study of two wheeler performance on two wheeler chassis dynamometer.

RECONDITIONING LAB

1. Study and practice on Connecting Rod alignment machine, Valve Re-facing machine, Cylinder re-boring machine, Cylinder honing machine and Crankshaft grinding machine.
2. Study and practice on Brake drum skimming lathe.
3. Visit to industry:

NOTE:

Students have to compulsorily visit at least Five Automobile related Industries of which One must be any one Automobile Manufacturing Plant. Students have to submit a report on their Industrial Visit.

ENGINE TESTING LAB

Subject Code	:	**06AUL78**	IA Marks	:	25
No. of Practical Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

1. Testing of multi cylinder SI / CI engines for performance calculate BP, Thermal, volumetric efficiencies, and BSFC with emission testing.

2. Study one engine performance by changing parameters like valve timing, ignition timing, carburetor nozzle jet.

3. Conduct Morse test for finding FP, IP, Indicated thermal efficiency and Mechanical efficiency.

4. Study of engine performance using alternate fuels like alcohol blends/ bio diesel / LPG.

5. Performance test on computerized IC engine test rig.

6. Study and testing of fuel injection pumps and injectors, MPFI.

7. Tuning of engines. Study and practice on computerized engine analyzer.

ELECTIVE-II (GROUP B)

TWO AND THREE WHEELED VEHICLES

Subject Code	:	**06AU751**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

THE POWER UNIT: Types of engines for two wheelers, advantages and disadvantages of two stroke and four stroke engines, engine components, constructional details, materials, symmetrical and unsymmetrical port timing diagrams, valve actuating mechanisms, valve timing diagrams. Rotary valve engine, Advantages and disadvantages of diesel engines for two wheelers, power plant for electric bikes, exhaust systems.

8 Hours

UNIT - 2

FUEL, LUBRICATION AND COOLING SYSTEM: Layout of fuel supply system, fuel tank construction, carburetor types, construction, working and adjustments. Types of cooling systems, advantages of air cooling system. Lubrication types, Lubrication of parts, grades of lubricating oils

6 Hours

UNIT - 3

TRANSMISSION SYSTEM: Advantages and disadvantages of belt drive, chain drive, shaft drive and variable drives, necessity of clutch, construction and working of clutches, clutch operating mechanism. Gear box types, construction and working, synchronizers.

6 Hours

UNIT - 4

FRAMES AND SUSPENSION: Types and constructional details of frames, advantages and limitations, frame materials, loads on frames. Front forks, suspension systems, fork type and spring type, shock absorber construction and working, Panel meters and controls on handle bar, body manufacture and painting.

6 Hours

PART - B

UNIT - 5

BRAKES AND WHEELS: Front and rear braking systems, disc and drum brakes, merits and demerits. Types of wheels, loads on wheels, construction

and materials for wheels, wheels designation. Tyre designation, inflation, types of tyres, construction details.

6 Hours

UNIT - 6

ELECTRICAL SYSTEM: Types of ignition system, their working principles, wiring diagram for Indian vehicles, spark plug construction, indicators and gauges used in two wheelers, lighting systems.

6 Hours

UNIT - 7

TWO WHEELERS AND THREE WHEELERS: Case study of major Indian models of major motor cycles, scooters, scooteretts and mopeds.

Case study of Indian models of three wheelers, Front mounted engine and rear mounted engine types, Auto rickshaws, pick up van, delivery van and trailer, Bijili electric vehicles.

8 Hours

UNIT - 8

MAINTENANCE: Importance of maintenance, Decarburizing procedure for engine and silencer, periodic inspection, maintenance schedules, trouble diagnosis charts, safety precautions, Lubrication charts

6 Hours

TEXT BOOKS:

1. **Motor Cycle engines -** P.E.IRVING, Temple Press Book, London, 1992
2. **Motor Cycles** --Michel M Griffin
3. **Motor Cycle Mechanics -** William H. Crouse and Donald L. Anglin TATA McGraw-Hill Publication

REFERENCES BOOKS:

1. **The Cycle Motor Manual -** Temple Press Ltd, 1990
2. **Vespa Maintenance and Repair Series -** Bryaut R. V.
3. **Encyclopedia of Motor Cycling 20 Volumes -** Marshall Cavendish, New York and London, 1989

THEORY OF PLASTICITY

Subject Code	:	**06ME752**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

FUNDAMENTAL OF ELASTICITY: Concept of stress, stress transformation laws, spherical and deviator stress tensors, equilibrium equations, octahedral stresses, concept of strain, deviator and spherical strain tensors, strain transformation laws, octahedral strains, generalized hook's law. elastic strain energy, compatibility equations, theories of strength. Problem

7 Hours

UNIT - 2

PLASTIC DEFORMATION OF METALS: Crystalline structure in metals, mechanism of plastic deformation, factors affecting plastic deformation, strain hardening, recovery, recrystallization and grain growth, flow figures or luder's cubes.

6 Hours

UNIT - 3

Cubical dilation, true stress and strain, strain tensor, principal strain, plane strain, spherical and deviator strain, octahedral strain and representative strain, problems.

7 Hours

UNIT - 4

STRESS STRAIN RELATIONS: Introduction, types of materials, empirical equations, theories of plastic flow, experimental verification of St.Verant's theory of plastic flow, the concept of plastic potential, the maximum work hypothesis, mechanical work for deforming a plastic substance.

6 Hours

PART - B

UNIT - 5

YIELD CRITERIA: Introduction, yield or plasticity conditions, Von Mises and Tresca criteria, Geometrical representation, yield surface, yield locus (two dimensional stress space), experimental evidence for yield criteria, energy required to change the shape with basic principle problems

7 Hours

UNIT - 6

SLIP LINE FIELD THEORY: Introduction, basic equations for incompressible two dimensional flow, continuity equations, stresses in conditions of plain strain, convention for slip lines, solutions of plastic deformation problem, Geometry of slip line field, Properties of the slip lines, construction of slip line nets

7 Hours

UNIT - 7

BENDING OF BEAMS: Analysis for stresses, Non linear stress strain curve, shear stress distribution, residual stresses in plastic bending, problems.

6 Hours

UNIT - 8

TORSION OF BARS: Introduction, plastic torsion of a circular bar, elastic perfectly plastic material, elastic work hardening of material, residual stresses and problems

6 Hours

TEXT BOOKS:

1. **Theory of Plasticity -** Chakraborty 3rd Edition Elsevier.
2. **Engineering Plasticity -** W.Johnson and P.B.Mellor D Van N.O Strand Co.Ltd 2000

REFERENCE BOOKS:

1. **Basic Engineering Plasticity -** by DWA Rees 1st Edition Elsevier.
2. **Theory of Plasticity -** by L.S.Srinath TMH,
3. **Theory of Plasticity** - by Sadhu Singh, Kanna publisher

ADVANCED I.C.ENGINES

Subject Code	:	**06AU753**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1 & 2

COMBUSTION IN SPARK IGNITION ENGINES: Thermodynamic analysis of SI engine Combustion: Burned and unburned mixture states. Analysis of cylinder pressure data, Combustion process characterization, Flame structure and speed; flame structure, laminar burning speeds, flame propagation relations, Cyclic variations in combustion, partial burning and misfire: definitions, causes of cycle – by – cycle and cylinder to cylinder

variations, partial burning, misfire and engine stability. Spark Ignition: Ignition fundamentals, conventional ignition systems, alternative ignition systems, alternative ignition approaches, Abnormal Combustion: knock and surface ignition, knock fundamentals, fuel factors.

13 Hours

UNIT - 3 & 4

COMBUSTION IN COMPRESSION IGNITION ENGINES: Types of diesel combustion systems: Direct injection systems, indirect injection systems, comparison of different combustion systems, Analysis cylinder pressure data; combustion efficiency, DI engines, IDI engines, Fuel spray behaviour: Fuel injection, overall spray structure, atomization, spray penetration, droplet size distribution and spray evaporation, Ignition delay: definitions and discussion, fuel ignition quality, auto ignition fundamentals, physical properties affecting delay, effect of fuel properties.

13 Hours

PART - B

UNIT - 5

EQUILIBRIUM CHARTS: Charts for burnt mixture, charts for unburned Mixture, transmission from unburned to burnt mixture, non-equilibrium Problems covering the above.

4 Hours

UNIT - 6

MODERN DEVELOPMENTS IN I.C.ENGINES: Lean burn engines, ceramic and adiabatic engines, Multi-valving, Tuned manifolding, camless valve gearing, variable valve timing, Turbo and supercharging – Waste gating, EGR, Part-load charge stratification in GDI systems. Sports vehicle engines, Stirling engines, MPFI engines – operation and performanance.

10 Hours

UNIT - 7

SPECIAL TYPES OF ENGINES: Introduction to working of startified charged engines, Wankel engine, variable compression engine, Surface ignition engines, free piston engines, Current engines and future trends (e.g. Convergence of SI and CI engine technology, Control developments, fuel quality), Effect of air cleaners and silencers on engine performance.

8 Hours

UNIT - 8

GAS TURBINE COMBUSTION: Simple brayton cycle, working of a gas turbine, modification of the simple cycle, intercooling reheat and regeneration, determination of efficiency and power output, numerical problems.

4 Hours

TEXT BOOKS:

1. **Internal Combustion Engines Fundamentals** - John B. Heywood, McGraw Hill International Edition,
2. **A Course in I.C. Engines** - Mathur & Sharma, Dhanpat Rai & sons, New Delhi,1994

REFERENCE BOOKS:

1. **I.C. Engines -** by Taylor, MIT Press England 1989
2. **I.C. Engines -** By Lichty., McGraw Hill
3. **Fuels & Combustion** By Smith & Stinson., McGrawHill
4. **Motor Vehicle Engines -** by M.Khovakh., Mir Publishers
5. **I.C. Engines -** by V.Ganesan, Tata Mc Graw Hill,1994

COMPUTER INTEGRATED MANUFACTURING

Subject Code	:	**06AU754**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

COMPUTER INTEGRATED MANUFACTURING SYSTEMS: INTRODUCTION, Automation definition, Types of automation, CIM, processing in manufacturing, Production concepts, Mathematical Models-Manufacturing lead time, production rate, components of operation time, capacity, Utilization and availability, Work-in-process, WIP ratio, TIP ratio, Problems using mathematical model equations.

8 Hours

UNIT - 2

HIGH VOLUME PRODUCTION SYSTEM: Introduction Automated flow line-symbols, objectives, Work part transport-continuous, Intermittent, synchronous, Pallet fixtures, Transfer Mechanism-Linear-Walking beam, roller chain drive, Rotary-rack and pinion, Rachet & Pawl, Geneva wheel, Buffer storage, control functions-sequence, safety, Quality, Automation for machining operation.

6 Hours

UNIT - 3

ANALYSIS OF AUTOMATED FLOW LINE & LINE BALANCING : General terminology and analysis, Analysis of Transfer Line with Out storage-upper bound approach, lower bound approach and problems,

Analysis of Transfer lines with storage buffer, Effect of storage, buffer capacity with example problem, Partial automation-with numerical problem example, flow lines with more than two stage, Manual Assembly lines line balancing problem.

6 Hours

UNIT - 4

MINIMUM RATIONAL WORK ELEMENT: work station process time, Cycle time, precedence constraints. Precedence diagram, balance delay methods of line balancing-largest candidate rule, Kilbridge and Westers method, Ranked positional weight method, Numerical problems covering above methods and computerized line balancing.

6 Hours

PART - B

UNIT - 5

AUTOMATED ASSEMBLY SYSTEMS: Design for automated assembly systems, types of automated assembly system, Parts feeding devices-elements of parts delivery system-hopper, part feeder, Selectors, feed back, escapement and placement analysis of Multistation Assembly machine analysis of single station assembly.

AUTOMATED GUIDED VEHICLE SYSTEM: Introduction, Vehicle guidance and routing, System management, Quantitative analysis of AGV's with numerical problems and application.

8 Hours

UNIT - 6

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.

6 Hours

UNIT - 7

CNC MACHINING CENTERS: Introduction to CNC, elements of CNC, CNC machining centers, part programming, fundamental steps involved in development of part programming for milling and turning

6 Hours

UNIT - 8

ROBOTICS: Introduction to Robot configuration, Robot motion, programming of Robots end effectors, Robot sensors and Robot applications.

6 Hours

TEXT BOOKS:

1. **Automation, Production system & Computer Integrated manufacturing -** M. P. Grover" Person India, 2007 2nd edition.
2. **Principles of Computer Integrated Manufacturing,** S. Kant Vajpayee, Prentice Hall India.

REFERENCE BOOKS:

1. **Computer Integrated Manufacturing -** J.A.Rehg & Henry.W. Kraebber.
2. **CAD/CAM by - Zeid,** Tata McGraw Hill.

GAS DYNAMICS

Subject Code	:	**06ME755**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

FUNDAMENTAL EQUATIONS OF STEADY FLOW: Continuity and momentum equations, the thrust function, the dynamic equation and Euler's Equation. Bernoulli's Equation.Steady flow energy equation.

8 Hours

UNIT - 2

ISENTROPIC FLOW: Acoustic velocity, Mach number, Mach cone and Mach angle. Flow parameters, stagnation temperature, pressure, and densi

6 Hours

UNIT - 3

ADIABATIC FLOW: Stagnation temperature change. Rayleigh line, Pressure ratio and temperature ratio, Entropy considerations, maximum heat transfer.

6 Hours

UNIT - 4

FLOW WITH FRICTION: The fanning equation, Friction factor and friction parameter, Fanno line, Fanno equations.

6 Hours

PART - B

UNIT - 5

WAVE PHENOMENA: Classification of wave phenomena, analysis of shock phenomena, Hugoniot equation. Weak waves, compression waves, Normal shock waves, oblique shock waves, Entropy considerations, Rayleigh Pilot equations, detonation and deflageration.

6 Hours

UNIT - 6

VARIABLE AREA FLOW: Velocity variation with Isentropic flow, Criteria for acceleration and deceleration. Effect of pressure ratio on Nozzle operation. Convergent nozzle and convergent divergent nozzle. Effect of back pressure on nozzle flow. Isothermal flow functions. Comparison of flow in nozzle. Generalized one dimensional flow.

7 Hours

UNIT - 7

Applications of dimensional analysis and similitude to gas dynamic problems.

6 Hours

UNIT - 8

INTRODUCTION TO FLAMES AND COMBUSTION: Flame propagation, diffusion flames, premixed flames, flame velocity, theories of flame propagation, ignition for combustible mixture, flame stabilization.

7 Hours

TEXT BOOKS:

1. **Fundamentals of Compressible flow** - Yahya, 2nd Edn. 1991; Wieley Eastern.
2. **Compressible fluid flow by -** J. F. Anderson
3. **Gas Dynamics,**E Rathakrishnan, P.H.I-2006

REFERENCE BOOKS:

1. **Introduction to Gas Dynamics -** Rolty, wiley 1998.
2. **Elements of Gas Dynamics -** Liepmann and roshko, Wiley 1994.
3. **The dynamics and thermodynamics of compressible fluid flow -** Shapiro Ronald press. 1994.
4. **Compressible Fluid Flow-**Anderson J.F.

MANAGEMENT INFORMATION SYSTEMS

Subject Code	:	**06ME756**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

FOUNDATION CONCEPTS: Foundations of Information Systems in business information system and technologies, business applications, developments and management, competing with information technology using information technology for strategic advantage.

7 Hours

UNIT - 2

REVIEW OF INFORMATION TECHNOLOGIES: Computer Hardware – computer systems, end user and enterprise computing, computer peripherals, input output, and storage technologies, computer software-application software, end user application, system software, computer system management.

6 Hours

UNIT - 3

DATA RESOURCE MANAGEMENT: Managing data resources, technical foundations of database management, telecommunication and networks overview of telecommunications and networks, technical telecommunications alternatives.

6 Hours

UNIT - 4

BUSINESS APPLICATIONSL: The Internet worked E. business Enterprise the Internet, Intranets and Extranets in Business, Enterprises Communication and Collaboration, Electronic Business Systems, Cross Functional E-Business systems, Functional E-Business systems Electronic Commerce systems Electronics commerce fundamentals commerce applications and Issues.

7 Hours

PART - B

UNIT - 5

BUSINESS DECISION E: Business decision supports systems for decision support, executive support systems, group decision support system, Artificial Intelligence Technologies in Business

6 Hours

UNIT - 6

DEVELOPMENT PROCESSES: Developing E-Business strategies, E-Business planning fundamentals, implementing E-Business strategies, Developing E-Business solutions Developing E-Business systems, Implementing E-Business systems.

7 Hours

UNIT - 7

MANAGEMENT CHALLENGES: Security and Ethical challenges of E-Business – Security, Ethical and Societal challenges of E-Business security management of E –Business, Enterprise and Global management of E-Business Technology – Managing E-Business Technologies, Global E-Business Technology Management.

7 Hours

UNIT - 8

MANAGING GLOBAL SYSTEMS: Growth of International Information Systems, Organizing International Information Systems, Managing Global systems, Off Outsourcing, Global Value chain, Case Studies

6 Hours

TEXT BOOKS:

1. **Management Information systems** – Managing information Technology in the int4ernet worked enterprise, Jams, A O'Braien - McGraw Hillpublishing company Ltd., 2002. 5th edition ISBN 0-07048637-9
2. **Managing information systems -** W.S.Jawadekar, Tata McGraw Hillpulbishing Co. Ltd., New Delhi 1998. ISBN 0-07-463197-9

REFERENCE BOOKS:

1. **Management information -** systems, Laaudon & Laudon, PHI 1998 Ed. ISBN 81-203-1282-1
2. **Management Information systems -** S.Sadagopan, Prentice Hall of India, 1998 Ed. ISBN 81-203-1180-9
3. **Information systems for Modern management -** G.R.Murdick PHI 2002.

TOTAL QUALITY MANAGEMENT

Subject Code	:	**06ME758**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

OVERVIEW OF TQM: Introduction-Definition, Basic Approach, And Contribution of Gurus – TQM framework, Historical Review, Benefits of TQM, TQM organization.

5 Hours

UNIT - 2

LEADERSHIP, CUSTOMER SATISFACTION AND EMPLOYEE INVOLVEMENT: Characteristics of quality leaders, Customers satisfaction, Customer perception of quality, Feedback, Using customers complaints, Employee involvement - Introduction, Teams, Cross functional teams, Quality circles, Suggestion system, Benefits of employee involvement

7 Hours

UNIT - 3

HUMAN RESOURCE PRACTICES: Scope of Human Resources Management, leading practices, designing high performance work systems-work and job design, Recruitment and career development, Training and education, Compensation and recognition, Health, safety and employee well-being, performance appraisal.

8 Hours

UNIT - 4

BUILDING AND SUSTAINING TOTAL QUALITY ORGANIZATIONS: Making the commitment to TQ, Organizational culture and Total Quality, Change management, sustaining the quality organization.

6 Hours

PART - B

UNIT - 5

TOOLS AND TECHNIQUES IN TQM: 7 basic tools of quality control, Kaizen, Re-engineering, 6 sigma, Benchmarking, Definition, Process of benchmarking, 5S, Yoke.

8 Hours

UNIT - 6

QUALITY MANAGEMENT SYSTEMS: Quality management systems, ISO-9000 series of standards, Overview of ISO-14000, Overview of TS 16959.

6 Hours

UNIT - 7

PRODUCT ACCEPTANCE CONTROL: Product acceptance control through IS 2500 part 1 and part 2.

6 Hours

UNIT - 8

QUALITY FUNCTION DEPLOYMENT AND FAILURE MODES EFFECTS ANALYSIS: Introduction to QFD and QFD process, Quality by design, Rationale for implementation of quality by design, FMEA, Design FMEA and process FMEA.

6 Hours

TEXT BOOKS:

1. **Total Quality Management -** Dale H. Besterfield, Publisher - Pearson Education India, ISBN: 8129702606, Edition 03/e Paperback (Special Indian Edition)
2. **The management and control of Quality -** James R. Evans and William M.Lindsay, ISBN: 981-243-552-0 , Publisher - Thomson South-Western, Edition –6

REFERENCE BOOKS:

1. **Total Quality Management for Engineers -** M. Zairi, ISBN: 1855730243, Publisher: Woodhead Publishing.
2. **100 Methods for Total Quality Management** - Gopal K. Kanji and Mike Asher , ISBN: 0803977476, Publisher: Sage Publications, Inc.; Edition – 1

ELECTIVE-III (GROUP C)

EXPERIMENTAL STRESS ANALYSIS

Subject Code	:	**06ME761**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Mechanical, Optical, Pneumatic, Acoustic strain gauges. Electrical Resistance Strain Gauges – Gauge factor , types, properties of an ideal gauge material, backing material, adhesive material, protective coating; Method of bonding strain gauges, strain gauges lead wire and connections, semiconductor strain gauges problems.

8 Hours

UNIT - 2

Strain gauge Circuits, Wheatstone's bridge, Error due to input impedance of measuring instrument, temperature compensation, multiple gauge circuits, calibration of strain measuring system, load cells, problems.

7 Hours

UNIT - 3

STRAIN GAUGE ROSETTES: Necessity, analysis, problems.

5 Hours

UNIT - 4

NATURE OF LIGHT: Harmonic wave, phase, amplitude, polarization. Crystal optics: Passage of light through crystalline media, absolute and relative phase difference, quarter wave plate, half wave plate, production of plane polarized light and circularly polarized light.

6 Hours

PART - B

UNIT - 5

TWO-DIMENSIONAL PHOTO ELASTICITY: Stress optic law, plane polariscope, isochromatics and isoclinics, circular polariscope, dark and bright field's arrangements, Isoclinic and Isochromatic fringe order at a point, methods of compensation separation technique.

8 Hours

UNIT - 6

PHOTO ELASTIC ANALYSIS: Calibration of photo elastic model material, properties of ideal photo elastic material, casting of photo elastic models, machining, stress relieving, scaling model prototype relation, two dimensional application, problems.

6 Hours

UNIT - 7

BIREFRINGENT COATING: Theory, photo elastic data for stress analysis, reflection polariscope. Moire techniques: Phenomenon, moiré fringe analysis, geometric approach, displacement approach, moiré techniques for inplane problems, sign and other of fringes, problems of moiré gratings, moiré fringe photograph.

6 Hours

UNIT - 8

Introduction to holography. Introduction to brittle coating technique. Introduction to computer techniques and fringe analysis.

6 Hours

TEXT BOOKS:

1. **Experimental stress analysis -** L.S. Srinath, M.R. Raghavan, K. Lingaiah, G. Gargesh, K. Ramachandara & B. Pant, Tata McGraw Hill publication 2000.
2. **Experimental stress analysis -** by Dally & Riley, Tata McGraw Hill Publication 2001.

REFERENCE BOOKS:

1. **Analysis of stress and strain -** A.J. Duraelli, E.A. Phillips and C.H. Trao McGraw Hill, 1958.
2. **Applied stress analysis -** A.J. Durelli, prentice hall India, 1970.
3. **Moire analysis of strain -** Durelli & parks. 1996.
4. **Hand Book of experimental mechanics -** A.S.Kobayassin (Ed.,) SEM/ VCH, 2nd edn. 2000.

ENGINEERING SYSTEM DESIGN

Subject Code	:	**06ME762**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: What is designing, Man as a designer: Design by evolution, inadequacies of traditional design method: System approach of engineering problems: Need models: design history of large scale existing system.

MORPHOLOGY OF DESIGN: The three phases of design projects, the structure of design process, decision making and iteration.

8 Hours

UNIT - 2

IDENTIFICATION AND ANALYSIS OF NEED: Preliminary need statement, analysis of need, specifications, and standards of performance and constrains.

6 Hours

UNIT - 3

ORIGINATION OF DESIGN CONCEPT: Process of idealization, mental fixity, and some design methods like morphological analysis, AIDA, brain storming etc.

6 Hours

UNIT - 4

PRELIMINARY DESIGN: Mathematical modeling for functional design: concept of sensitivity, compatibility and stability analysis.

6 Hours

PART - B

UNIT - 5

EVALUATION OF ALTERNATIVES AND DESIGN DECISIONS: Physical realisability, DESIGN TREE: Quality of design, Concept of utility, multi criteria decisions, decisions under uncertainty and risk (Numerical)

8 Hours

UNIT - 6

RELIABILITY CONSIDERATIONS IN DESIGN: Bath tub curve, exponential reliability function, system reliability concept. (Numerical)

7 Hours

UNIT - 7

ECONOMICS AND OPTIMIZATION IN ENGINEERING DESIGN: Economics in Engineering Design, Fixed and variable costs, break-even analysis. (Numerical)

OPTIMIZATION: Introduction to LPP.

6 Hours

UNIT - 8

MAN-MACHINE INTERACTION: Designing for use and maintenance, Man-Machine Cycle, Design of displays and controls. Factors influencing displays and controls.

5 Hours

TEXTBOOKS:

1. **An Introduction to Engineering Design Method -** by V. Gupta and P. Murthy, Tata McGraw Hill. 2000
2. **Introduction of Engineering Design** by T. Woodson, McGraw Hil1.2001

REFERENCE BOOKS:

1. **Design & Planning of Engineering systems** by D.D. Meredith, K.W. Wong, R.W. Woodhead & K.K. Worthman. 2000
2. **Introduction to Design** by M.A. Asimov-Prentice Hall. 1996
3. **Design Methods - Seeds of Human Futures**-Wiley Inter Science. 1970.

ENGINEERING ECONOMICS AND AUTOMOTIVE COST ESTIMATION

Subject Code	:	**06AU763**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Definition of various economic terms such as economic goods, utility, value, price, wealth, wants capital, rent and profit, Laws of returns.

3 Hours

UNIT - 2

DEMAND AND SUPPLY: Law of diminishing utility and total utility. Demand Schedule .Law of demand. Elasticity of demand, Law of substitution, Law of supply, supply schedule, elasticity of supply.

4 Hours

UNIT - 3

WAGES: Nominal and real wages, Factors affecting real wages, theory of wages, Difference in wages, methods of wage payment.

3 Hours

MONEY AND EXCHANGE: Theory of exchange, Barter, stock exchange, Speculation money qualities of a good money, function of a money, classification of money, value of money, index number, appreciation and depreciation of money value, Gresham's Law and its limitations.

4 Hours

UNIT - 4

TAXATION AND INSURANCE: Principle of taxation, characteristics of a good taxation system, kinds of taxes, and their merits and demerits, Vehicle Insurance, Loss Assessment.

4 Hours

INTEREST AND DEPRECIATION: Introduction, theory of interest, interest rate, interest from lender's and borrower's view point, simple and compound interest. Nominal and effective interest rates, interest formulae Annual compounding, Annual payments and continuous compounding annual payment, simple numerical problems. Need for depreciation causes of depreciation life and salvage value methods of depreciation, simple numerical problems.

6 Hours

PART - B

UNIT - 5

COSTS: Standard costs estimated cost, First cost, Fixed cost, Variable costs, Incremental cost, Differential cost, Sunk and marginal cost, Breakeven and minimum cost analysis, simple numerical problems.

COST ACCOUNTING: Introduction, objectives of cost accounting, elements of cost material cost, labour cost, and expenses, allocation of over heads by different methods, simple numerical problems.

6 Hours

UNIT - 6

BASIS FOR COMPARISON OF ALTERNATIVES, present worth methods, capital recovery methods, and rate of return method, simple numerical problems.

REPLACEMENT ANALYSIS: Basic reasons for replacement present asset and its replacement, consideration leading to replacement, installation and removal cost.

5 Hours

UNIT - 7

BOOK KEEPING AND ACCOUNTS: Introduction, Necessity for book keeping, single entry and double entry, Ledger, Trial balance, Final accounts, trading accounts, profit and loss accounts, Balance sheet, simple problems.

5 Hours

UNIT - 8

COST ESTIMATION: Introduction, importance, objectives and functions of estimating, principle factors in estimating, Functions and qualities of ah estimator, estimating procedure. Estimation of material cost of overhauling and servicing of automotive components, estimating of different types of repairs, estimating the cost of body building, estimating the cost of overhauling the automotive components like cylinder, valves, valve seats, crankshaft, FIP, Brake drum etc. Estimating the cost of manufacturing of simple automotive components.

12 Hours

TEXT BOOKS:

1. **Engineering Economy -** TARACHAND, 2000
2. **Engineering Economy -** RIGGS J.L., McGraw Hill, 2002
3. **Engineering Economy -** THUWSEN H.G., PHI, 2002

REFERENCE BOOKS:

1. **Industrial Engineering and Management -** O.P KHANNA, Dhanpat Rai & Sons.
2. **Financial Management -**I.M PANDAY, Vikas Publishing House
3. **Engineering Economy -** Paul Deoarmo, Macmillan Pub, Co., 2001
4. **Mechanical Estimation and Costing -** D. Kannappan.

SMART MATERIALS

Subject Code	:	**06ME764**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Characteristics of composites and ceramics materials, Dynamics and controls, concepts, Electro-magnetic materials and shape memory alloys-processing and characteristics

6 Hours

UNIT - 2

SENSING AND ACTUATION: Principals of electromagnetic, acoustics, chemical and mechanical sensing and actuation, Types of sensors and their applications, their compatibility writer conventional and advanced materials, signal processing, principals and characterization.

7 Hours

UNIT - 3

CONTROL DESIGN: Design of shape memory alloys, Types of MR fluids, Characteristics and application, principals of MR fluid value designs, Magnetic circuit design, MR Dumpers, Design issues.

6 Hours

UNIT - 4

OPTICS AND ELECTROMAGNETIC: Principals of optical fiber technology, characteristics of active and adaptive optical system and components Design and manufacturing principles.

7 Hours

PART - B

UNIT - 5

STRUCTURES: Principles of drag and turbulence control through smart skins, applications in environment such as aerospace and transportation vehicles, manufacturing, repair and maintainability aspects.

7 Hours

UNIT - 6

CONTROLS: Principles of structural acoustic control, distributed, analog and digital feed back controls, Dimensional implications for structural control.

6 Hours

UNIT - 7

Principles of Vibration and Modal Analysis, PZT Actuators, MEMS, Magnetic shape Memory Alloys, Characteristics and Applications.

7 Hours

UNIT - 8

INFORMATION PROCESSING: Neural Network, Data Processing, Data Visualization and Reliability – Principals and Application domains.

6 Hours

TEXT BOOKS:

1. **Analysis and Design -** A.V.Srinivasan, 'Smart Structures – Cambridge University Press, New York, 2001, (ISBN : 0521650267)
2. **Smart Materials and Structures -** M V Gandhi and B S Thompson Chapmen & Hall, London, 1992 (ISBN : 0412370107)

REFERENCE BOOKS:

1. **Smart Materials and Structures -** Banks HT, RC Smith, Y Wang, Massow S A, Paris 1996
2. **G P Gibss'Adaptive Structures -** Clark R L, W R Saunolers, Jhon Wiles and Sons, New York, 1998
3. **An Introduction for Scientists and Engineers -** Esic Udd, Optic Sensors : John Wiley & Sons, New York, 1991 (ISBN : 0471830070)

MANUFACTURE OF AUTOMOBILE COMPONENTS

Subject Code	:	**06AU765**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

MANUFACTURING OF ENGINE & ENGINE COMPONENTS: Casting of engine block – conventional and expandable pattern, machining of engine blocks in machining center. Preparation of casting for cylinder heads, forging of crankshaft, connecting rod and gudgeon pins, machining and heat treatment, casting of piston by gravity casting, squeeze casting, machining and finishing, upset forging of valves, heat treatment and surface improvement, cylinder liners and piston ring manufacturing.

10 Hours

UNIT - 2

MANUFACTURE OF CLUTCH AND GEAR BOX COMPONENTS: Manufacturing friction plates using conventional blanking and fine blanking. Manufacture of composite friction lining, composite moulding of phenol formaldehyde lining. Casting of gear box casting, gear hobbing, shaping powder metallurgy, orbital forming of spur, helical, and bevel gears, hypoid gears, heat treatment and finishing.

8 Hours

UNIT - 3

MANUFACTURE OF PROPELLAR SHAFT: Continuous casting of propeller shaft, extrusion of propeller shaft, extrusion of dies**,** heat treatment and surface hardening of propeller shaft, composite propeller shaft manufacturing.

4 Hours

UNIT - 4

MANUFACTURE OF AXLES AND SPRINGS: Forging of front and rear axles, casting of rear axle casing, leaf spring manufacturing, composite leaf springs, wrap forming of coil springs.

4 Hours

PART - B

UNIT - 5

MANUFACTURE OF BODY PANELS: Introduction, thermoforming and hydro forming, press forming, welding of body panels, resistance welding and other welding processes.

4 Hours

UNIT - 6

MANUFACTURE OF AUTOMOTIVE PLASTIC COMPONENTS: Introduction, principle of injection moulding, injection moulding of instrument panel, moulding of bumpers, tooling and tooling requirements, hand lay up process for making composite panels, manufacture of metal/polymer/metal panels.

6 Hours

UNIT - 7

MANUFACTURE OF ENGINE COMPONENTS USING CERAMIC MATRIX COMPOSITES: Introduction, ceramic matrix piston rings, chemical vapour deposition, physical vapour deposition, cryogenic grinding of powders, sol-gel processing, advanced machine processes using RPT, CNC, etc.

6 Hours

UNIT - 8

ADVANCED MACHINING PROCESS: Machining concepts using NC, generation of numerical control codes using Pro-E and IDEAS package, interfacing the CNC machine and manufacturing package. Introduction to rapid prototyping using fused deposition, laser sintering.

6 Hours

UNIT - 9

MISCELLANEOUS: Tyre and tube manufacturing, painting, painting booth, coach work.

4 Hours

TEXT BOOKS:

1. **High Speed Combustion Engines -** Heldt P.M. Oxford IBH publishing Co. 1996
2. **Manufacturing Processes and Systems -** Philip F., Ostward & Jairo Munuz, John Wiley & Sons, 1997

REFERENCE BOOKS:

1. **Manufacturing and Engineering Technology -** Kalpakjian. Addison wesloy, publishing company, 1995.
2. **Materials and Process in Manufacturing -** Degarmo E.P., Macmillan Publishing Co., 1997

ROBOTICS

Subject Code	:	**06ME766**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION AND MATHEMATICAL REPRESENTATION OF ROBOTS: History of Robots, Types of Robots, Notation, Position and Orientation of a Rigid Body, Some Properties of Rotation Matrices, Successive Rotations, Euler Angles For fixed frames X-Y-Z and moving frame ZYZ. Transformation between coordinate system, Homogeneous coordinates, Properties of ${}^{A}_{B}T$, Types of Joints: Rotary, Prismatic joint, Cylindrical joint, Spherical joint, Representation of Links using Denvit-Hartenberg Parameters: Link parameters for intermediate, first and last links, Link transformation matrices, Transformation matrices of 3R manipulator, PUMA560 manipulator, SCARA manipulator

7 Hours

UNIT - 2

KINEMATICS OF SERIAL MANIPULATORS: Direct kinematics of 2R, 3R, RRP, RPR manipulator, puma560 manipulator, SCARA manipulator, Stanford arm, Inverse kinematics of 2R, 3R manipulator, puma560 manipulator.

6 Hours

UNIT - 3

VELOCITY AND STATIC'S OF MANIPULATORS: Differential relationships, jacobian, Differential motions of a frame (translation and rotation), Linear and angular velocity of a rigid body, Linear and angular velocities of links in serial manipulators, 2R, 3R manipulators, Jacobian of serial manipulator, Velocity ellipse of 2R manipulator, Singularities of 2R manipulators, Statics of serial manipulators, Static force and torque analysis of 3R manipulator, Singularity in force domain.

7 Hours

UNIT - 4

DYNAMICS OF MANIPULATORS: Kinetic energy, Potential energy, Equation of motion using Lagrangian, Equation of motions of one and two degree freedom spring mass damper systems using Lagrangian formulation, Inertia of a link, Recursive formulation of Dynamics using Newton Euler equation, Equation of motion of 2R manipulator using Lagrangian, Newton-Euler formulation.

6 Hours

PART - B

UNIT - 5

TRAJECTORY PLANNING: Joint space schemes, cubic trajectory, Joint space schemes with via points, Cubic trajectory with a via point, Third order polynomial trajectory planning, Linear segments with parabolic blends, Cartesian space schemes, Cartesian straight line and circular motion planning

7 Hours

UNIT - 6

CONTROL: Feedback control of a single link manipulator- first order, second order system, PID control, PID control of multi link manipulator, Force control of manipulator, force control of single mass, Partitioning a task for force and position control- lever, peg in hole Hybrid force and position controller

8 Hours

UNIT - 7

ACTUATORS: Types, Characteristics of actuating system: weight, power-to-weight ration, operating pressure, stiffness vs. compliance, Use of reduction gears, comparison of hydraulic, electric, pneumatic, actuators,

Hydraulic actuators, proportional feedback control, Electric motors: DC motors, Reversible AC motors, Brushles DC motors, Stepper motors-structure and principle of operation, stepper motor speed-torque characteristics

6 Hours

UNIT - 8

SENSORS: Sensor characteristics, Position sensors- potentiometers, Encoders, LVDT, Resolvers, Displacement sensor, Velocity sensor-encoders, tachometers, Acceleration sensors, Force and Pressure sensors – piezoelectric, force sensing resistor, Torque sensors, Touch and tactile sensor, Proximity sensors-magnetic, optical, ultrasonic, inductive, capacitive, eddy-current proximity sensors.

5 Hours

TEXT BOOKS:

1. **Fundamental Concepts and Analysis -** Ghosal A., Robotics, Oxford,2006
2. **Introduction to Robotics Analysis, Systems, Applications,** Niku, S. B., Pearso Education, 2008

REFERENCE BOOKS:

1. **Introduction to Robotics: Mechanics and Control -** Craig, J. J., 2nd Edition, Addison-Welsey, 1989.
2. **Fundamentals of Robotics, Analysis and Control -** Schilling R. J., PHI, 2006

PROJECT MANAGEMENT

Subject Code	:	**06AU767**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

CONCEPTS OF PROJECT MANAGEMENT: Concepts of a Project, Categories of projects, Phases of project life cycle, Roles and responsibilities of project leader, tools and techniques for project management.

6 Hours

UNIT - 2

PROJECT PLANNING AND ESTIMATING: Feasibility report phased Planning, Project planning steps, Objectives and goals of the project, preparation of cost estimation, and evaluation of the project profitability.

7 Hours

UNIT - 3

ORGANIZING AND STAFFING: The Project Team: Skills / abilities required for project manager, Authorities and responsibilities of project manager, Project organization and types accountability in project execution, controls, tendering and selection of contractors

7 Hours

UNIT - 4

PROJECT SCHEDULING: Project implementation scheduling, different scheduling techniques bar (GANTT) charts, Bar charts for combined activities. Project evaluation and review techniques, PERT planning, computerized project management, Resources allocation methods with out resource contents, Numerical.

6 Hours

PART - B

UNIT - 5

TOOLS & TECHNIQUES OF PROJECT MANAGEMENT: Bat (GAMTT) chart, bar chart for combined activities, logic diagrams and networks. Project evaluation and review techniques (PERT) planning. Computerized project management.

8 Hours

UNIT - 6

CO-ORDINATION AND CONTROL: Project direction communication in a project, Role of MIS in project control, performance control, schedule control, cost Control cases.

8 Hours

UNIT - 7

PERFORMANCE MEASURES IN PROJECT MANAGEMENT: Performance indicators, Performance improvement for the CM & DM companies for better project management, Project management and environment.

6 Hours

UNIT - 8

CASE STUDIES ON PROJECT MANAGEMENT: Case studies covering project planning, scheduling, use of tools and techniques, performance measurement.

4 Hours

TEXT BOOKS:

1. **Project Management a System approach to Planning Scheduling & Controlling** - Harold Kerzner, CBS Publishers and Distributors.2002

2. **Project Execution Plan: plan for project Execution nteraction. 2001 -** Chaudhry S.,

REFERENCE BOOKS:

1. **Project Management** - Beningston Lawrence-McGraw Hill-1970.
2. **A Management Guide to PERT and CPM, WEIST & LEVY -** Eastern Economy of PHI 2002.
3. **PERT & CPM-L.**S. Srinath, Affiliated East West Press Pvt. Ltd. 2002
4. **Project Management with PERT and CPM -** Moder Josep and Phillips cerel R., 2nd edition, New York V AN Nostrand, Reinhold-1976.
5. **Harvey Maylor, project management -** 3RD Edition, Pearson, 2003
6. **Project Planning analysis selection implementation & review** – Prasanna chandra, ISBNO-07-462049-5. 2002
7. **Angus, Planning, Performing and Controlling Projects -** 3rd End, Pearson Education Pvt. Ltd., ISBN: 812970020.2001
8. **Project planning, Scheduling & control -** James P. Lewis, Meo Publishing company. 2001
9. **Project Management -** Bhavesh M Patel, Vikas Publishing House, ISBN 81-259-0777-7 2002
10. **Successful Project management -** Jack Gido, James P Clements, Vikas Publishing House, ISBN 981-243-137-3 2002

VIII SEMESTER

VEHICLE TRANSPORT MANAGEMENT

Subject Code	:	**06AU81**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Historical background, the growth of a network, trams, trolley buses, buses, private cars, subsidies. **Motor Vehicle Act 1988**.

6 Hours

UNIT - 2

THE INFRASTRUCTURE: Road, Highway network, traffic control, Bus priorities, pedestrianization, out town shopping centers, 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.

MAINTENANCE: Preventive, breakdown, overhauling - major, minor, repair schedules & workshop, facilities, documentation, analysis & corrective maintenance schedules

7 Hours

UNIT - 3

ORGANIZATION AND MANAGEMENT: Forms of ownership, municipal undertaking, company undertaking, traffic, secretarial and engineering deportments, 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.

7 Hours

UNIT - 4

ROUTE PLANNING, TIMING, BUS WORKING AND SCHEDULE: 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 travelers, 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 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

7 Hours

PART - B

UNIT - 5

FARE COLLECTIONS & FARE STRUCTURE: Need, Principles of collection, tickets, the way bill, stage by stage, bell punch system, bellgraphic system, reduced ticket stocks willbrew system, mechanical ticket machines, T.I.M and straight machines, verometer, one-man operation, two stream boarding, pre paid tickets, lenson parason 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.

6 Hours

UNIT - 6

OPERATING COST AND TYPES OF VEHICLES: Classification of costs, average speed, running costs, supplementary costs, depreciation obsolescence, life of vehicles, sinking fund, factor affecting cost per vehicles mile incidence of wages and overheads, 100 seats miles basis, average seating capacity, vehicles size and spread overs, types of vehicle economic considerations authorization of trolley, bus services, statuary procedure taxes and hire car.

7 Hours

UNIT - 7

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, sings, 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.

6 Hours

UNIT - 8

VEHICLE DESIGN: Buses & coaches, types & capacities, basic features, entrances & exits, comfort & capacity, steps & staircases, miscellaneous arrangements & fitments, articulated buses, standardization.

THE FUTURE: A projection from the past, future demand, environmental and social issues, the energy situation, new technology, hybrid, battery/trolley bus, other types of hybrid, lead acid battery bus, advanced battery bus

6 Hours

TEXT BOOKS:

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

REFERENCE BOOKS:

1. **Compendium of transport terms** - Cirt, Pune
2. M.V. Act 1988 - **Central Law Agency**, Allahabad
3. **The elements of transportation** - R.J. Eaton
4. **Goods vehicle operation** - C.S. Dubbar
5. **Road transport law** - L.D. Kitchen
6. **Automobile Engineering** -G B S Narang, Khanna Publishers, New Delhi
7. **Automobile Engineering** -R B Gupta, Satya Prakashan, New Delhi

AUTOMOTIVE ELECTRICAL AND ELECTRONIC SYSTEMS

Subject Code	:	**06AU82**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

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 batterie

6 Hours

UNIT - 2

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, cutout - construction, working and adjustment. Construction of A.C. systems.

6 Hours

UNIT - 3

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.

6 Hours

UNIT - 4

IGNITION SYSTEM: Ignition fundamentals, Types of solid state ignition systems, components, construction and operating parameters high energy ignition distributors, Electronic spark timing and control.

6 Hours

PART - B

UNIT - 5

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, signaling devices, electrical fuel pump, fuel, oil and temperature gauge(Dash board instruments)

6 Hours

UNIT - 6

HEATING AND AIR CONDITIONING: Conventional heating and ventilation, Air conditioning theory and systems, seat heaters.

6 Hours

UNIT - 7

ENGINE MANAGEMENT SYSTEMS: Combined ignition and fuel management 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. Hybrid vehicles and fuel cells.

8 Hours

UNIT - 8

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.

8 Hours

TEXT BOOKS:

1. **Automobile Electrical and Electronic systems** - Tom Denton, SAE publication, 2000.
2. **Automobile Electrical Equipment -** P.M. Kohli, Tata McGraw Hill

REFERENCE BOOKS:

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

ELECTIVE-IV (GROUP D)

TRIBIOLOGY

Subject Code	:	**06ME831**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION TO TRIBILOGY: Properties of oils and equation of flow: Viscosity, Newton's of viscosity, Hagen-Poiseuille Law, Flow between parallel stationary planes, viscosity measuring apparatus. Lubrication principles, classification of lubricants.

6 Hours

UNIT - 2

HYDRODYNAMICS LUBRICATION: Friction forces and power loss in lightly loaded bearing, Petroff's law, Tower's experiments, idealized full journal bearings.

6 Hours

UNIT - 3

Mechanism of pressure development in an oil film, Reynold's investigations, Reynold's equation in two dimensions. Partial journal bearings, end leakages in journal bearing, numerical problems.

7 Hours

UNIT - 4

SLIDER / PAD BEARING WITH A FIXED AND PIVOTED SHOE: Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a pivoted shoe bearing, influence of end leakage, numerical examples.

7 Hours

PART - B

UNIT - 5

OIL FLOW AND THERMAL EQUILIBRIUM OF JOURNAL BEARING: Oil flow through bearings, self-contained journal bearings, bearings lubricated under pressure, thermal equilibrium of journal bearings.

6 Hours

UNIT - 6

HYDROSTATIC LUBRICATION: Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing.

6 Hours

UNIT - 7

BEARING MATERIALS: Commonly used bearings materials, properties of typical bearing materials.

WEAR: Classification of wear, wear of polymers, wear of ceramic materials, wear measurements, effect of speed, temperature and pressure.

7 Hours

UNIT - 8

BEHAVIOR OF TRIBOLOGICAL COMPONENTS: Selection, friction, Wear of ceramic materials, wear measurements, effects of speed, temperature and pressure.

TRIBOLOGICAL MEASURES: Material selection, improved design, surface engineering

7 Hours

TEXT BOOKS:

1. **Fundamentals of Tribiology -** Basu S K., Sengupta A N., Ahuja B. B., PHI 2006
2. **Introduction to Tribiology bearings -** Mujumdar B. C., Wheelers and company pvt. Ltd 2001.

REFERENEC BOOKS:

1. **Theory and Practice of Lubrication for Engineers -** Fuller, D., New York company 1998
2. **Principles and applications of Tribiology -** Moore, Pergamaon press 1998

3. **Tribiology in Industries -** Srivastava S., S Chand and Company limited, Delhi 2002
4. **Lubrication of bearings –** Theoretical Principles and Design**,** Redzimovskay E I., Oxford press company 2000

EARTHMOVING EQUIPMENTS & TRACTORS

Subject Code	:	**06AU832**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

EQUIPMENTS AND OPERATION: Different types of earth moving equipments and their applications. Dozers, Loaders, Shovels, Excavators, Scrapers, Motor graders, Rollers, Compactors, Tractors and Attachments.

9 Hours

UNIT - 2

ENGINE: All systems of engine and special features like Automatic injection timer, turbochargers, after coolers etc

4 Hours

UNIT - 3

UNDER CARRIAGE AND SUSPENSION: Tyre and tracked vehicles, advantages and disadvantages, under carriage components like, tracks, roller frames, drive sprockets, track rollers, track chains and track shoes. **SUSPENSION**: rubber spring suspension and air spring suspension

6 Hours

UNIT - 4

TRANSMISSIONS AND FINAL DRIVES: Basic types of transmissions, auxiliary transmission, compound transmission, twin & triple countershaft transmissions and planetary transmission, constructional and working principles, hydroshift automatic transmission and retarders. FINAL DRIVES: types of reductions like, single reduction, double reduction final drives and planetary final drives, PTO shaft.

6 Hours

PART - B

UNIT - 5

HYDRAULICS: Basic components of hydraulic systems like pumps (types of pumps), control valves like flow control valves, directional control valves

and pressure control valves, hydraulic motors and hydraulic cylinders. Depth & draft control systems.

7 Hours

UNIT - 6

STEERING AND BRAKES: Power steering types like, linkage type power steering, semi integral power steering & integral power steering. STEERING OF TRACKED VEHICLES: Skid steering, articulated steering, clutch /brake steering system, controlled differential steering system and planetary steering system. BRAKES: Types of brakes like, disc brake, engine brakes etc

6 Hours

UNIT - 7

EARTH MOVING EQUIPMENTS MAINTENANCE AND SAFETY: Types of maintenance schedules purpose and advantages, organization set ups, documentation. Safety methods for earth moving equipments.

6 Hours

UNIT - 8

METHODS OF SELECTION OF EQUIPMENTS

1. Selection of machines
2. Basic rules of equipments including the nature of operation
3. Selection based on type of soil
4. Selection based on haul distance
5. Selection based on weather condition

CALCULATION OF OPERATING CAPACITY

1. Methods of calculating operating capacity
2. Calculation of productivity of a bull dozer

8 Hours

TEXT BOOKS:

1. **Diesel Equipment -** volume I and II by Erich J.Schulz
2. **Construction Equipment and Its Management** - By S.C. Sharma, Dhanapat Rai & Sons, New Delhi

REFERENCE BOOKS:

1. **Farm machinery and mechanism -** by Donald R. hunt and L. W.garner
2. **Theory of ground vehicles** - by J.Y.Wong John Wiley and Sons
3. **Moving the earth** by Herbert Nicholas, Galgotia publishing House
4. **On and with the earth** - by Jagman Singh, W.Newman and Co. culkatta

SIMULATION OF I.C. ENGINE PROCESSES

Subject Code	:	**06AU833**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Principal of computer modeling and simulation, Monte Carlo simulation, Nature of computer modeling and simulation. Limitations of simulation, areas of application.

6 Hours

UNIT - 2

SYSTEM AND ENVIRONMENT: components of a system-discrete and continuous systems. Models of a system-a variety of modeling approaches.

4 Hours

UNIT - 3

DESIGN AND EVOLUTION OF SIMULATION EXPERIMENTS: Variance reduction techniques. Antithetic variables. Variables verification and validation of simulation models.

6 Hours

UNIT - 4

COMBUSTION PROCESS – General - Heat of reaction – Adiabatic flame temperature – Temperature change due to fuel Vapourisation.

4 Hours

UNIT - 5

COMBUSTION AND HEAT TRANSFER IN ENGINES: Combustion in diesel engines – Heat transfer in engines – Heat transfer correlations

4 Hours

PART - B

UNIT - 6

C.I. AND S.I. ENGINE SIMULATION: Simulation of Otto cycles under full load and part load and supercharged conditions. Progressive combustion, Exhaust and intake process analysis.

12 Hours

UNIT - 7

TWO STROKE ENGINE SIMULATION: Engine and porting geometry, gas flow, Scavenging.

8 Hours

UNIT - 8

SIMULATION EXERCISES: Simulation exercises using computers-MATLAB SimuLink, ProE / ICEM, CFD Analysis, FE Analysis and Validation of models.

8 Hours

TEXT BOOKS:

1. **Computer Simulation of Spark Ignition Engine Processes -** V.GanesanUniversities Press, 1995.
2. **Computer Simulation of Compression Ignition Engine Processes -**V.Ganesan, Universities Press, 2002.
3. **System Simulation with digital Computer -** NARS1NGH DEO, prentice Hall Of India, 1979.
4. **Internal Combustion Engine Modeling -** J.I.Ramos, Hemisphere Publishing Corporation, 1989

REFERENCE BOOKS:

1. **Thermodynamic Analysis of Combustion Engines -** Ashley S. Campbell, John Wiley and Sons, 1980.
2. **Combustion Modeling in Reciprocating Engines -** J.N.Mattavi and C. A. Amann, Plenum Press, 1980.
3. **The Thermodynamics and Gas Dynam1cs of Internal Combustion Engines -** Horlockan and lWlnterbone, Vol.I & II, Clarendon Press, 1986.
4. **The Basic Design of Two-Stroke engines -** Gordon P. Blair, SAE Publications, 1990.

NANOTECHNOLOGY

Subject Code	:	**06ME834**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

AN OVERVIEW OF NANOSCIENCE & NANOTECHNOLOGY: Historical background – nature, scope and content of the subject – multidisciplinary aspects – industrial, economic and societal implications.

5 Hours

UNIT - 2

EXPERIMENTAL TECHNIQUES AND METHODS: for investigating and manipulating materials in the nano scale – electron microscope – scanning probe microscope – optical and other microscopes – light scattering – x-ray diffraction.

7 Hours

UNIT - 3

FULLERENES: Discovery, synthesis and purification – chemistry of fullerenes in the condensed phase – orientational ordering – pressure effects – conductivity and superconductivity – ferromagnetism – optical properties.

Carbon Nano-tubes – synthesis and purification – filling of nanotubes – mechanism of growth – electronic structure – transport properties – mechanical and physical properties – applications.

7 Hours

UNIT - 4

SELF-ASSEMBLED MONOLAYERS: monolayers on gold – growth process – phase transitions – patterning monolayers – mixed monolayers – applications.

GAS PHASE CLUSTERS – history of cluster science – formation and growth – detection and analysis – type and properties of clusters – bonding in clusters.

7 Hours

PART - B

UNIT - 5

SEMICONDUCTOR QUANTUM DOTS: Synthesis – electronic structure of nanocrystals – how quantum dots are studied – correlation of properties with size – uses.

5 Hours

UNIT - 6

MONOLAYER-PROTECTED METAL NANOPARTICLES: method of preparation –characterization – functionalized metal nanoparticles – applications – superlattices.

CORE-SHELL NANOPARTICLES – types – characterization – properties – applications.

NANOSHELLS – types – characterization – properties – applications.

8 Hours

UNIT - 7

NANOBIOLOGY: interaction between biomolecules and nanoparticle surfaces – materials used for synthesis of hybrid nano-bio assemblies – biological applications – nanoprobes for analytical applications – nanobiotechnology – future perspectives.

NANOSENSORS – what make them possible – nanoscale organization for sensors – characterization – nanosensors based on optical properties – nanosensors based on quantum size effects – electrochemical sensors – sensors based on physical properties – nanobiosensors – sensors of the future.

NANOMEDICINES – approach to development – nanotechnology in diagnostic and therapeutic applications.

8 Hours

UNIT - 8

MOLECULAR NANOMACHINES: Covalent and non-covalent approaches – molecular motors and machines – other molecular devices – single molecular devices – practical problems involved.

NANOTRIBOLOGY – studying tribology on the nanoscale – applications.

5 Hours

TEXTBOOK:

1. **NANO: The Essentials – Understanding Nanoscience and Nanotechnology;** T Pradeep (Professor, IIT Madras); Tata McGraw-Hill India (2007)

REFERENCES BOOKS:

1. **Nanotechnology -** Richard Booker & Earl Boysen; Wiley (2005).
2. **Introduction to Nanoscale Science and Technology [Series: Nanostructure Science andTechnology -** Di Ventra, et al (Ed); Springer (2004)
3. **Nanotechnology Demystified** - Linda Williams & Wade Adams; McGraw-Hill (2007)
4. **Introduction to Nanotechnology -** Charles P Poole Jr, Frank J Owens, Wiley India Pvt. Ltd., New Delhi, 2007.

HYDRAULICS AND PNEUMATICS

Subject Code	:	**06AU835**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION TO HYDRAULIC POWER: Pascal's law and problems on Pascal's Law, continuity equations, introduction to conversion of UNIT s. 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.

8 Hours

UNIT - 2

HYDRAULIC ACTUATORS AND MOTORS: Linear Hydraulic Actuators [cylinders], Mechanics of Hydraulic Cylinder loading, Hydraulic Rotary Actuators, Gear motors, vane motors, piston motors, Hydraulic motor theoretical torque, power and flow rate, hydraulic motor performance.

6 Hours

UNIT - 3

CONTROL COMPONENTS IN HYDRAULIC SYSTEMS: Directional Control Valves – Symbolic representation, Constructional features, pressure control valves – direct and pilot operated types, flow control valves.

5 Hours

UNIT - 4

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 circuits. Locked cylinder using pilot check valve, cylinder synchronizing circuits, speed control of hydraulic cylinder, speed control of hydraulic motors, accumulators and accumulator circuits.

7 Hours

PART - B

UNIT - 5

MAINTENANCE OF HYDRAULIC SYSTEMS: Hydraulic oils – Desirable properties, general type of fluids, sealing devices, reservoir system, filters and strainers, problem caused by gases in hydraulic fluids, wear of moving parts due to solid particle contamination, temperature control, trouble shooting.

6 Hours

UNIT - 6

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.

6 Hours

UNIT - 7

DIRECTIONAL CONTROL VALVES: Symbolic representation as per ISO 1219 and ISO 5599. Design and constructional aspects, poppet valves, slide valves spool valve, suspended seat type slide valve.

SIMPLE PNEUMATIC CONTROL: Direct and indirect actuation pneumatic cylinders, use of memory valve. Flow control valves and speed control of cylinders supply air throttling and exhaust air throttling use of quick exhaust valve.

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.

7 Hours

UNIT - 8

MULTI-CYLINDER APPLICATIONS: Coordinated and sequential motion control. Motion and control diagrams – Signal elimination methods. Cascading method – principle. Practical application examples (up to two cylinders) using cascading method (using reversing valves).

ELECTRO-PNEUMATIC CONTROL: Principles-signal input and out put pilot assisted solenoid control of directional control valves, use of relay and contactors. Control circuitry for simple single cylinder applications.

COMPRESSED AIR: Production of compressed air – compressors, preparation of compressed air- Driers, Filters, Regulators, Lubricators, Distribution of compressed air- Piping layout.

7 Hours

TEXT BOOKS:

1. **Fluid Power with Applications -** Anthony Esposito, Fifth edition pearson education, Inc. 2000.
2. **Pneumatics and Hydraulics:** Andrew Parr. Jaico Publishing Co. 2000.

REFERENCE BOOKS:

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

COMPUTER GRAPHICS

Subject Code	:	**06ME836**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

Scan Conversion and Clipping Representation of Points: lines, Line Drawing Algorithms: DDA algorithm, Bresenham's integer line algorithm, Bresenham's circle algorithm, Polygon filling algorithms: scan conversion, seed filling, scan line algorithm. Viewing transformation, Clipping –points, lines, text, polygon, Cohen-Sutherland line clipping, Sutherland-Hodgmen algorithm.

7 Hours

UNIT - 2

Two Dimensional Transformations: Representation of points, Transformations: Rotation, Reflection, Scaling, Combined Transformations,

Translations and Homogeneous Coordinates, A geometric interpretation of homogeneous coordinates, Over all scaling, Points at infinity, rotation about an arbitrary point, Reflection through an arbitrary line.

6 Hours

UNIT - 3

Three Dimensional Transformations and Projections 3D Transformation matrix: general matrix, Translation, scaling, Shearing, Rotation, Reflection, Multiple transformations, Rotation about an axis parallel to coordinate axis, Rotation about an arbitrary axis in space, Reflection through an arbitrary plane, Orthographic Transformations, one, Perspective projections- one point, two point and three point.

6 Hours

UNIT - 4

Plane and Space Curves Curve representation, Nonparametric curves, parametric curves, parametric representation and generation of line, circle, ellipse, parabola, hyperbola, generation of circle, ellipse, parabola, hyperbola, Cubic spline, normalized cubic splines, Bezier curves: blending function, properties, generation, B-spline curves- Cox-deBoor recursive formula,properties,open uniform basis functions, Non-uniform basis functions, periodic B-spline curve.

7 Hours

PART - B

UNIT - 5

Types and Mathematical Representation of Solids Solid Models, Solid entities, Solid representation, Solid modeling- set theory, regularized set operations, set membership classification, Half spaces, Half spaces of plane, cylinder, sphere, conical half-space, Boundary representation, Constructive Solid Geometry- basic elements, Building operations.

7 Hours

UNIT - 6

Visual Realism-I Introduction, hidden line removal- visibility of object views, Visibility techniques: minimax test, containment test, surface test, Silhouttes, Homogeneity test, Sorting, Coherence, Hidden line priority algorithm, Hidden surface removal- Z-buffer algorithm, Warnock's algorithm, Hidden solid removal- ray tracing algorithm.

6 Hours

UNIT - 7

Visual Realism-II Shading: shading models- diffuse reflection, specular reflection, ambient light, Shading surfaces- constant shading, gourmand shading, Phong shading, Shading enhancements, Shading Solids- Ray tracing for CSG, z- buffer algorithm for B-rep and CSG, octree encoded objects, Colouring- RGB, CMY, HSV, HSL colour models.

7 Hours

UNIT - 8

Computer Animation Introduction: Conventional animation-key frame, Inbetweening, Line testing, Painting, Filming, Computer animation-entertainment and engineering animation, Animation system hardware, software architecture, Animation types- frame buffer, colour table, zoom-pan-scroll, cross bar, real time play back, Animation techniques- key frame, skelton. Path of motion and p-curves.

6 Hours

TEXT BOOKS:

1. **CAD/CAM-Theory and Practice -** Ibraham Zeid, McGraw Hill, 2006
2. **Mathematical Elements for Computer Graphics -** Rogoer's Adams, McGraw Hill. 1990

REFERENCE BOOKS:

1. **Computer Graphics, Schaums outlines -** Xiang z, Plastock, R. A., McGraw Hill. 2007.
2. **Computer Graphics - principles and practice,** Foley, Van- Damn, Finner and Hughes, Addison Wesley. 2000
3. **Computer Graphics -** Sinha A. N., Udai A. D., Tata McGraw Hill, 2008.

FOUNDRY TECHNOLOGY

Subject Code	:	**06ME838**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

FOUNDRY METALLURGY: Oxidation of liquid metals, gas dissolution in liquid metals, methods of degassing, fluidity, factors affecting fluidity, fluidity tests, hot tearing, shrinkage of liquid and metals.

6 Hours

UNIT - 2

CASTING DESIGN: Introduction to casting design, redesign considerations, design for minimum casting stresses, design for directional solidification, design for metal flow, cast weld design, safety factors, design for low pattern cost and minimum manipulation, model making as an aid in design.

6 Hours

UNIT - 3

SOLIDIFICATION OF CASTINGS: Crystallization and development of cast structure - nucleation, growth and dendritic growth. Structure of castings - significance and practical control cast structure, grain shape and orientation, grain size, refinement and modification of cast structure. Concept of progressive and direction solidification, solidification time and derivation of Chvorinov's equation, influence on mold characteristics and cast metal.

7 Hours

UNIT - 4

RISERING AND GATING: The reason for risering, requirement of a riser, riser size and directional solidification, riser location and directional solidification, atmospheric pressure and risering, insulation, moldable exostherimic sleeves, exothermic riser compounds, internal chills and chaplets, external chills, molding materials of different chill capacities, padding, riser shape, size and contact area, side and blind risers, location of risers, general considerations of risering, riser size, riser treatment, riser feeding distance, risering of alloys, Gating system, theoretical considerations of gating, turbulence in the gating system, velocity calculations, the tapered sprue, velocity calculations in real gating systems, problems.

7 Hours

PART - B

UNIT - 5

MODERN MOULDING: Modern moulding process like vacuum moulding, flaskless moulding, nobake moulding.

Cupola: Developments in cupola melting like, secondary tyers, uniblast cupola, balanced blast cupola, hot blast cupola, water cooled cupola, cupola charge calculations.

7 Hours

UNIT - 6

FOUNDRY REFRACTORIES: Introduction, classification of refractories, refractory raw materials, forms of refractories and refractory materials, structure of refractories, general considerations of acid refractories, fireclay and other alumina-silica refractories, silica refractories, general considerations of basic and neutral refractories, refractories in the acid cupola, refractories in the basic cupola, open-hearth steel furnaces, induction and direct-arc furnaces for ferrous melting, ladle refractories for iron and steel, refractories in the non-ferrous foundry, molding materials.

6 Hours

UNIT - 7

FERROUS FOUNDRY: Manufacturing of steel ingots, casting, Structure, properties, production and application of Grey cast iron, malleable iron and spheroidal graphite iron.

7 Hours

UNIT - 8

MODERNISATION OF MECHANISATION OF FOUNDRY: Need for modernization area mechanization, moulding and core making, melting, pouring, shake out equipment and fettling dust and fume control, material handling equipments for sand moulds and cores, molten metal and castings, reclamation of sands.

6 Hours

TEXT BOOKS:

1. **Principles & Metal Casting –** Heineloper &Howard F Taylor, Merton C Flemings & John Wulff Wiley Eastern LimRusenthal THM 2005.
2. **Principle at Foundry Technology -** P.L.Jain, TMH – 2006.

REFERENCE BOOKS:

1. **Casting -John Campbell,** 2nd edition R.K.Jain.
2. **Foundry Technology -** P.N.Rao.
3. **Manufacturing process –** Radha Krishna-5th edition, Sapna Book House Bangalore
4. **Principles of metal cutting** Hein Coper & Rosenthal TMH - 2005

INDUSTRIAL MANAGEMENT

Subject Code	:	**06AU841**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Historical perspective, contribution of Taylor, Henry Fayol, Gilbert, Charles Babbage, HL Gantt and others to the evolution of management science in the Indian context. Ownership of Industries Proprietorship, partnership, joint stock companies, public and private undertakings, co-operative organizations

6 Hours

UNIT - 2

MANAGEMENT FUNCTIONS: Planning: corporate objectives, policies, strategies need for planning, responsibilities and types of plans, modern toll of planning, selection of alternatives and process of decision making, case studies.

ORGANIZATION: Basic requirement, types, structures and merits, Departmentation, vertical and horizontal growth, span of control, authority and responsibility, centralization and decentralization, formal and informal organizations, case studies.

7 Hours

UNIT - 3

STAFFING: Appraisal of needs, executive development schemes, performance appraisal and managerial mobility.

Directing: Types of instructions and characteristics of good order, communication follow of instructions motivation and leadership.

Controlling: process of control, requirements of effective controlling, controlling techniques.

7 Hours

UNIT 4

WORK STUDY, INCENTIVES, HEALTH AND SAFETY: Method study and time study, Foundations of work study, Job evaluation systems, Multi skilling, Incentive schemes, Training and Development, Safety Regulations and safe practices

6 Hours

PART - B

UNIT - 5

MANAGEMENT AND BEHAVIORAL APPROACH: Contribution of Elton Mayo and skinner and others to behavior sciences. Skills of a manager at various levels in an organization and inter-related systems, understanding past behavior, predicting future behavior, directing, changing and controlling behavior.

6 Hours

UNIT - 6

MOTIVATION AND BEHAVIOR: Maslow's hierarchy of needs, pretence of needs and satisfaction of needs, goal oriented behavior, integration of organizational goals and needs of employee. Hawthorn's studies and its findings theory X and theory Y, immaturity theory, motivation hygiene theory.

6 Hours

UNIT - 7

PROCESS MANAGEMENT: Definition of process management**.** Major process decisions-process choice, vertical integration, resource flexibility, customer involvement, capital intensity, relationships between decisions, service operation relationships between decisions, service operation relationships, economics of scoop and gaining focus. Designing process-process rearranging and process improvement.

7 Hours

UNIT - 8

MANAGEMENT OF TECHNOLOGY: Meaning and role of technology-primary areas of technology management, management of technology and its

role in improving business performance. Creating and applying technology-R and D stages and technology fusion. Technology strategy. Implementation guidelines.

7 Hours

TEXT BOOKS:

1. **Principles of Management -** Koontz Odonnel, Mc.Graw Hill Intl.Book Co.
2. **Production and operations Management -** S.N Chery, TATA McGraw Hill

REFERENCE BOOKS:

1. **Essentials of management -** Koontz Weirich, TATA McGraw Hill Intl. Book Co., 7th Edition.
2. **Management of Organizational Behaviour** - Hersey Paul and Kenneth H, PHI.
3. **Operations management-strategy and analysis -** Lee J.Krajewski and Larry P. Ritzman, Fifth Edition Addison-Weley.

ALTERNATE ENERGY SOURCES FOR AUTOMOBILES

Subject Code	:	**06AU842**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

INTRODUCTION: Types of energy sources, their availability, need of alternative energy sources, availability merits and limitations of solar energy, wind energy, ocean energy, biomass and hydrogen energy.

6 Hours

UNIT - 2

SOLAR ENERGY: solar energy geometry, solar radiation measurement devices, solar energy collectors, types of collectors, direct application of solar energy, solar energy storage systems, P-V effect solar cells and characteristics. Application of solar energy for automobiles.

10 Hours

UNIT - 3

BIOMASS ENERGY: Definition of biomass, types of biomass, biomass conversion techniques, bio gas, biogas generation processes, types of biogas plants, construction and working, application of biogas for IC engines,

modifications needed. Vegetable oils, Types - Properties – Biodiesel Esterification – Performance in Engines.

10 Hours

PART - B

UNIT - 4

WIND ENERGY: Introduction, principle of wind energy conversion, types of wind mills, relative advantages and limitations, factors considered for site selection, application of wind energy.

5 Hours

UNIT - 5

HYDROGEN ENERGY: Properties and thermodynamics of water splitting, Hydrogen production methods, problems associated in use of hydrogen fuel, Storage and Transportation methods, Precautions and safety for use. combustion, emission and performance characteristics of hydrogen engine, engine modifications required.

Fuel cells, types of fuel cells, their characteristics, requirements and applications of fuel cells.

8 Hours

UNIT - 6

Properties of alcohols, production of ethanol and methanol, performance of IC engines using ethanol and methanol blends, production and properties of natural gas and LPG. Advantages and disadvantages of using natural gas and LPG as fuel in IC engine. Comparision with respect to conventional fuel.

7 Hours

UNIT - 7

ELECTRIC VEHICLES: Requirements, features of different electric vehicles available in India, design of electric vehicle, components, types of batteries and power plant. Advantages, disadvantages and future prospects of electric vehicles.

6 Hours

TEXT BOOKS:

1. **Present and Future Automotive Fuels** Osamu Hirao and Richard K.Pefley, John Wiley and Sons, 1988.
2. **Non conventional energy sources** - G.D.Rai, Khanna Pub, New Delhi
3. **Electric Automobiles** - William Hamilton, PHI

REFERENCE BOOKS:

1. **Automotive Fuels Handbook -** 1.Keith Owen and Trevor Eoley, SAE Publications, 1990.
2. **Automotive Fuels Guide Book -** Richard L.Bechtold, SAE Publications, 1997.
3. **Solar energy -** Sukatme, Tata McGrawHill

DESIGN OF AUTOMOTIVE ENGINE COMPONENTS

Subject Code	:	**06AU843**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

GENERAL CONSIDERATIONS IN ENGINE DESIGN: Preliminary analysis, choice of cycle, speed, fuel, bore and stroke, cylinder arrangement, choice of material, stress and fatigue considerations.

4 Hours

UNIT - 2

DESIGN OF MAJOR COMPONENTS: Detailed design procedure for piston assembly, connecting rod, crankshaft, poppet valve, valve gear, cylinder, cylinder head and crank case.

10 Hours

UNIT - 3 & 4

DESIGN OF OTHER COMPONENTS: Inlet and exhaust manifolds, Engine foundations and mountings, gaskets, bearings, Flywheel, Turbocharger, Supercharger, Fuel injection system.

10 Hours

PART - B

UNIT - 5

DESIGN OF FUEL SUPPLY SYSTEM: S.I Engines- Carburetor design. C.I Engines - Fuel pump, fuel injector

8 Hours

UNIT - 6

DESIGN OF LUBRICATING SYSTEMS: Oil pump, oil filter, oil cooler

4 Hours

UNIT - 7

DESIGN OF COOLING SYSTEM COMPONENTS: Water pump, Radiator, Cooling fan.

4 Hours

UNIT - 8

DESIGN OF TWO – STROKE ENGINES: Design of Inlet and Exhaust ports, piston assembly, intake and exhaust system, scavenging, application to automotive gasoline and marine diesel engines.

12 Hours

TEXTBOOKS:

1. **Design of Automotive Engines -** A.Kolchinand V.Demidov, Mir Publishers, Moscow1984

2. **Basic design of Two stroke Engines -** Gordon P. Blair. SAE 1992
3. **Internal-Combustion Engines: Theory and Design -** V.L. Maleev, McGraw-Hill Book Company, Inc. 1994.

REFERENCE BOOKS:

1. **Engine Design**- GilesJ. G., lliffe Book Ltd.
2. **Advanced concepts of Two-stroke Engines -** Gordon P. Blair, SAE -1990
3. **Engine Design -** John Fenton, University Press Cambridge, Great Britain, 1986
4. **Design techniques for Engine Manifolds. Wave action methods for I.C. Engines -** D.E. Winterbone and R.J. Pearson, Professional engineering Publishing Ltd, UK, 2000
5. **Engine Design -** Crouse, Tata McGraw Publication, delhi.
6. **SAE Handbooks**

HYBRID VEHICLES

Subject Code	:	**06ME844**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

HYBRID VEHICLES: Performance characteristics of road vehicles, calculation of road load, predicting fuel economy, Grid connected hybrids.

4 Hours

UNIT - 2 & 3

PROPULSION METHODS: DC motors-series wound, shunt wound. Compound wound and separately excited motors AC motors - induction, synchronous, brushless DC motor, switched reluctance motors.

12 Hours

UNIT - 4

HYBRID ARCHITECTURE: Series configuration- locomotive drives, series parallel switching, load tracking architecture. Pre transmission parallel and combined configurations-Mild hybrid, power assist, dual mode, power split, power split with shift, Continuously Variable transmission (CVT). Wheel motors.

8 Hours

PART - B

UNIT - 5

HYBRID POWER PLANT SPECIFICATIONS: Grade and cruise targets. launching and boosting, braking and energy recuperation, drive cycle

implications, engine fraction-engine downsizing and range and performance, usage requirements.

8 Hours

UNIT - 6

SIZING THE DRIVE SYSTEM: Matching electric drive and ICE, sizing the propulsion motor, sizing power electronics

4 Hours

UNIT - 7

ENERGY STORAGE TECHNOLOGY: Battery basics, lead-acid battery, different types of batteries, battery parameters.

6 Hours

UNIT - 8

FUEL CELLS: Fuel cell characteristics, fuel cell types - alkaline fuel cell, proton exchange membrane, direct methanol fuel cell, phosphoric acid fuel cell, molten carbonate fuel cell, solid oxide fuel cell, hydrogen storage systems, reformers, fuel cell EV, super and ultra capacitors, flywheels.

10 Hours

TEXTBOOKS:

1. **The Electric Car: Development & Future of Battery, Hybrid & Fuel-Cell Cars -** Dr Mike Westbrook, M H Westbrook, British library Cataloguing in Publication Data, UK, ISBN0 85296 0131.
2. **Electric and Hybrid Vehicles -** Robin Hardy, Iqbal Husain, CRC Press, ISBN 0-8493-1466-6.
3. **Propulsion Systems for Hybrid Vehicles -** John M. Miller, Institute of Electrical Engineers, London, ISBN0 863413366.

REFERENCEBOOKS:

1. **Energy Technology Analysis Prospects for Hydrogen and Fuel Cells,** International Energy Agency, France.
2. **Hand Book of Electric Motors -** Hamid A Taliyat,Gerald B Kliman, Mercel Dekker Inc., US,ISBN0-8247-4105-6.

DATABASE MANAGEMENT SYSTEMS

Subject Code	:	**06ME845**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

DATABASE AND DATABASE USERS: Introduction, characteristics of database approach, intended uses of a DBMS, advantages and implementation of database approach.

6 Hours

UNIT - 2

DATABASE SYSTEMS CONCEPTS AND ARCHITECTURE: Data models, schemes and instances, DBMS architecture and data independence, database languages and interfaces, database system environment, classification of database management systems.

6 Hours

UNIT - 3

DATA MODELING: High level conceptual data models for database design. Entity types, entity sets, attributes and keys, Relationships, relationship types, roles and structural constraints. Weak entity types, ER diagram and design issue.

8 Hours

UNIT - 4

RECORD STORAGE AND PRIMARY FILE ORGANIZATIONS: Secondary storage devices, buffering of the blocks, placing file records on the disk, operations on files, heap files and sorted files, hashing techniques.

6 Hours

PART - B

UNIT - 5

RELATIONAL DATA MODEL AND RELATIONAL ALGEBRA: Brief discussion on code rules, relational model concepts, constraints and schemas. Update operation on relations, basic and additional relational algebra operations. And queries in relational algebra.

7 Hours

UNIT - 6

Structural Query Language (SQL): Data definition etc., in SQL2. Basic and complex queries in SQL, Inser, Delete;Update statements, and views in SQKL, embedded SQL.

7 Hours

UNIT - 7

DATABASE DESIGN: Design guidelines for relational schemas, functional dependencies, normalization 1^{st}, 2^{nd}, 3^{rd}, 4^{th} and 5^{th}; normal forms. Database design process, factors influencing physical database design guidelines, and guidelines for relational systems.

7 Hours

UNIT - 8

SYSTEM IMPLEMENTATION: System catalogue for RDBMSs, transaction processing, and system concepts, properties of transaction, brief discussion on concurrency control and recovery techniques, database security and authorization.

5 Hours

TEXT BOOKS:

1. **Fundamentals of Database Systems -** Ramez Elmasri and Shanmkanth B. Navathe, 3rd Edition, Addison Pearson.
2. **Database Management System Use -** by Raghu Ramakrishnan, Tata Mc Graw Hill, 3rd Edn. 2002.

REFERENCE BOOKS:

1. **Database Mangaement and design -** by Gray W.hansen and James V. Hansen, 2nd Edn. Printice Hall India Pvt. Ltd., 2002.
2. **Database Management Systems- Designing and Building business applications,** Gerald V. Post, 3rd Edition, Tata Mc Graw Hill Publishing company Ltd.,- 2005
3. **Project Mangment with PERT and CPM,** Moder Joseph J and Phillips cerel, R., VAN Noserand, Reinhold, 2nd Edn., 1976.

ARTIFICIAL INTELLIGENCE

Subject Code	:	**06ME846**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART - A

UNIT - 1

ARTIFICIAL INTELLIGENCE: Introduction, definition, underlying assumption, importance of AI, AI and related fields.

6 Hours

UNIT - 2

SPACE REPRESENTATION: Defining a problem. Production systems and its characteristics, Search and Control strategies – Generate and Test, Hill Climbing, Best – first Search, Problem reduction, Constraint Satisfaction, Means – Ends Analysis.

7 Hours

UNIT - 3

KNOWLEDGE REPRESENTATION ISSUES: Representations and Mappings, Types of knowledge – Procedural Vs Declarative, Logic programming. Forward Vs Backward reasoning, Matching.

7 Hours

UNIT - 4

USE OF PREDICATE LOGIC: Representing simple facts, Instance and Isa relationships, Syntax and Semantics for Prepositional logic, FQPL and properties of Wffs, Conversion to Clausal form, Resolution, Natural deduction.

6 Hours

PART - B

UNIT - 5

STATISTICAL AND PROBABILISTIC REASONING: Symbolic reasoning under uncertainty, Probability and Bayes' theorem, Certainity factors and Rule based systems, Bayesian Networks, Shafer Theory, Fuzzy Logic.

7 Hours

UNIT - 6

EXPERT SYSTEMS: Structure and uses, Representing and using domain knowledge, Expert System Shells. Pattern recognition Learning classification patterns, recognizing and understanding speech. Introduction to knowledge Acquisition, Types of Learning.

7 Hours

UNIT - 7

TYPICAL EXPERT SYSTEMS: MYCIN, Variants of MYCIN, PROSPECTOR, DENDRAL, PUFF, ETC.

6 Hours

UNIT - 8

INTRODUCTION TO MACHINE LEARNING: Perceptrons, Checker Playing Examples, Learning Automata, Genetic Algorithms, Intelligent Editors.

6 Hours

TEXT BOOKS:

1. **Artificial Intelligence** – Elaine Rich & Kevin Knight, M/H 1983.
2. **Introduction to AI & ES** – Dan W. Patterson, Prentice Hall of India, 1999.

REFERENCE BOOKS:

1. **Principles of Artificial Intelligence** – Springer Verlag, Berlin, 1981.
2. **Artificial Intelligence in Business, Science & Industry** – Wendy'B.Ranch
3. **A Guide to expert systems** – Waterman, D.A., Addison – Wesley inc. 1986
4. **Building expert systems** – Hayes, Roth, Waterman, D.A. Addison – Wesley, 1983

DESIGN OF EXPERIMENTS

Subject Code	:	**06ME847**	IA Marks	:	25
No. of Lecture Hrs/ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hours	:	52	Exam Marks	:	100

PART -A

UNIT - 1

INTRODUCTION: Strategy of Experimentation, Typical applications of Experimental design, Basic Principles, Guidelines for Designing Experiments.

5 Hours

UNIT - 2

BASIC STATISTICAL CONCEPTS: Concepts of random variable, probability, density function cumulative distribution function. Sample and population, Measure of Central tendency; Mean median and mode, Measures of Variability, Concept of confidence level. Statistical Distributions: Normal, Log Normal & Weibull distributions. Hypothesis testing, Probability plots, choice of sample size. Illustration through Numerical examples.

7 Hours

UNIT - 3

EXPERIMENTAL DESIGN: Classical Experiments: Factorial Experiments: Terminology: factors, levels, interactions, treatment combination, randomization, Two-level experimental designs for two factors and three factors. Three-level experimental designs for two factors and three factors, Factor effects, Factor interactions, Fractional factorial design, Saturated Designs, Central composite designs. Illustration through Numerical examples.

7 Hours

UNIT - 4

ANALYSIS AND INTERPRETATION METHODS: Measures of variability, Ranking method, Column effect method & Plotting method, Analysis of variance (ANOVA) in Factorial Experiments: YATE's algorithm for ANOVA, Regression analysis, Mathematical models from experimental data. Illustration through Numerical examples.

7 Hours

PART - B

UNIT - 5

QUALITY BY EXPERIMENTAL DESIGN: Quality, Western and Taguchi's quality philosophy, elements of cost, Noise factors causes of variation. Quadratic loss function & variations of quadratic loss function. Robust Design: Steps in Robust Design: Parameter design and Tolerance

Design. Reliability Improvement through experiments, Illustration through Numerical examples.

6 Hours

UNIT - 6

EXPERIMENT DESIGN USING TAGUCHI'S ORTHOGONAL ARRAYS: Types of Orthogonal Arrays, selection of standard orthogonal arrays, Linear graphs and Interaction assignment, Dummy level Technique, Compound factor method, Modification of linear graphs. Illustration through Numerical examples.

8 Hours

UNIT - 7

SIGNAL TO NOISE RATIO: Evaluation of sensitivity to noise. Signal to Noise ratios for static problems: Smaller-the-better type, Nominal-the – better-type, Larger-the-better type. Signal to Noise ratios for Dynamic problems. Illustration through Numerical examples.

6 Hours

UNIT - 8

PARAMETER AND TOLERANCE DESIGN: Parameter and tolerance design concepts, Taguchi's inner and outer arrays, parameter design strategy, tolerance design strategy. Illustration through Numerical examples.

6 Hours

TEXT BOOKS:

1. **Design and Analysis of Experiments -** Douglas C. Montgomery, 5th Edition Wiley India Pvt. Ltd. 2007
2. **Quality Engineering using Robust Design -** Madhav S. Phadke, Prentice Hall PTR, Englewood Cliffs, New Jersy 07632 ,1989.

REFERENCE BOOK:

1. **Quality by Experimental Design -** Thomas B. Barker, Marcel Dekker, Inc ASQC Quality Press.1985.
2. **Experiments Planning, analysis, and parameter Design optimization** - By C.F.Jeff Wu Michael Hamada, John Wiley Editions. 2002.
3. **Reliability Improvement by Experiments -** W.L. Condra, Marcel Dekker, Inc ASQC Quality Press.1985.
4. **Taguchi Techniques for Quality Engineering** - Phillip J. Ross, 2nd Edn. McGraw Hill International Editions, 1996.

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