ELECTIVE I							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BAU18E01	Simulation of IC Engines	Ty	3	0/0	0/0	3
2	BAU18E02	Automotive Air-conditioning	Ty	3	0/0	0/0	3
3	BAU18E03	Engine Auxiliary Systems	Ty	3	0/0	0/0	3
4	BAU18E04	Advanced Theory of I.C. Engines	Ty	3	0/0	0/0	3
5	BAU18E05	Supercharging and Scavenging	Ty	3	0/0	0/0	3
6	BAU18E06	Engine Management system	Ty	3	0/0	0/0	3

ELECTIVE II							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BAU18E07	Automotive Aero-dynamics	Ty	3	0/0	0/0	3
2	BAU18E08	Fuel Cell Technology	Ty	3	0/0	0/0	3
3	BAU18E09	New Generation and Hybrid Vehicles	Ty	3	0/0	0/0	3
4	BAU18E10	Alternate Fuels and Energy Systems	Ty	3	0/0	0/0	3
5	BAU18E11	Two and Three Wheeler Technology	Ty	3	0/0	0/0	3
6	BAU18E12	Manufacturing of Auto Components	Ty	3	0/0	0/0	3

ELECTIVE III							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BAU18E13	Vibration, Noise and Harshness Control	Ty	3	0/0	0/0	3
2	BAU18E14	Automotive Crash worthiness & Occupant Safety	Ty	3	0/0	0/0	3
3	BRE18E05	Finite Element Analysis	Ty	3	0/0	0/0	3
4	BME18E10	Tribology	Ty	3	0/0	0/0	3
5	BME18E11	Design for Manufacture and Assembly	Ty	3	0/0	0/0	3
6	BME18E13	Industrial Robotics	Ty	3	0/0	0/0	3

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Maduravoyal, Chennai 600 095

ELECTIVE IV							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BAU18E15	Marketing Management	Ty	3	0/0	0/0	3
2	BAU18E16	Entrepreneurship Development	Ty	3	0/0	0/0	3
3	BAU18E17	Interiors & Ergonomics	Ty	3	0/0	0/0	3
4	BME18E15	Process Planning and Cost Estimation	Ty	3	0/0	0/0	3
5	BME18E20	Total Quality Management	Ty	3	0/0	0/0	3
6	BME18E23	Quality Engineering	Ty	3	0/0	0/0	3

ELECTIVE V							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BAU18E18	Earth Moving Vehicles	Ty	3	0/0	0/0	3
2	BAU18E19	Transport Management	Ty	3	0/0	0/0	3
3	BAU18E20	Composite Materials	Ty	3	0/0	0/0	3
4	BME18E09	Design of Material Handling Equipments	Ty	3	0/0	0/0	3
5	BME18E05	Computational Fluid Dynamics	Ty	3	0/0	0/0	3

ELECTIVE I

Subject Code: BAU18E01	Subject Name : SIMULATION OF IC ENGINES	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Pre requisite: Thermodynamics and Thermal Engineering-I	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The student will learn

- To impart knowledge in simulation of SI and CI engine processes.
- The detailed concept of air standard, fuel air cycle, progressive and actual cycle simulation of SI engine..

COURSE OUTCOMES (COs) : (3- 5)

CO1	Gain the knowledge of advantages of computer simulation and engine thermodynamic models.
CO2	Gain the knowledge of engine combustion stoichiometry and adiabatic flame temperature.
CO3	Gain the knowledge of SI engine Combustion Simulation and Gas exchange process.

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		M		L		H					
CO2		L		M								
CO3	H						M					
Cos / PSOs	**PSO1**		**PSO2**		**PSO3**		**PSO4**		**PSO5**			
CO1	H				M							
CO2	M				M							
CO3	M		M		L		M					

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: BAU18E01	Subject Name : SIMULATION OF IC ENGINES	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Pre requisite: Thermodynamics and Thermal Engineering-I	Ty	3	0/0	0/0	3

UNITI:INTRODUCTION **9**

Introduction to Simulation, Advantages of computer simulation, Classification of engine models. Intake and exhaust flow models – Quasi steady flow - Filling and emptying - Gas dynamic Models. Thermodynamic based in cylinder models. Step by step approach in SI engine simulation.

UNIT II COMBUSTION AND STOICHIOMETERY **9**

Reactive processes, Heat of reaction, measurement of URP, measurement of HRP. Introduction - combustion equation for hydrocarbon fuels. Calculation of minimum air required for combustion, excess air supplied and stoichiometric air required for complete combustion. Conversion of volumetric analysis to mass analysis.

UNIT III ADIABATIC FLAME TEMPERATURE **9**

Introduction, complete combustion in C-H-N-O systems, constant volume adiabatic combustion, constant pressure adiabatic combustion, calculation of adiabatic flame temperature, isentropic changes of state. SI Engine simulation with air as working medium, deviation between actual and ideal cycle.

UNIT IV SI ENGINE SIMULATION WITH ADIABATIC COMBUSTION **9**

Introduction, Engine details, temperature drop due to fuel vaporization, full throttle operation, work output and efficiency calculation, part-throttle operation, engine performance at part throttle, super charged operation, SI Engines simulation with progressive combustion. Wiebe's law combustion analysis.

UNIT V SI ENGINE SIMULATION WITH GAS EXCHANGE PROCESS **9**

Introduction, gas exchange process, Heat transfer process, friction calculations, compression of simulated values, validation of the computer code, engine performance simulation, pressure crank angle diagram, brake power, brake thermal efficiency, effect of speed on performance.

Total no. of Periods: 45

TEXTBOOKS:

1. Ganesan.V. "Computer Simulation of spark ignition engine process", Universities Press (I) Ltd, Hyderabad, 1996.

REFERENCES:

1.*John. B. Heywood, "Internal Combustion Engines'", Tata McGraw Hill Co., Newyork, 1988.*
2.Benson.R.S., Whitehouse.N.D., "Internal Combustion Engines", Pergamon Press, oxford, 1979
3.Ramoss. A.L., "Modelling of Internal Combustion Engines Processes", McGraw Hill Publishing Co., 1992.
4.Ashley Campbel, "Thermodynamic analysis of combustion engines", John Wiley & Sons, New York, 1986.

Subject Code:	Subject Name : AUTOMOTIVE AIR-CONDITIONING	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E02	Pre requisite: Thermodynamics and Thermal Engineering-I	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The student will learn

- To understand the components of the automotive air-conditioning and their functions and the latest developments in this field.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Gain the knowledge of fundamentals of refrigeration and air conditioning of automobiles
CO2	Gain the knowledge of heaters and cooling system and refrigerants used in automobiles air conditioners.
CO3	Gain the knowledge of temperature control and service of an automobile..

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		M		L		H					
CO2		L		M								
CO3	H						M					

Cos / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H		M		
CO2	M		M		
CO3	M	M	L	M	

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code:	Subject Name : AUTOMOTIVE AIR-CONDITIONING	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E02	Pre requisite: Thermodynamics and Thermal Engineering-I	Ty	3	0/0	0/0	3

UNIT I AIR CONDITIONING FUNDAMENTALS 9

Basic air conditioning system - location of air conditioning components in a car, schematic layout of a refrigeration system, compressor components, condenser and high pressure service ports, thermostatic expansion valve, expansion valve calibration, controlling evaporator temperature, evaporator pressure regulator, evaporator temperature regulator.

UNIT II AIR CONDITIONER – HEATING SYSTEM 9

Automotive heaters, manually controlled air conditioner, heater system, automatically controlled air conditioner and heater systems, automatic temperature control, air conditioning protection, engine protection.

UNIT III REFRIGERANT 9

Containers handling refrigerants, tapping into the refrigerant container, refrigeration system diagnosis, diagnostic procedure, ambient conditions affecting system pressures**.**

UNIT IV AIR ROUTING AND TEMPERATURE CONTROL 9

Objectives, evaporator airflow through the recirculating unit, automatic temperature control, duct system, controlling flow, vacuum reserve, testing the air control and handling systems.

UNIT V AIR CONDITIONING SERVICE 9

Air conditioner maintenance and service, servicing heater system removing and replacing components, trouble shooting of air controlling system, compressor service.

Total no. of Periods: 45

TEXT BOOKS

William H. Crouse and Donald I. Anglin - "Automotive Air conditioning" - McGraw Hill Inc. - 1990.
Boyce H.D.Wiggins - "Automotive Air Conditioning" - Delmar – 2002

REFERENCES

1. *Mitchell information Services, Inc - "Mitchell Automatic Heating and Air Conditioning Systems" - Prentice Hall Ind. - 1989.*
2. Paul Weiser - "Automotive Air Conditioning" - Reston Publishing Co., Inc., - 1990.
3. MacDonald, K.I. - "Automotive Air Conditioning" - Theodore Audel series - 1978
4. Goings.L.F. – "Automotive Air Conditioning" - American Technical services - 1974.

Subject Code:	Subject Name : ENGINE AUXILLARY SYSTEMS	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E03	Pre requisite:Automotive Engines, Applied Thermodynamics	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The student will learn

- To make the students understand the various auxiliary systems used in automobiles and their functions.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Gain the knowledge of carburetion and types of gasoline injection and ignition system.
CO2	Gain the knowledge of methods of diesel fuel injection systems and mixture distribution systems..
CO3	Gain the knowledge of different types of lubrication and cooling system.

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		M		L		H					
CO2		L		M								
CO3	H						M					

Cos / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H		M					
CO2	M		M					
CO3	M	M	L	M				

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code:	Subject Name : ENGINE AUXILLARY SYSTEMS	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E03	Pre requisite:Automotive Engines	Ty	3	0/0	0/0	3

UNIT I CARBURETION **10**

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.

UNIT II GASOLINE INJECTION AND IGNITION SYSTEM **9**

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.

UNIT III DIESEL FUEL INJECTION **9**

Factors influencing fuel spray atomization, penetration and dispersion of diesel and heavy oils and their properties, rate and duration of injection, fuel line hydraulics, fuel pump, injectors, CRDI systems and its merits and demerits.

UNIT IV MANIFOLDS AND MIXTURE DISTRIBUTION **9**

Intake system components, Discharge coefficient, Pressure drop, Air filter, Intake manifold, Connecting pipe, Exhaust system components, Exhaust manifold and exhaust pipe, Spark arresters, Waste heat recovery, Exhaust mufflers, Type of mufflers,

UNIT V LUBRICATION AND COOLING SYSTEMS **8**

Lubricants, lubricating systems, 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.

Total no. of Periods: 45

TEXT BOOKS:

1. Ramalingam,K.K, Internal Combustion Engine, Scitech Publication (India)
2. Ganesan, V., Internal Combustion Engines, Tata McGraw-Hill Book Co., 1995.

REFERENCES

1. *Do mkundwar, V.M, A Course in Internal Combustion Engines, Dhanpat Rai and Co., 1999.*
2. Mathur,M.L., and Sharma,R.P., A Course in Internal Combustion Engines, Dhanpat Rai Publications (P) Ltd., 1998.
3.Duffy Smith, Auto Fuel Sytstems, The Good Heart Willcox Company Inc., Publishers, 1987.
4. Edward F, Obert, Internal Combustion Engines and Air Pollution, Intext Education Publishers, 1980.

Subject Code:	Subject Name : ADVANCED THEORY OF I.C ENGINES	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E04	Pre requisite:Automotive Engines	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The student will learn

- To explain the theory of combustion processes in SI and CI .Engines and the gas exchange processes and the various possible alternate fuels and the developments in the recent years in this area.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Gain the knowledge of combustion in SI Engines and gas exchange process.
CO2	Gain the knowledge of different types and characteristics of alternative fuel for IC Engines..
CO3	Gain the knowledge of recent developments in IC engines..

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		M		L		H					
CO2		L		M								
CO3	H						M					
Cos / PSOs	PSO1		PSO2		PSO3		PSO4		PSO5			
CO1	H				M							
CO2	M				M							
CO3	M		M		L		M					

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code:	Subject Name : ADVANCED THEORY OF I.C ENGINES	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E04	Pre requisite: Prerequisite:Automotive Engines	Ty	3	0/0	0/0	3

UNIT I COMBUSTION IN SI ENGINES **9**

Stages of combustion - ignition, flame propagation, factors affecting flame structure and speed, cycle by cycle variations, misfire, knock and pre-ignition. Factors controlling combustion chamber design. Combustion in diesel engines, comparison of different combustion systems, fuel spray structure and factors affecting it. Models for combustion in SI and CI engines.

UNIT II GAS EXCHANGE PROCESSES **9**

Gas exchange processes in two and four stroke engines, factors affecting volumetric efficiency, flow through valves and ports, multi valve concept. Charge motion within the cylinder. Turbo charging and Turbocharger control. Different methods of charging and scavenging two stroke engines.

UNIT III COMBUSTION ANALYSIS **9**

Introduction to HWA, LDA and PIV systems to analyze engine flows. Engine heat transfer and energy balance, correlations for heat transfer coefficient, variables affecting heat transfer in engines. Cylinder pressure data acquisition and thermodynamic analysis of engine pressure data to yield heat release rates.

UNIT IV ALTERNATIVE FUELS **9**

Alternative gaseous and liquid fuels for SI and CI engines, Alcohols, Biogas, LPG, CNG, Hydrogen, Biodiesel and Straight Vegetable oils, their properties and characteristics when used as engine fuels. Production, storage and distribution of different alternative fuels.

UNIT V RECENT DEVELOPMENTS **9**

Homogeneous charge compression ignition, Stratified charge and gasoline direct injection, Dual fuel, lean burn and Hot surface Ignition engine concepts. Hybrid Electric Drives.

Total no. of Periods: 45

TEXT BOOKS:

1. Internal Combustion Engines by V. Ganesan, 2007, Tata Mc Graw Hill
2. Internal Combustion Engine Fundamentals, John B Heywood, Mc Graw Hill
3. Advanced Engine Technology by Heisler, SAE Publication

REFERENCES:

1. Internal Combustion Engines by Richard Stone, Macmillan Book Company also SAE Publications
2. Internal Combustion Engines by Colin R Ferguson, John Wiley and Sons
3. Design and Simulation of Two Stroke Engines, GP Blair SAE Publications

Subject Code:	Subject Name : SUPERCHARGING AND SCAVENGING	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E05	Pre requisite: Prerequisite:Automotive Engines,	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The student will learn

- To make the students understand the need for supercharging and the various types of superchargers used and their performance characteristics and the scavenging methods for two stroke engines. These concepts and principles are familiarized for design of components.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Gain the knowledge of principles of super charger and matching of super chargers
CO2	Gain the knowledge of scavenging in two stroke engines. .
CO3	Gain the knowledge of design of muffler and ports in two stroke engines.

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		M		L		H					
CO2		L		M								
CO3	H						M					
Cos / PSOs	PSO1		PSO2		PSO3		PSO4		PSO5			
CO1	H				M							
CO2	M				M							
CO3	M		M		L		M					

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: BAU18E05	Subject Name : SUPERCHARGING AND SCAVENGING	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Pre requisite: Prerequisite:Automotive Engines	Ty	3	0/0	0/0	3

UNIT I SUPERCHARGING **8**

Effects on engine performance – engine modification required Thermodynamics of Mechanical Supercharging and Turbo charging – Turbo charging methods – Engine exhaust manifolds arrangements.

UNIT II SUPERCHARGERS **10**

Types of compressors – Positive displacement blowers – Centrifugal compressors – Performance characteristic curves – Suitability for engine application – Surging – Matching of supercharger compressor and Engine – Matching of compressor, Turbine, Engine.

UNIT III SCAVENGING OF TWO STROKE ENGINES **12**

Peculiarities of two stroke cycle engines – Classification of scavenging systems – Mixture control through Reed valve induction – Charging Processes in two stroke cycle engine – Terminologies – Shankey diagram – Relation between scavenging terms – scavenging modeling – Perfect displacement, Perfect mixing – Complex scavenging models.

UNIT IV PORTS AND MUFFLER DESIGN **8**

Porting – Design considerations – Design of Intake and Exhaust Systems – Tuning.

UNIT V EXPERIMENTAL METHODS **7**

Experimental techniques for evaluating scavenging – Firing engine tests – Non firing engine tests – Port flow characteristics – Kadenacy system – Orbital engine combustion system.

Total no. of Periods: 45

TEXT BOOKS

1.Watson, N. and Janota, M.S., Turbocharging the I.C.Engine, MacMillan Co., 1982.
2.John B.Heywood, Two Stroke Cycle Engine, SAE Publications, 1997.

REFERENCES

1.*Obert, E.F.,Internal Combustion Engines and Air Pollution, Intext Educational Publishers, 1980.*
2.Richard Stone, Internal Combustion Engines, SAE, 1992.
3.Vincent,E.T., Supercharging the I.C.Engines, McGraw-Hill. 1943
4.Schweitzer, P.H., Scavenging of Two Stroke Cycle Diesel Engine, MacMillan Co., 1956

Subject Code:	Subject Name : ENGINE MANAGEMENT SYSTEM	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E06	Pre requisite:Automotive Engines	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The student will learn

- To explain the principle of engines electronic management system and different sensors used in the systems.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Gain the knowledge of fundamentals of auto electronics, sensors and actuators
CO2	Gain the knowledge of SI and CI Engine management system
CO3	Gain the knowledge of digital engine control system.

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		M		L		H					
CO2		L		M								
CO3	H						M					
Cos / PSOs	PSO1		PSO2		PSO3		PSO4		PSO5			
CO1	H				M							
CO2	M				M							
CO3	M		M		L		M					

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code:	Subject Name : ENGINE MANAGEMENT SYSTEM	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E06	Prerequisite: Prerequisite:Automotive Engines	Ty	3	0/0	0/0	3

UNIT I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS 9

Components for electronic engine management system, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Parameters to be controlled in SI and CI engines.

UNIT II SENSORS AND ACTUATORS 9

Inductive, Hall Effect, hot wire, thermistor, piezo electric, piezoresistive, based sensors. Throttle position, mass air flow, crank shaft position, cam position, engine and wheel speed, steering position, tire pressure, brake pressure, steering torque, fuel level, c Engine and vehicle design data rash, exhaust oxygen level (two step and linear lambda), knock, engine temperature, manifold temperature and pressure sensors.

UNIT III SI ENGINE MANAGEMENT 9

Three way catalytic converter, conversion efficiency versus lambda. Layout and working of SI engine management systems like Bosch Monojetronic, L-Jetronic and LH-Jetronic. Group and sequential injection techniques. Working of the fuel system components. Advantages of electronic ignition systems. Types of solid state ignition systems and their principle of operation, Contactless electronic ignition system, Electronic spark timing control.

UNIT IV CI ENGINE MANAGEMENT 9

Fuel injection system parameters affecting combustion, noise and emissions in CI engines. Pilot, main, advanced post injection and retarded post injection. Electronically controlled Unit Injection system. Layout of the common rail fuel injection system. Working of components like fuel injector, fuel pump, rail pressure limiter, flow limiter, EGR valve.

UNIT V DIGITAL ENGINE CONTROL SYSTEM 9

Cold start and warm up phases, idle speed control, acceleration and full load enrichment, deceleration fuel cutoff. Fuel control maps, open loop control of fuel injection and closed loop lambda control – Integrated engine control system, Exhaust emission control engineering, Electromagnetic compatibility – EMI Suppression techniques – Electronic dash board instruments – Onboard diagnosis system.

Total No. of Periods:.45

TEXT BOOKS:

1. Understanding Automotive Electronics William B Ribbens, SAE 1998
2. Automobile Electronics by Eric Chowanietz SAE

REFERENCES:

1. *Diesel Engine Management by Robert Bosch, SAE Publications, 3rd Edition, 2004*
2. *Gasoline Engine Management by Robert Bosch, SAE Publications, 2nd Edition, 2004.*

ELECTIVE II

Subject Code:	Subject Name : AUTOMOTIVE AERODYNAMICS	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E07	Pre requisite: Fluid Mechanics and Applied Thermodynamics .	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The student will learn

- To make the students understand the design concept of automobile bodies and to determine their drag coefficients and optimize their shapes using wind tunnel.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Gain the knowledge of aerodynamic effect of cabs and cars.
CO2	Gain the knowledge of design of shape optimization of cars and vehicle handling
CO3	Gain the knowledge of application of wind tunnel applications on aerodynamics.

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		M		L		H					
CO2		L		M								
CO3	H						M					

Cos / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H		M					
CO2	M		M					
CO3	M	M	L	M				

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code:	Subject Name : AUTOMOTIVE AERODYNAMICS	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E07	Pre requisite: Fluid Mechanics and Applied Thermodynamics	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION **9**

Scope – historical development trends – Fundamentals of fluid mechanics – Flow phenomenon related to vehicles – External & Internal flow problems.. – Resistance to vehicle motion – Performance – Fuel consumption and performance – Potential of vehicle aerodynamics.

UNIT II AERODYNAMIC DRAG OF CABS **9**

Car as a bluff body – Flow field around car – drag force – types of drag force – analysis of aerodynamic drag – drag coefficient of cars – strategies for aerodynamic development -low drag profiles.

UNIT III SHAPE OPTIMIZATION OF CABS **9**

Front and modification – front and rear wind shield angle – Boat tailing – Hatch back, fast back and square back – Dust flow patterns at the rear – Effect of gap configuration – effect of fasteners.

UNIT IV VEHICLE HANDLING **9**

The origin of force and moments on a vehicle – side wind problems – methods to calculate forces and moments – vehicle dynamics Under side winds – the effects of forces and moments – Characteristics of forces and moments – Dirt accumulation on the vehicle – wind noise – drag reduction in commercial vehicles.

UNIT V WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS **9**

Introduction – Principles of wind tunnel technology – Limitation of simulation – Stress with scale models – full scale wind tunnels – measurement techniques – Equipment and transducers – road testing methods – Numerical methods.

Total no. of Periods: 45

TEXT BOOK :

1.Hucho,W.H., Aerodynamics of Road vehicles, Butterworths Co. Ltd., 1987.
2.Pope,A., Wind Tunnel Testing, John Wiley & Sons, 2nd Edn., New York, 1974.

REFERENCES :

1.*Automotive Aerodynamics: Update SP-706, SAE, 1987.*
2.Vehicle Aerodynamics, SP-1145, SAE, 1996.

Subject Code:	Subject Name : FUEL CELL TECHNOLOGY	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E08	Prerequisite: Thermodynamics and Thermal Engineering-I	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The student will learn

- To introduce the concept of fuel cells for use in automobiles, analyze the performance characteristics of the various components and compare them with the other powering devices

COURSE OUTCOMES (COs) : (3- 5)

CO1	Gain the knowledge of different types of fuel cells and principles and applications.
CO2	Gain the knowledge of fuel cell components and storage of hydrogen
CO3	Gain the knowledge of fuel cell cycle analysis and fuel cell fuelled with Natural gas.

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		M		L		H					
CO2		L		M								
CO3	H						M					

Cos / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H		M					
CO2	M		M					
CO3	M	M	L	M				

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: BAU18E08	Subject Name : FUEL CELL TECHNOLOGY	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Pre requisite: Automotive Electrical and Electronics systems	Ty	3	0/0	0/0	3

UNIT IINTRODUCTION TO FUEL CELLS **9**

Introduction – working and types of fuel cell – low, medium and high temperature fuel cell, liquid and methanol types, proton exchange membrane fuel cell solid oxide, hydrogen fuel cells – thermodynamics and electrochemical kinetics of fuel cells.

UNIT II FUEL CELLS FOR AUTOMOTIVE APPLICATIONS **9**

Fuel cells for automotive applications – technology advances in fuel cell vehicle systems-bonboard hydrogen storage – liquid hydrogen and compressed hydrogen – metal hydrides, fuel cell control system – alkaline fuel cell – road map to market.

UNIT III FUEL CELL COMPONENTS AND THEIR IMPACT ON PERFORMANCE **9**

Fuel cell performance characteristics – current/voltage, voltage efficiency and power density, ohmic resistance, kinetic performance, mass transfer effects – membrane electrode assembly components, fuel cell stack, bi-polar plate, humidifiers and cooling plates.

UNIT IV FUELING **9**

Hydrogen storage technology – pressure cylinders, liquid hydrogen, metal hydrides, carbon fibers – reformer technology – steam reforming, partial oxidation, auto thermal reforming – CO removal, fuel cell technology based on removal like bio-mass.

UNIT V FUEL CYCLE ANALYSIS **9**

Introduction to fuel cycle analysis – application to fuel cell and other competing technologies like battery powered vehicles, SI engine fueled by natural gas and hydrogen and hybrid electric vehicle.

Total no. of Periods: 45

TEXTBOOKS

1. Fuel Cells for automotive applications – professional engineering publishing UK. ISBN 1-86058 4233, 2004.
2. Fuel Cell Technology Handbook SAE International Gregor Hoogers CRC Press ISBN 0-8493-0877-1-2003.

Subject Code: BAU18E09	Subject Name : NEW GENERATION AND HYBRID VEHICLES	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Pre requisite: Automotive Electrical and Electronics systems	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The student will learn

- To illustrate the new generation vehicles and their operation and controls

COURSE OUTCOMES (COs) : (3- 5)

CO1	Gain the knowledge of different types of powered vehicles like solar and magnetic power vehicle.
CO2	Gain the knowledge of automated vehicle and vehicle operation and control.
CO3	Gain the knowledge of suspension, brakes, aerodynamics and safety .in automobiles.

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		M		L		H					
CO2		L		M								
CO3	H						M					

Cos / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H		M		
CO2	M		M		
CO3	M	M	L	M	

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: BAU18E09	Subject Name : NEW GENERATION AND HYBRID VEHICLES	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Automotive Electrical and Electronics systems	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION **7**

Electric and hybrid vehicles, flexible fuel vehicles (FFV), solar powered vehicles, magnetic track vehicles, fuel cells vehicles.

UNIT II POWER SYSTRM AND NEW GENERATION VEHICLES **12**

Hybrid Vehicle engines, Stratified charge engines, learn burn engines, low heat rejection engines, hydrogen engines, HCCI engine, VCR engine, surface ignition engines, VVTI engines. High energy and power density batteries, fuel cells, solar panels, flexible fuel systems.

UNIT III VEHICLE OPERATION AND CONTROL **9**

Computer Control for pollution and noise control and for fuel economy - Transducers and actuators - Information technology for receiving proper information and operation of the vehicle like optimum speed and direction.

UNIT IV VEHICLE AUTOMATED TRACKS **9**

Preparation and maintenance of proper road network - National highway network with automated roads and vehicles - Satellite control of vehicle operation for safe and fast travel, GPS.

UNIT V SUSPENSION, BRAKES, AERODYNAMICS AND SAFETY **8**

Air suspension – Closed loop suspension, compensated suspension, anti skid braking system, retarders, regenerative braking, safety gauge air backs- crash resistance. Aerodynamics for modern vehicles, safety systems, materials and standards.

Total no. of Periods: 45

TEXT BOOKS

1. Modern Vehicle Technology by Heinz.
2. Bosch Hand Book, SAE Publication,, 2000

REFERENCES

1. *Light weight electric for hybrid vehicle design.*
2. *Advance hybrid vehicle power transmission, SAE.*
3. *Noise reduction, Branek L.L., McGraw Hill Book company, New York, 1993.*

Subject Code:	Subject Name : ALTERNATE FUELS AND ENERGY SYSTEMS	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E10	Pre requisite: **Automotive Engines**	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The student will learn

- To acquire knowledge of alternate fuels and the changes in the engine design for handling them and understand various energy systems for use in the automobiles**.**

COURSE OUTCOMES (COs) : (3- 5)

CO1	Gain the knowledge of different types of alternate fuels and its suitability in IC Engines.
CO2	Gain the knowledge of liquid and gaseous fuel used in automotives.
CO3	Gain the knowledge of use of biodiesel in engine and its performance and emission characteristics

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		M		L		H					
CO2		L		M								
CO3	H						M					

Cos / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H		M					
CO2	M		M					
CO3	M	M	L	M				

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code:	Subject Name : ALTERNATE FUELS AND ENERGY SYSTEMS	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E10	Prerequisite: **Automotive Engines**	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION **9**

Need for alternate fuel, availability and properties of alternate fuels, general use of alcohols, LPG, hydrogen, ammonia, CNG and LNG, vegetable oils and biogas, merits and demerits of various alternate fuels, introduction to alternate energy sources. Like EV, hybrid, fuel cell and solar cars.

UNIT II ALCOHOLS **9**

Properties as engine fuel, alcohols and gasoline blends, performance in SI engine, methanol and gasoline blends, combustion characteristics in CI engines, emission characteristics, DME, DEE properties performance analysis, performance in SI & CI Engines.

UNIT III NATURAL GAS, LPG, HYDROGEN AND BIOGAS **9**

Availability of CNG, properties, modification required to use in engines, performance and emission characteristics of CNG using LPG in SI & CI engines, performance and emission of LPG. Hydrogen; storage and handling, performance and safety aspects.

UNIT IV VEGETABLE OILS **9**

Various vegetable oils for engines, esterification, performance in engines, performance and emission characteristics, bio diesel and its characteristics

UNIT V ELECTRIC, HYBRID, FUEL CELL AND SOLAR CARS **9**

Layout of an electric vehicle, advantage and limitations, specifications, system components, electronic control system, high energy and power density batteries, hybrid vehicle, fuel cell vehicles, solar powered vehicles.

Total no. of Periods: 45

TEXT BOOK

1. Richard.L.Bechfold – Alternative Fuels Guide Book - SAE International Warrendale **- 1997.**
2. Maheswar Dayal - "Energy today & tomorrow"- I & B Horishr India - 1982.

REFERENCES

1. *Nagpal - "Power Plant Engineering" - Khanna Publishers - 1991.*
2. *"Alcohols as motor fuels progress in technology" - Series No.19 - SAE Publication USE - 1980.*
3. *SAE paper nos. 840367, 841333, 841334, 841156, Transactions, SAE, USA.*

Subject Code: BAU18E11	Subject Name : TWO AND THREE WHEELERS TECHNOLOGY	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Pre requisite: Automotive Engines, Automotive Chassis	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The student will learn

- To make the students to know and understand the constructional details operating characteristics and vehicle design aspects.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Gain the knowledge of different types power units and ignition systems.
CO2	Gain the knowledge on automotive chassis subsystems, wheel and tyres.
CO3	Gain the knowledge of two and three wheelers technology in different manufacturers.

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		M		L		H					
CO2		L		M								
CO3	H						M					

Cos / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H		M					
CO2	M		M					
CO3	M	M	L	M				

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code:	Subject Name : TWO AND THREE WHEELERS TECHNOLOGY	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E11	Pre requisite: Automotive engine and Automotive chassis	Ty	3	0/0	0/0	3

UNIT I: POWER UNIT **9**

Two stroke SI engine, four stroke SI engine; merits and demerits. Symmetrical and unsymmetrical port timing diagrams. Types of scavenging processes; merits and demerits, scavenging pumps. Rotary valve engine. Fuel system. Lubrication system. Magneto coil and battery coil spark ignition system, electronic ignition system. Starting system; Kick starter system.

UNIT II CHASSIS AND SUB-SYSTEMS **9**

Mainframe and its types. Chassis and shaft drive, Single, multiple plates and centrifugal clutches. Gear box and gear controls. Front and rear suspension systems. Shock absorbers. Panel meters and controls on handle bar.

UNIT III BRAKES, WHEELS AND TYRES **9**

Drum brakes, disc brakes, front and rear brake links, layouts. Spoked wheel, cast wheel, disc wheel, disc types. Tyros and tubes.

UNIT IV TWO WHEELERS **9**

Case study of major Indian models of motorcycles, scooters and mopeds. TVS mopeds and motorcycles, HeroHonda motorcycles, Bajaji scooters and motorcycles, Yamaha, Enfield motorcycles. Servicing and maintenance.

UNIT V THREE WHEELERS **9**

Case study of Indian models. Auto rickshaws, pickup van, delivery van and trailer. Maintenance:& Fault tracing.

Total no. of Periods: 45

TEXT BOOKS:

1. Irving.P.E. - Motor Cycle Engineering - Temple Press Book, London – 1992.
2. The Cycle Motor Manual - Temple Press Limited, London – 1990.

REFERENCES:

1. *Encyclopedia of Motorcycling - 20 Volume Marshall, Cavensih, UK - 1989*
2. Brayant R.V, Vespa - Maintenance and Repair Series – S.Chand & Co., New Delhi - 1986.
3. Raymond Broad Lambretta - A Practical Guide to maintenance and repair – S.Chand & Co., New Delhi - 1987.

Subject Code:	Subject Name : MANUFACTURING OF AUTO COMPONENTS	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E12	Pre requisite: Automotive Materials and Metallurgy, Manufacturing Technology	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The student will learn

- To make the production methods of various engine components like piston, connecting rod, crankshaft etc.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Gain the knowledge of elastic and plastic behavior of materials..
CO2	Gain the knowledge of powder metallurgy, forging and extrusion process
CO3	Gain the knowledge of design of manufacturing of auto componeents.

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		M		L		H					
CO2		L		M								
CO3	H						M					

Cos / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H		M					
CO2	M		M					
CO3	M	M	L	M				

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code:	Subject Name : MANUFACTURING OF AUTO COMPONENTS	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E12	Pre requisite: Automotive Materials and Metallurgy, Manufacturing Technology	Ty	3	0/0	0/0	3

UNIT I ELASTIC AND PLASTIC BEHAVIOUR OF MATERIALS 9

Elasticity-forms - Stress and strain relationship in engineering materials - Deformation mechanism - Strengthening material - Strain hardening, alloying, polyphase mixture, martensitic precipitation, dispersion, fibre and texture strengthening - iron carbon diagram.

UNIT II POWDER METALLURGY AND PROCESSING OF PLASTICS 6

Powder metallurgy process, process variables, Manufacture of friction lining materials for clutches and brakes – plastics-raw material –automobile components – molding – injection, compression and blow – PU foam molding - Machining of plastics.

UNIT III FORGING AND EXTRUSION PROCESS 10

Forging materials - process flow chart, forging of valves, connecting rod, crank shaft, cam shaft, propeller shaft, and transmission gear blanks, steering column. Extrusions: Basic process steps, extrusion of transmission shaft, housing spindle, steering worm blanks, piston pin and valve tappets. Hydro forming - Process, hydro forming of manifold and comparison with conventional methods- Hydro forming of tail lamp housing – forming of wheel disc and rims. Stretch forming - Process, stretch forming of auto body panels –Super plastic alloys for auto body panels.

UNIT IV CASTING AND MACHINING 10

Sand casting of cylinder block and liners - Centrifugal casting of flywheel, piston rings, bearing bushes, and liners, permanent mould casting of piston, pressure die casting of carburetor other small auto parts. Machining of connecting rods - crank shafts - cam shafts - pistons - piston pins - piston rings - valves - front and rear axle housings - fly wheel - Honing of cylinder bores - Copy turning and profile grinding machines.

UNIT V RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS 10

Powder injection moulding - Production of aluminum MMC liners for engine blocks - Plasma spray coated engine blocks and valves - Recent developments in auto body panel forming –Squeeze Casting of pistons - aluminum composite brake rotors. Sinter diffusion bonded idler sprocket – gas injection molding of window channel – cast con process for auto parts.

Total no. of Periods: 45

TEXT BOOK

1. Heldt.P.M., " High Speed Combustion Engines ", Oxford Publishing Co., New York, 1990.

REFERENCES

1. *Haslehurst.S.E., " Manufacturing Technology ", ELBS, London, 1990.*
2. *Rusinoff, " Forging and Forming of metals ", D.B. Taraporevala Son & Co. Pvt Ltd., Mumbai, 1995.*
3. *Sabroff.A.M. & Others, "Forging Materials & Processes ", Reinhold Book Corporation, New York, 1988.*
4. *Upton, "Pressure Die Casting ", Pergamon Press, 1985.*
5. *High Velocity "Forming of Metals ", ASTME, prentice Hall of India (P) Ltd., New Delhi, 1990*
6. *HMT handbook.*

ELECTIVE III

Subject Code: BAU18E13	Subject Name : VIBRATION, NOISE AND HARSHNESS CONTROL	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Pre requisite: Strength of Materials, Mechanics of Machines	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: Students will learn

- To understand the sources of vibration, noise and harshness in automobiles and make design modifications to
- reduce them and improve the life of the components and the comfort of the passengers.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Basic knowledge in vibrations
CO2	Multi-degree of freedom system in different modes.
CO3	Vibration measurement techniques

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M			M			L					L
CO2	L	M	H	M								
CO3	M	M		H		L						L

Cos / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	L	L	L	L				
CO2	M	H	M					
CO3	M	H		M				

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: BAU18E13	Subject Name : VIBRATION , NOISE AND HARSHNESS CONTROL	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Pre requisite: Strength of Materials, Mechanics of Machines	Ty	3	0/0	0/0	3

UNIT I BASICS OF VIBRATION **10**

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies.

UNIT II VIBRATION CONTROL TECHNIQUES **10**

Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers

UNIT III BASICS OF NOISE AND SOURCES **10**

Introduction, , noise dose level, legislation, measurement and analysis of noise in engines, Noise characteristics, overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.

UNIT IV NOISE CONTROL **9**

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers

UNIT V HARSHNESS AND ITS CONTROL **6**

Harshness, sources and its effects,. measurement and control

Total no. of Periods: 45

TEXT BOOKS

1. Singiresu S.Rao - "Mechanical Vibrations" - Pearson Education, ISBM –81-297-0179-0 - 2004.
2. Rao V. Dukkipati and J.Srinivas ,"Text book of Mechanical Vibrations", Prentice-Hall of India P Ltd,New Delhi.2004
3. Kewal Pujara "Vibrations and Noise for Engineers, Dhanpat Rai & Sons, 1992.

REFERENCES

1. *Bernard Challen and Rodica Baranescu - "Diesel Engine Refrence Book" - Second edition - SAE International - ISBN 0-7680-0403-9 – 1999.*
2. *Julian Happian-Smith - "An Introduction to Modern Vehicle Design"- Butterworth- Heinemann, ISBN 0750-5044-3 - 2004*
3. *John Fenton - "Handbook of Automotive body Construction and Design Analysis* - Professional Engineering Publishing, ISBN 1-86058-073- 1998

Subject Code: BAU18E14	Subject Name : AUTOMOTIVE CRASH WORTHINESS AND OCCUPANT SAFETY	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Pre requisite: Automotive transmission system, Automotive Electrical and Electronic systems	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The student will learn

- At the end, the students will have good exposure to automotive safety aspects including the understanding of the various safety equipments.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Gain the knowledge of different types of fits and tolerances and surface finish.
CO2	Gain the knowledge of design of Piston, Connecting rod and crank shaft.
CO3	Gain the knowledge of design of crank shaft, flywheel and Valves.

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		M		L		H					
CO2		L		M								
CO3	H						M					

Cos / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H		M					
CO2	M		M					
CO3	M	M	L	M				

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: BAU18E14	Subject Name : AUTOMOTIVE CRASH WORTHINESS AND OCCUPANT SAFETY	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Pre requisite: Automotive transmission system, Automotive Electrical and Electronic systems	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION **9**

Design of the body for safety, energy equation, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumble zone, safety sandwich construction.

UNIT II SAFETY CONCEPTS **9**

Active safety: driving safety, conditional safety, perceptibility safety, operating safety- passive safety: exterior safety, interior safety, deformation behaviour of vehicle body, speed and acceleration characteristics of passenger compartment on impact.

UNIT III SAFETY EQUIPMENTS **9**

Seat belt, regulations, automatic seat belt tightener system, collapsible steering column, tiltable steering wheel, air bags, electronic system for activating air bags, bumper design for safety.

UNIT IV COLLISION WARNING AND AVOIDANCE **9**

Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system interactions.

UNIT V COMFORT AND CONVENIENCE SYSTEM **9**

Steering and mirror adjustment, central locking system , Garage door opening system, tyre pressure control system, rain sensor system, environment information system

Total no. of Periods: 45

TEXT BOOK

1. Bosch - "Automotive Handbook" - 5th edition - SAE publication - 2000.
2. J.Powloski - "Vehicle Body Engineering" - Business books limited, London - 1969.

REFERENCE

1.Ronald. K.Jurgen - "Automotive Electronics Handbook" - Second edition- McGraw- Hill Inc., - 1999.

Subject Code:	Subject Name : FINITE ELEMENT ANALYSIS	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BRE18E05	Pre requisite: Strength of Materials, Design of Machine Elements-I	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The student will learn
Fundamentals of finite element analysis and their applications.
Method of solving one, two and iso-parametric elements.

COURSE OUTCOMES (COs) :

CO1	Fundamentals of finite element analysis and their applications.
CO2	Use professional level finite element software to solve engineering problems in Solid Mechanics, Fluid Mechanics and Heat Transfer
CO3	Derive element matrix equation by different methods

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M								L		L
CO2			M		H					L		
CO3	L		M									L

Cos / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	M		L				
CO2	M	M	M	M				
CO3	L	L	L					

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code:	Subject Name : FINITE ELEMENT ANALYSIS	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BRE18E05	Pre requisite: Strength of Materials, Design of Machine Elements-I	Ty	3	0/0	0/0	3

UNIT- I INTRODUCTION **9**

Historical Background – Mathematical Modeling of field problems in Engineering –Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

UNIT- II ONE-DIMENSIONAL PROBLEMS **9**

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors-Assembly of Matrices - Solution of problems from solid mechanics including thermal stresses-heat transfer. Natural frequencies of longitudinal vibration and mode shapes. Fourth Order Beam Equation –Transverse deflections and Transverse Natural frequencies of beams.

UNIT- III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS **9**

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation –Finite Element formulation – Triangular elements and Quadrilateral elements- Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems – Torsion of Non circular shafts.

UNIT- IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS **9**

Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Constitutive matrices and Strain displacement matrices – Stiffness matrix – Stress calculations - Plate and shell elements.

UNIT- V ISOPARAMETRIC FORMULATION AND ADVANCED TOPICS **9**

Natural co-ordinate systems – Isoparametric elements – Shape functions for isoparametric elements – One and two dimensions – Serendipity elements – Numerical integration - Matrix solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis Software- Introduction to Non Linearity.

Total No. of Periods: 45

TEXT BOOKS:

1. J.N.Reddy, "An Introduction to the Finite Element Method", 3rd Edition, Tata McGrawHill,2005
2. Seshu, P, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., NewDelhi, 2007.

REFERENCES:

1. *Logan, D.L., "A first Subject in Finite Element Method", Thomson Asia Pvt. Ltd., 2002.*
2. *Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th Edition, Wiley Student Edition, 2002.*
3. *Rao, S.S., "The Finite Element Method in Engineering", 3rd Edition, Butter worth Heinemann, 2004.*
4. *Chandrupatla and Belagundu, "Introduction to Finite Elements in Engineering", 3rd Edition.*

Subject Code:	Subject Name : TRIBOLOGY	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BME18E10	Pre requisite: Engineering Mechanics, Fluid Mechanics and Machineries & Automotive Fuels and Lubricants	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The student will learn

- To impart knowledge in the friction , wear and lubrication aspects of machine components.
- To understand the material properties which influence the tribological characteristics of surfaces.
- To understand the analytical behavior of different types bearings and design of bearings based on analytical /theoretical approach..

COURSE OUTCOMES (COs) : (3- 5)

CO1	To impart knowledge in the friction , wear and lubrication aspects of machine components.
CO2	To understand the material properties which influence the tribological characteristics of surfaces.
CO3	To understand the analytical behavior of different types bearings and design of bearings based on analytical /theoretical approach

Mapping of Course Outcomes with Program Outcomes (POs)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	M									
CO2	L	M	L			L						
CO3	L	L	H	L								
Cos / PSOs	PSO1		PSO2		PSO3		PSO4		PSO5			
CO1			M		L		M					
CO2	L				L		L					
CO3	L		M		M							

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code:	Subject Name : TRIBOLOGY	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BME18E10	Pre requisite: : Engineering Mechanics, Fluid Mechanics and Machineries & Automotive Fuels and Lubricants	Ty	3	0/0	0/0	3

UNIT- I - SURFACE INTERACTION AND FRICTION **9**

Topography of Surfaces – Surface features-Properties and measurement – Surface interaction –Adhesive Theory of Sliding Friction –Rolling Friction-Friction properties of metallic and non-metallic materials.

UNIT- II WEAR AND SURFACE TREATMENT **9**

Types of wear – Mechanism of various types of wear – Laws of wear –Theoretical wear models-Wear of Metals and Non-metals – Surface treatments – Surface modifications – surface coatings methods

UNIT- III LUBRICANTS AND LUBRICATION REGIMES **9**

Lubricants and their physical properties- Viscosity and other properties of oils –Additives-and selection of Lubricants- Lubricants standards ISO,SAE,AGMA, BIS standards – Lubrication Regimes.

UNIT- IV THEORY OF HYDRODYNAMIC AND HYDROSTATIC LUBRICATION **9**

Reynolds Equation,-Assumptions and limitations-One and two dimensional Reynolds Equation-Reynolds and **Somerfield boundary conditions- Pressure wave, flow, load capacity and friction calculations in Hydrodynamic and Hydrostatic bearings.**

UNIT- V HIGH PRESSURE CONTACTS **9**

Rolling contacts of Elastic solids- contact stresses – Hertzian stress equation- Spherical and cylindrical contacts-Contact Fatigue life- Oil film effects- Elasto Hydrodynamic lubrication Theory-Soft and hard EHL-Reynolds equation for elasto hydrodynamic lubrication

Total No. of Periods: 45

TEXT BOOKS:

1. Rabinowicz.E, “Friction and Wear of materials”, John Willey &Sons ,UK,1995
2. Cameron, A. “Basic Lubrication Theory”, Ellis Herward Ltd., UK, 1981

REFERENCES

1. *Halling, J. (Editor) – “Principles of Tribology “, Macmillian – 1984.*
2. *Williams J.A. “Engineering Tribology”, Oxford Univ. Press, 1994.*
3. *S.K.Basu, S.N.Sengupta & B.B.Ahuja ,”Fundamentals of Tribology”, Prentice –Hall of India Pvt Ltd , New Delhi, 2005*
4. *G.W.Stachowiak & A.W .Batchelor , Engineering Tribology, Butterworth-Heinemann, UK, 2005*

Subject Code: BME18E11	Subject Name : DESIGN FOR MANUFACTURE AND ASSEMBLY	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Pre requisite: Manufacturing Technlogy	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The student will learn

- Rules and requirements of designing to ease manufacturing
- Rules and requirements of designing to ease assembly
- Methods for design and Assembly

COURSE OUTCOMES (COs) : (3- 5)

CO1	Rules and requirements of designing to ease manufacturing
CO2	Rules and requirements of designing to ease assembly
CO3	Methods for design and Assembly

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M		M							L		
CO2	M		M			L						L
CO3		M	H	L	L							

Cos / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1			H	L				
CO2	L	M	M	L				
CO3	L	L	H	M				

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: BME18E11	Subject Name : DESIGN FOR MANUFACTURE AND ASSEMBLY	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Manufacturing Technology	Ty	3	0/0	0/0	3

UNIT- I: INTRODUCTION **9**

General design principles for manufacturability - strength and mechanical factors, Process capability - Feature tolerances - Geometric tolerances - Assembly limits -Datum features - Tolerance stacks.

UNIT- II: FORM DESIGN - CASTING **9**

Production methods on form design - Casting considerations - Requirements and rules - Redesign of components for castings and Case studies.

UNIT- III: FORM DESIGN - FORGING **9**

Forging considerations - Requirements and rules - Redesign of components for forging and Case studies.

UNIT- IV: FORM DESIGN - MACHINING **9**

Machining considerations - Requirements and rules -Redesign of components for Machining and Case studies.

UNIT- V: DESIGN FOR ASSEMBLY METHODS **9**

Approaches to design for assembly - Qualitative evaluation procedures, knowledge based approach, Computer aided DFA methods. Assemblability measures. Boothroyd - Dewhurst DFA method - Redesign of a simple product - Case studies.

Total no. of Periods: 45

TEXT BOOKS:

1. Harry Peck, (1983) Design *for Manufacture*. Pittman Publication
2. Alan Redford and Chal, (1994) *Design for Assembly - Principles and Procedures*. McGraw Hill International

REFERENCES

1. *Robert Matousek, (1963) Engineering Design - A Systematic Approach. Blackie & Sons Ltd*
2. *James G. Bralla, (1986) Hand Book of Product Design for Manufacturing. McGraw Hill Co*
3. *Swift, K.G. (1987) Knowledge Based Design for Manufacture.*

Subject Code:	Subject Name : INDUSTRIAL ROBOTICS	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BME18E13	Pre requisite: Strength of Materials, Automotive Electrical and Electronic Systems	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES: Students will learn

- Basic components of an industrial robot and Sensors used in robots
- Robot programming methods and Robot applications

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COURSE OUTCOMES (COs) : (3- 5)

CO1	Expose to the basic components of robots used in industry
CO2	Knows the uses and applications of Sensors
CO3	Ability to write programming used in robots based on the applications

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	M	M	H							M
CO2	M	M	H	H	H	M	L		M			M
CO3	M	M	H	H	H	M	L		H			M

Cos / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1		M		H				
CO2		M	M	H				
CO3		H	H	H				

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code:	Subject Name : INDUSTRIAL ROBOTICS	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BME18E13	Pre requisite: Strength of Materials, Automotive Electrical and Electronic Systems	Ty	3	0/0	0/0	3

UNIT- I: INTRODUCTION **9**

Definition of a Robot – Basic Concepts –- Robot components –manipulator-configurations –joints-degree of freedom. Types of Robot Drives – Basic Robot Motion types – Point to Point Control – Continuous Path Control.

UNIT- II:COMPONENTS AND OPERATIONS **9**

Basic Control System Concepts – open loop and closed loop control-Control System Analysis – Robot Actuation and Feed Back, Manipulators – Direct and Inverse Kinematics, Co-ordinate Transformation – Brief Robot Dynamics, Types of Robot and Effectors – Grippers – Tools as End Effectors – Robot / End Effort Interface.

UNIT- III:SENSING AND MACHINE VISION **9**

Range Sensing – Proximity Sensing – Touch sensing – Force and Torque Sensing. Introduction to Machine Vision – functions and applications.

UNIT- IV:ROBOT PROGRAMMING **9**

Methods – Languages –programming for pick and place applications-palletizing. Capabilities and Limitation – Artificial Intelligence – Knowledge Representation – Search Techniques – AI and Robotics.

UNIT- V:ROBOT CELL DESIGN AND APPLICATIONS **9**

Robot cell design-types and control. Applications of Robots –process applications in welding and painting – Assembly applications– Material Handling applications.

Total no. of Periods: 45

TEXT BOOK

1) K. S. Fu, R. C. Gonalez, C.S.G. Lee, *"Robotics Control Sensing Vision and Intelligence"*, McGraw Hill International Edition, 10987.

REFERENCES

1) *Mikell P. Groover, Mitchell Weiss, (2008) "Industrial Robotics, Technology, Programming and Application", Tata McGraw Hill International Editions, 10986.*
2) *Richard D. Klafter, Thomas A. Chonieleswski and Michael Negin, (1989) "Robotic Engineering – An Integrated Approach", Prentice Hall Inc., Englewoods Cliffs, NJ, USA, 109809.*

ELECTIVE IV

Subject Code:	Subject Name : MARKETING MANAGEMENT	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E15	Pre requisite: Basic Knowledge of Quality and Manufacturing Systems	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab./Embedded Theory and Lab.

OBJECTIVE: Students will learn:

- To understand the various processes involved in Marketing and its Philosophy.
- To learn the Psychology of consumers.
- To formulate strategies for advertising, pricing and selling

COURSE OUTCOMES (COs) :

CO1	Various TQM Principles
CO2	Various Tools of TQM
CO3	ISO Standards 2008 and 14001

Mapping of Course Outcomes (COs) with Program Outcomes (Pos) & Program Specific Outcomes (PSOs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M				M	L		M	H	M	M	L
CO2	M				M	L		M	H	M	M	L
CO3	M				L	L		M	H	L	M	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1		M	L	L				
CO2		M	L	L				
CO3			L	L				

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code:	Subject Name : MARKETING MANAGEMENT	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E15	Pre requisite: Basic Knowledge of Quality and Manufacturing Systems	Ty	3	0/0	0/0	3

UNIT I MARKETING PROCESS **9**

Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION **9**

Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic - Psycho graphic and geographic segmentation, process, patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH **9**

Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research**.**

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION **9**

Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION **9**

Characteristics, impact, goals, types, and sales promotions- point of purchase- unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

Total no. of Periods: 45

TEXT BOOKS

1. Govindarajan. M, "Marketing management – concepts, cases, challenges and trends", Prentice hall of India, second edition 2007.
2. Philip Kolter,Koshy Jha "Marketing Management", Pearson Education ,Indian adapted edition.2007

REFERENCES

1. *Ramasamy and Nama kumari, "Marketing Environment: Planning, implementation and control the Indian context", 1990.*
2. *Czinkota&Kotabe, "Marketing management", Thomson learning, Indian edition 2007*
3. *Adrain palmer, " Introduction to marketing theory and practice", Oxford university press IE 2004.*
4. *Donald S. Tull and Hawkins, "Marketing Reasearch", Prentice Hall of Inida-1997.*
5. *Philip Kotler and Gary Armstrong "Principles of Marketing" Prentice Hall of India, 2000.*
6. *Steven J.Skinner, "Marketing", All India Publishers and Distributes Ltd. 1998.*
7. *Graeme Drummond and John Ensor, Introduction to marketing concepts, Elsevier, Indian Reprint, 2007.*

Subject Code: BAU18E16	Subject Name :ENTREPRENEURSHIP DEVELOPMENT	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Pre requisite: Basic Knowledge of Manufacturing & Marketing Systems	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab./Embedded Theory and Lab.

OBJECTIVE: Students will learn:

- Study of this subject provides an understanding of the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc

COURSE OUTCOMES (COs) :

CO1	Gain the knowledge of types of Entrepreneurs and Economic Growth of Entrepreneurs.
CO2	Gain the knowledge of motivation and training of Entrepreneurs.
CO3	Gain the knowledge of sources of finance and accounting and support to Entrepreneurs.

Mapping of Course Outcomes (COs) with Program Outcomes (Pos) & Program Specific Outcomes (PSOs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M				M	L		M	H	M	M	L
CO2	M				M	L		M	H	M	M	L
CO3	M				L	L		M	H	L	M	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1		M	L	L				
CO2		M	L	L				
CO3			L	L				

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: BAU 18E16	Subject Name : ENTREPRENEURSHIP DEVELOPMENT	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Pre requisite: Basic Knowledge of Manufacturing & Marketing Systems	Ty	3	0/0	0/0	3

UNIT I:NTREPRENEURSHIP **9**

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrepreneur – Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT II: MOTIVATION **9**

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, Objectives.

UNIT III BUSINESS **9**

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING **9**

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, management of working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/CPM – Taxation – Income Tax, Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS **9**

Sickness in small Business – Concept, Magnitude, causes and consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

Total no. of Periods: 45

TEXT BOOKS

1. S.S.Khanka "Entrepreneurial Development" S.Chand & Co. Ltd. Ram Nagar New Delhi, 1999.
2. Kuratko & Hodgetts, "Enterprenuership – Theory, process and practices", Thomson learning 6th edition.

REFERENCES

1. Hisrich R D and Peters M P, "Entrepreneurship" 5th Edition Tata McGraw-Hill, 2002.
2. Mathew J Manimala," Enterprenuership theory at cross roads: paradigms and praxis" Dream tech 2nd edition 2006.
3. Rabindra N. Kanungo "Entrepreneurship and innovation", Sage Publications, New Delhi, 1998.
4. EDII " Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development" Institute of India, Ahmadabad, 1986.

Subject Code: BAU18E17	Subject Name : INTERIORS & ERGONOMICS	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	**Ty**	**3**	**0/0**	**0/0**	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The student will learn

- Design creates emotions and makes the client fall in love with the product.
- Making the designers know the basics of ergonomics, specifying its impact on design in order to help designers think about the problem and select the best solution.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Gain the knowledge of ergonomics and . antropometrics and interfaces.
CO2	Gain the knowledge of design of interiors of the automobiles..
CO3	Gain the knowledge of design of ergonomics of the automobiles..

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H		M		L		H					
CO2		L		M								
CO3	H						M					
Cos / PSOs	**PSO1**		**PSO2**		**PSO3**		**PSO4**		**PSO5**			
CO1	H				M							
CO2	M				M							
CO3	M		M		L		M					

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: BAU18E17	Subject Name : INTERIORS & ERGONOMICS	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Ty	3	0/0	0/0	3

UNIT –I ERGONOMICS **9**

Definition of ergonomics: history and evolution of ergonomics over the course of the last century; definition and fields of application; user centered design approach; ergonomics in the automobile: 6 main themes (habitation, accessibility, visibility, usability, appreciation, comfort on board).Driving as a complex task: driving as a primary task (driving) and secondary tasks (listening to music, adjusting the seats, looking at maps and other automatic actions); man-car-environment system; well-being on board: usability, comfort, appreciation; methods of well-being evaluation: SAE ranking.

UNIT –II ANTROPOMETRICS AND INTERFACES **9**

Antropometrics: human measurements: total height, legs, bust, arms, hands, head, eyes; percentiles; human biomechanics (movements and strengths); human posture: driving posture (signs of habitation).Interfaces: car – man interaction; on board information systems; driving support systems; central Informatic system on board –interfaces and commands; training on design of the car interface system; understanding ergonomics and quality perception

UNIT-III DEVELOPMENT AND INSPECTION **9**

Usability and evaluation techniques: interaction with design; trial testings Development process: the concept; marketing requirements; ergonomics requirements; preparation of the package; presentation and choice of the final design;

UNIT-IV SENSES **9**

Six main themes in ergonomics applied to the automotive field: - Inhabitance: general posture, the driver and the passengers, the seat movement, space- Accessibility: to the front seats, to the back seats, to the boot, -Visibility: front, rear, direct and indirect, towards the various objects, reflexes-Usability of commands: the steering wheel, the gear change, hand brake, diversion-driving lever, buttons, etc. - Satisfaction: the 5 human senses judging the various components- Comfort: vibration, muscular, interfacing, the seats

UNIT –V DESIGN OF ERGONOMICS **9**

Ergonomics and design, a new perspective: interactive process with style department during the various stages of the making of the model. From Advanced Design to actual production. Case studies and practical examples (console and seats: mono frame, refined)

Total no. of Periods: 45

REFERENCE:

Transportation-Car Design., Advanced interior Design, Avetik Kalashyan

Subject Code: BME18E15	Subject Name : PROCESS PLANNING AND COST ESTIMATION	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Manufacturing Technology	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES: Students will learn

- Process planning activities, Various elements of cost of a product and Methods of computer aided process planning.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the method of planning the various machining processes
CO2	Know the method of estimation of the cost of manufacturing a component
CO3	Applications of computers in process planning

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M		H	M	M			M			M
CO2	M	M		H	M	M			M			M
CO3	M	M		H	H	M			M			M

Cos / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	H					
CO2	M	H	H	H				
CO3	L	M	M	H				

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code: BME18E15	Subject Name : PROCESS PLANNING AND COST ESTIMATION	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Pre requisite: Manufacturing Technology	Ty	3	0/0	0/0	3

UNIT- I: PROCESS PLANNING **9**

Definition – OBJECTIVES – Scope – approaches to process planning- Process planning activities – Finished part requirements- operating sequences- machine selection –material selection parameters- Set of documents for process planning- Developing manufacturing logic and knowledge- production time calculation – selection of cost optimal processes.

UNIT- II: COMPUTER AIDED PROCESS PLANNING **9**

Variant process planning - Generative approach -Forward and Backward planning, Input format, Logical Design of a Process Planning - Implementation considerations. Application of computer softwares in process planning.

UNIT- III: ELEMENTS OF COST **9**

Introduction - Importance and aims of Cost estimation - Estimation procedure. Material Cost - Determination of Material Cost Labour Cost - Determination of Direct Labour Cost - Expenses - Cost of Product (Ladder of cost) - Illustrative examples. Analysis of overhead expenses - Factory expenses - Depreciation - Causes of depreciation - Methods of depreciation - Administrative expenses - Selling and Distributing expenses - Allocation of overhead expenses.

UNIT- IV: PRODUCT COST ESTIMATION **9**

Estimation in forging shop - Losses in forging - Forging cost - Illustrative examples. Estimation in welding shop - Gas cutting - Electric welding - illustrative examples. Estimation in foundry shop - Estimation of pattern cost and casting cost - Illustrative examples.

UNIT- V: ESTIMATION OF MACHINING TIME AND COST **9**

Estimation of machining time and cost for Lathe operations - Estimation of machining time and cost for drilling, boring, shaping, planning, milling and grinding operations - Illustrative examples. Value engineering - cost reduction

Total no. of Periods: 45

TEXT BOOKS

1) M.Adithan and B.S. Pabla, (1989) *"Estimating and Costing"*, Konark Publishers Pvt. Ltd.
2) V.Jayakumar (2012) *"Process Planning and Cost Estimation"*, Lakshmi Publication.

REFERENCES

1) *Nanua Singh, (1996) "System approach to Computer Integrated Design and Manufacturing",John Wiley & Sons, Inc.*
2) *Joseph G. Monks, (1982) "Operations Management, Theory & Problems", McGraw Hill Book Company.*
3) *T.R. Banga and S.C. Sharma, (2011) "Estimating and Costing", Khanna Publishers, 16thEdition*
4) *Sadhu singh, (2002) "Computer aided Design and manufacturing", Khanna publisher ,new delhi, second edition.*

Subject Code: BME 18E20	Subject Name : TOTAL QUALITY MANAGEMENT	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Pre requisite: Basic Knowledge of Quality and Manufacturing Systems	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab./Embedded Theory and Lab.

OBJECTIVE: Students will learn: Various Principles and Tools of TQM, ISO Standards

COURSE OUTCOMES (COs) :

CO1	Various TQM Principles
CO2	Various Tools of TQM
CO3	ISO Standards 2008 and 14001

Mapping of Course Outcomes (COs) with Program Outcomes (Pos) & Program Specific Outcomes (PSOs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M				M	L		M	H	M	M	L
CO2	M				M	L		M	H	M	M	L
CO3	M				L	L		M	H	L	M	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1		M	L	L				
CO2		M	L	L				
CO3			L	L				

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code:	Subject Name : TOTAL QUALITY MANAGEMENT	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BME 18E20	Pre requisite: Basic Knowledge of Quality and Manufacturing Systems	Ty	3	0/0	0/0	3

UNIT- I: INTRODUCTION **9**

Definition of Quality, Dimensions, Planning of quality, conformance to specification, Quality costs-. Basic concepts and evolution of Total Quality Management, Principles of TQM, Deming Philosophy Deming prize MBNQA. Barriers to TQM Implementation.

UNIT- II: TQM PRINCIPLES **9**

Customer satisfaction-Customer Perception of Quality, Customer Complaints. Service Quality, Customer Retention. Employee Involvement- Motivation, Empowerment, Teams. Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement-Juran Triology, PDSA Cycle,58,Kaizen.Supplier Partnership- Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures-Basic Concepts. Strategy, Performance Measure.

UNIT- III: SIX SIGMA **9**

The Seven Tools Of Quality, Statistical Fundamentals, Control Charts For Variables And Attributes, Process Capability, Concept Of Six Sigma, Phases And Defective UNIT-s Of Six Sigma .Overview Of GB,BB,MBB Leadership Characteristics ,Leadership Concept , Role Of Senior Management, Lean Management Principle, Strategic Planning New Seven Management Tools.

UNIT- IV: TQM TOOLS **9**

Benchmarking-Reasons to Benchmark, Benchmarking Process. Quality Function Deployment (QFD), pareto, process flow diagram, check sheets and histogram Taguchi Quality Loss Function. Total Productive Maintenance (TPM)-Concept, Improvement Needs, FMEA-Stages of FMEA.

UNIT- V: QUALITY SYSTEMS **9**

Need For ISO 9000 and Other Quality Systems, ISO 09000 – 2000 Quality System -Elements. Implementation Of Quality System, Documentation , Quality Auditing, Quality Council, Quality statements ,Quality Management System TS 1609409, ISO 14000 Concept, Requirements And Benefits. Introduction To Capability Material Management (CMM), People Capability Management (PCM).

Total no. of Periods: 45

TEXT BOOK

1) Dale H Besterfied , "*Total Quality Management"*, Prentice Hall Publishing House

REFERENCES

1) S.Ramachandran,Dn.S.Jose, "*Total Quality Management"*, Airwalk Publications, First Edition, December.
2) Kulneet Suri, (2004 – 05) "*Total Quality Management: Priciples & Practce, Tools & Techniques"*, S.K. Kateria & sons, First Edition,
3) James R.Evans & William M.Lidsay, "*The Management and Control of Quality"*, (^{5th} Edition), South Western(Thomson Learning),2002(ISBN 0-324-06680-5).
4) Feigenbaum.A.V. *"Total Quality Management"*, Tata Mcgraw-Hill, 109091.
5) Oakland.J.S. "*Total Quality Management"*, Butterworth-Heinemann Ltd.,Oxford,109809
6) R.S.Nagarajan,A.A.Arivalagar, "*Total Quality Management"*, New Age International(p) Ltd., Publishers, First Edition.

Subject Code: BME18E23	Subject Name : QUALITY ENGINEERING	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Pre requisite: Manufacturing Technonology	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab./Embedded Theory and Lab.

OBJECTIVE: The student will learn:
Basic conceptual idea of Supply Chain Management systems and its internal structural systems; also focused the theory and applications of SCM Networks with simple case study

COURSE OUTCOMES (COs) :

CO1	Knowledge of basic concepts of quality and control charts
CO2	Concept of process capability and control charts
CO3	Knowledge of sampling inspection and TQM concepts and principles

Mapping of Course Outcomes (COs) with Program Outcomes (POs) & Program Specific Outcomes (PSOs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		M	L	L		L			M	M	H	M
CO2	L	L	M	M	H	L			L	M	M	L
CO3				M	M					M	M	M
COs / PSOs	PSO1		PSO2		PSO3		PSO4					
CO1					M							
CO2					M							
CO3					M							

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code:	Subject Name : QUALITY ENGINEERING	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BME18E23	Pre requisite: Manufacturing Technonology	Ty	3	0/0	0/0	3

UNIT I: QUALITY CONCEPTS 6

Quality, History of Quality, Quality Control, Quality Assurance, Quality Costs, Optimum Quality, Opportunity Loss, Taguchi's Quality loss function

UNIT II: CONTROL CHARTS FOR VARIABLES & PROCESS CAPABILITY 10

Statistical Process Control (SPC), Control Charts for Variables, Action & Warning Limits in Control Charts, Process Capability, Process Capability Indices, Process Capability Studies, Problems in Control Charts for Variables

UNIT III: OTHER CONTROL CHARTS 8

Control Charts for Attributes, Special Control Charts – Group Control Chart, Moving Averages/Moving Range Control Charts, Difference Control Charts, Mid-Range and Median Control Charts & Cumulative Sum Control Charts

UNIT IV: SAMPLING ISPECTION 9

Economics of Sampling, Sampling Methods, Sampling Plans, OC Curves, Quality Indices, Standard tables used in Sampling Inspection - Dodge-Romig & ABC Standard

UNIT V: TOTAL QUALITY MANAGEMENT (TQM) 12

Main Concepts of TQM, Quality Dimensions, TQM concepts in depth - KAIZEN, POKA YOKE, Six Sigma, 5S & Kano's Model, TQM Tools – Benchmarking, QFD & FMEA

Total no. of Periods: 45

TEXT BOOKS:

REFERENCES:

1. *Douglas C. Montgomery, (2007) "Introduction to Statistical Quality Control", John Wiley & Sons*
2. *Grant E.L. and Leavenworth R.S.,(2000), "Statistical Quality Control", TMH*
3. *Dale H. Besterfield, (2002) "Total Quality Management", Pearson Education Asia*

ELECTIVE V

Subject Code:	Subject Name : EARTH MOVING VEHICLES	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E18	Pre requisite: Automotive Engines.	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The students will be able

- To understand the various off road vehicles and their systems and features

COURSE OUTCOMES (COs) : (3- 5)

CO1	Knowledge of various material handling devices used in industries
CO2	Knowledge of hoists design and drives.
CO3	Knowledge of different types of cranes and their design
CO4	Knowledge of conveyor systems and elevators for material handling.

Mapping of Course with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	M			M	M					
CO2	H	H	M			M	M					
CO3	H	H	M			M	M					
CO4	H	H	M			M	M					

Cos / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1		H	H					
CO2		H	H					
CO3		H	H					
CO4		H	H					

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code:	Subject Name : EARTH MOVING VEHICLES	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E18	Pre requisite: Automotive Engines	Ty	3	0/0	0/0	3

UNIT I CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES **6**

Construction layout, capacity and applications. Power Plants, Chassis and Transmission, multi axle vehicles.

UNIT II EARTH MOVING MACHINES **10**

Earthmovers like dumpers, loaders - single bucket, Multi bucket and rotary types - bulldozers, excavators, backhoe loaders, scrappers, drag and self powered types, Bush cutters, stumpers, tree dozer, rippers etc. – Power and capacity of earth moving machines.

UNITY III SCRAPPERS ,GRADERS, SHOVELS AND DITCHERS **10**

Scrappers, elevating graders, motor graders, self powered scrappers and graders, Power shovel, revolving and stripper shovels – drag lines – ditchers – capacity of shovels.

UNIT IV FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES **8**

Power take off, special implements. Special features and constructional details of tankers, gun carriers and transport vehicles.

UNIT V VEHICLE SYSTEMS ,FEATURES **11**

Brake system and actuation – OCDB and dry disc caliper brakes. Body hoist and bucket operational hydraulics. Hydro-pneumatic suspension cylinders. Power steering system. Kinematics for loader and bulldozer operational linkages. Safety features, safe warning system for dumper. Design aspects on dumper body, loader bucket and water tank of sprinkler.

Total no. of Periods: 45

TEXT BOOKS

1. Robert L Peurifoy, "Construction, planning, equipment and methods" Tata McGrawel Hill Publishing company Ltd.
2. Nakra C.P., "Farm machines and equipments" Dhanparai Publishing company Pvt. Ltd.
3. Abrosimov.K. Bran berg.A and Katayer.K. Road making machinery, MIR Publishers, Moscow, 1971.
4. SAE Handboob Vol. III. Wong.J.T. Theory of Ground Vehicles", John Wiley & Sons, New York, 1987.

REFERENCES:

1. *Off the road wheeled and combined traction devices – Ashgate Publishing Co. Ltd. 1988.*
2. *Schulz Erich.J, Diesel equipment I & II, McGraw Hill company, London.*
3. *Bart H Vanderveen, Tanks and Transport vehicles, Frederic Warne and Co Ltd., London.*
4. *Satyanarayana. B., Construction planning and equipment, standard publishers and distributors, New Delhi.*

Subject Code: BAU18E19	Subject Name : TRANSPORT MANAGEMENT	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Pre requisite: Basic Knowledge of Quality and Manufacturing Systems	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab./Embedded Theory and Lab.

OBJECTIVE:

- After completion of this course the students are able to manage a transport fleet and their related activities for minimizing operational cost.

COURSE OUTCOMES (COs) :

CO1	Various TQM Principles
CO2	Various Tools of TQM
CO3	ISO Standards 2008 and 14001

Mapping of Course Outcomes (COs) with Program Outcomes (Pos) & Program Specific Outcomes (PSOs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M				M	L		M	H	M	M	L
CO2	M				M	L		M	H	M	M	L
CO3	M				L	L		M	H	L	M	L

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1		M	L	L				
CO2		M	L	L				
CO3			L	L				

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code:	Subject Name : TRANSPORT MANAGEMENT	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E19	Pre requisite: Basic Knowledge of Quality and Manufacturing Systems	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION **9**

Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.

UNIT II TRANSPORT SYSTEMS **9**

Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

UNIT III SCHEDULING AND FARE STRUCTURE **9**

Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.

UNIT IV MOTOR VEHICLE ACT **9**

Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.

UNIT V MAINTENANCE **9**

Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

Total No. of Periods: 45

TEXTBOOK

1. John Duke - Fleet Management – McGraw-Hill Co, USA -1984.
2. Kitchin.L.D., - Bus Operation - Illiffee and Sons Co., London, III edition - 1992

REFERENCES

1. *Government Motor Vehicle Act –Publication on latest act to be used as on date*

Subject Code:	Subject Name : COMPOSITE MATERIALS	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
BAU18E20	Pre requisite: Materials Science; Engineering Metallurgy; Strength of Materials	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES: Students will learn

- Different composites and their manufacturing methods
- Design parameters of composites
- To gain knowledge in need and applications of composite materials

.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Aware of different composites and their manufacturing methods
CO2	Know the mechanics and performance of composite materials
CO3	Understand the design parameters of composites

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M		H			H		H			M
CO2	M	M	M	H					H			M
CO3	M	M	M	H			H		H			M

Cos / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	M	H	H	M				
CO2		H	H	H				
CO3	L	H	H					

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code:	Subject Name : **COMPOSITE MATERIALS**	**Ty/Lb/ ETL**	L	T / S.Lr	P/ R	C
BAU18E20	**Pre requisite: Materials Science; Engineering Metallurgy; Strength of Materials**	**Ty**	**3**	**0/0**	**0/0**	**3**

UNIT- I: INTRODUCTION **9**

Limitations of Conventional Materials- Definition of Composite Materials- Types and Characteristics Applications.

UNIT- II: MATERIALS **9**

Fibers- Materials- Fiber Reinforced Plastics- Thermo set Polymers- Coupling Agents, Fillers and Additives- Metal Matrix and Ceramics Composites.

UNIT- III: MANUFACTURING **9**

Fundamentals- Bag Moulding- Compression Moulding Pultrusion- Filament Winding- Other Manufacturing Process- Quality Inspection and Non-Destructive Testing.

UNIT- IV: MECHANICS AND PERFORMANCE **9**

Introduction to Micro-mechanics- Unidirectional Lamina-Laminates- Inter laminar Stress- Statics Mechanical Properties- Fatigue Properties- Impact Properties- Environmental Effects- Fracture Mechanics and Toughening mechanisms, Failure Modes

UNIT- V: DESIGN **9**

Failure Predictions- Design Considerations- Joint Design- Codes- Design Examples. Optimization of Laminated Composites- Application of FEM for Design.

Total no. of Periods: 45

TEXT BOOKS

1) P.K.Mallick, (2006) *"Fiber-Reinforced Composites"*, Monal Deklatr Inc., New York.
2) B.D.Agrawal and L.J.Broutmam, (2006) "*Analysis and Performance of Fiber Composites"*, John Wiley and Sons, New York.

REFERENCES

1) *Micaelhyer, (1998) "Stress Analysis of Fiber- Reinforced Composite Materials", Tata McGraw Hill.*
2) *Ronald Gibson, (2007) "Principles of Composite Material Mechanics", Tata McGraw Hill.*

Subject Code:	Subject Name : DESIGN OF MATERIAL HANDLING EQUIPMENTS	Ty / bL/ ETL	L	T / S.Lr	P/ R	C
BME18E09	Pre requisite: Design of Machine Elements.	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE:
Design of different types of material handling systems used for engineering and process industries.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Knowledge of various material handling devices used in industries
CO2	Knowledge of hoists design and drives.
CO3	Knowledge of different types of cranes and their design
CO4	Knowledge of conveyor systems and elevators for material handling.

Mapping of Course with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO10	PO11	PO12
CO1	H	H	M			M	M					
CO2	H	H	M			M	M					
CO3	H	H	M			M	M					
CO4	H	H	M			M	M					

Cos / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1		H	H					
CO2		H	H					
CO3		H	H					
CO4		H	H					

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code:	Subject Name : DESIGN OF MATERIAL HANDLING EQUIPMENTS	T y/ Lb/ ETL	L	T / S.Lr	P/ R	C
BME18E09	Pre requisite: Design of Machine Elements.	Ty	3	0/0	0/0	3

UNIT- I: INTRODUCTION TO MATERIALS HANDLING EQUIPMENT **9**

Overview - consideration in material handling system design, ten principles of material handling. Types of material handling equipments-trolleys, industrial trucks, AGV, monorails and other rail guided vehicles, conveyors, cranes, hoists and elevators.

UNIT- II: DESIGN OF HOISTS **9**

Design of hoisting elements: Welded and roller chains - Hemp and wire ropes - Design of ropes, pulleys, pulley systems, sprockets and drums, Load handling attachments. Design of forged hooks and eye hooks – crane grabs - lifting magnets - Grabbing attachments - Design of arresting gear - Brakes: shoe, band and cone types.

UNIT- III: DRIVES OF HOISTING GEAR **9**

Hand and power drives - Travelling gear - Rail travelling mechanism - cantilever and monorail cranes - slewing, jib and luffing gear - cogwheel drive - selecting the motor ratings.

UNIT- IV: CONVEYORS **9**

Types - description - design and applications of Belt conveyors, apron conveyors and escalators Pneumatic conveyors, Screw conveyors and vibratory conveyors.

UNIT- V: ELEVATORS **9**

Bucket elevators: design - loading and bucket arrangements - Cage elevators - shaft way, guides, counter weights, hoisting machine, safety devices - Design of fork lift trucks.

Total no. of Periods: 45

***NOTE:** Use of Approved Data Book is permitted in examination

.**TEXT BOOKS:**

1. Rudenko, N. (1970) *Materials handling equipment*. ELnvee Publishers
2. Mikell Groover, P. (2006) *Automation, Production system and computer integrated Manufacturing*. Second Edition, Prentice Hall of India Pvt. Ltd

REFERENCES

1. *Alexandrov, M. (1981) Materials Handling Equipments. MIR Publishers*
2. *Boltzharol, A. (1958) Materials Handling Handbook. The Ronald Press Company*
3. *P.S.G. Tech, (2003) Design Data Book. Kalaikathir Achchagam*
4. *Lingaiah. K. and Narayana Iyengar, (1983) Machine Design Data Hand Book. Vol.1 & 2, Suma Publishers*
5. *Spivakovsy, A.O. and Dyachkov, V.K. (1985) Conveying Machines. Volumes I and II, MIR Publishers.*

Subject Code: BME18E05	Subject Name : COMPUTATIONAL FLUID DYNAMICS	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Pre requisite: Thermodynamics, Heat and Mass transfer and Fluid Mechanics	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES: Students will learn

- Governing equation of fluid dynamics.
- Methods of solving the equations by Finite element and Finite Volume methods

COURSE OUTCOMES (COs) : (3- 5)

CO1	Governing equations and boundary conditions of fluid dynamics.
CO2	Methods of solving the conduction problems by Finite element method
CO3	Methods of solving the fluid flow problems by Finite Volume method

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M											
CO2		H	M		H							
CO3			M	M	H							

COs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	H							
CO2								
CO3								

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					√							

Subject Code:	Subject Name : COMPUTATIONAL FLUID DYNAMICS	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
BME18E05	Pre requisite: Thermodynamics, Heat and Mass transferand Fluid Mechanics	Ty	3	0/0	0/0	3

UNIT- I: GOVERNING EQUATIONS AND BOUNDARY CONDITIONS **8**

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behavior of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

UNIT- II: FINITE DIFFERENCE METHOD **9**

Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – solution methods for finite difference equations – Elliptic equations – Iterative solution Methods – Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations.

UNIT- III: FINITE VOLUME METHOD (FVM) FOR DIFFUSION **9**

Finite volume formulation for steady state One, Two and Three -dimensional diffusion problems. One dimensional unsteady heat conduction through Explicit, Crank – Nicolson and fully implicit schemes.

UNIT- IV: FINITE VOLUME METHOD FOR CONVECTION DIFFUSION **10**

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes-properties of discretization schemes – Conservativeness, Boundedness, Trasnportiveness, Hybrid, Power-law, QUICK Schemes.

UNIT- V: CALCULATION FLOW FIELD BY FVM **9**

Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants. Turbulence models, mixing length model, Two equation (k-Є) models – High and low Reynolds number models

Total no. of Periods : 45

TEXT BOOKS

1) Ghoshdastidar , P.S., (1998) "*Computer Simulation of flow and heat transfer"*, Tata McGraw Hill Publishing Company Ltd.

2) Versteeg, H.K., and Malalasekera, W., (1998) *"An Introduction to Computational Fluid Dynamics: The finite volume Method"*, Longman.

REFERENCES

1. *Patankar, S.V. (2004) "Numerical Heat Transfer and Fluid Flow", Hemisphere Publishing Corporation.*

2. *Muralidhar, K., and Sundararajan, T., (1995) "Computations Fluid Flow and Heat Transfer", Narosa Publishing House, NewDelhi.*

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