B. TECH (AUTOMOBILE ENGINEERING)

STUDY SCHEME

BATCH 2018-19 ONWARDS

I.K.G.P.T.U KAPURTHALA

3rd Semester; Contact Hours: 30

Code	Subjects	L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
BTAE301-18	Strength of Materials	3	1	0	4	40	60	100	4
BTAE302-18	Engineering Thermodynamics	3	1	0	4	40	60	100	4
BTAE303-18	Fluid Mechanics and Fluid Machines	3	1	0	4	40	60	100	4
BTAE304-18	Machine Drawing	1	0	6	7	40	60	100	4
BTAE305-18	Automotive Materials	3	0	0	3	40	60	100	3
BTAE306-18	Strength of Materials Lab	0	0	2	2	30	20	50	1
BTAE307-18	Fluid Mechanics and Fluid Machines Lab	0	0	2	2	30	20	50	1
BTAE308-18	Engineering Thermodynamics Lab	0	0	2	2	30	20	50	1
BMPD301-18	Mentoring and Professional Development	0	0	2	2	Satisfactory / Unsatisfactory			Non-Credit
Total					**30**	**290**	**360**	**650**	**22**

4th Semester; Contact Hours: 30

Code	Subjects	L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
BTAE401-18	Manufacturing Processes	4	0	0	4	40	60	100	4
BTAE402-18	Kinematics and Theory of Machines	3	1	0	4	40	60	100	4
BTAE403-18	Heat Transfer and Combustion	4	0	0	4	40	60	100	4
BTAE404-18	Automotive Electrical and Electronics Systems	4	0	0	4	40	60	100	4
BTAE405-18	Transport Management and Automobile Industry	3	1	0	4	40	60	100	4
EVS101-18	Environment Science	3	0	0	3	100	00	100	Non - credit
BTAE406-18	Manufacturing Processes Lab	0	0	2	2	30	20	50	1
BTAE407-18	Automotive Electrical and Electronics Systems Lab	0	0	2	2	30	20	50	1
BTAE408-18	Kinematics and Theory of Machines Lab	0	0	2	2	30	20	50	1
BMPD401-18	Mentoring and Professional Development	0	0	2	2	Satisfactory / Unsatisfactory			Non-Credit
Total					**30**	**390**	**360**	**750**	**23**

5th Semester; Contact Hours: 28

Code	Subjects	L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit Points
BTAE501-18	Automotive Chassis system	4	0	0	4	40	60	100	4
BTAE502-18	Numerical Methods	3	1	0	4	40	60	100	4
BTAE503-18	Automotive Petrol and Diesel Engines	3	0	0	3	40	60	100	3
BTAE504-18	Vehicle Body Engineering	4	0	0	4	40	60	100	4
HSMC101-18 /HSMC102-18*	Humanities-I	3	0	0	3	40	60	100	3
BTMC102-18	Essence of Indian Knowledge Traditions	3	0	0	3	100	00	100	Non-Credit
BTAE505-18	Automotive chassis System Lab	0	0	2	2	30	20	50	1
BTAE506-18	Numerical Methods Lab	0	0	2	2	30	20	50	1
BTAE507-18	Vehicle Body Engineering Lab	0	0	2	2	30	20	50	1
BMPD501-18	Mentoring and Professional Development	0	0	2	2	Satisfactory / Unsatisfactory			Non-Credit
Total					**28**	**390**	**360**	**750**	**21**

6th Semester; Contact Hours: 31

Code	Subjects	L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit Points
BTAE601-18	Measurement & Instrumentation	4	0	0	4	40	60	100	4
BTAE602-18	Automation Transmission	4	0	0	4	40	60	100	4
BTAE603-18	Design of Automotive Components	3	1	0	4	40	60	100	4
BTAE604-18	Open Elective-II (Humanities)	3	0	0	3	40	60	100	3
BTAE605-18	Two and Three Wheelers	3	1	0	4	40	60	100	4
BTAE606-18	Project -I (Project/Internship)	0	0	4	4 / 90 hrs	30	20	50	2
BTAE607-18	Measurement & Instrumentation Lab	0	0	2	2	30	20	50	1
BTAE608-18	Automotive Transmission Lab	0	0	2	2	30	20	50	1
BTAE609-18	Design of Automotive Components Lab	0	0	2	2	30	20	50	1
BMPD601-18	Mentoring and Professional Development	0	0	2	2	Satisfactory / Unsatisfactory			Non-Credit
Total					**31**	**320**	**380**	**700**	**24**

7th Semester; Contact Hours: 32

Code	Subjects	L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit Points
BTAE701-18	Vehicle Dynamics	3	1	0	4	40	60	100	4
BTAE702-18	Automotive Heating Ventilation and Air Conditioning	4	0	0	4	40	60	100	4
BTAE703-18	Automotive Pollution and Control	4	0	0	4	40	60	100	4
	Elective-I	3	0	0	3	40	60	100	3
BTAE704-18	Quality Control & Reliability	3	0	0	3	40	60	100	3
BTAE705-18	Project -II	0	0	8	8	40	60	100	4
BTAE706-18	Engine Testing & Pollution Measurement Lab	0	0	2	2	30	20	50	1
BTAE707-18	Automotive heating, Ventilation and Air Conditioning Lab	0	0	2	2	30	20	50	1
BMPD701-18	Mentoring and Professional Development	0	0	2	2	Satisfactory / Unsatisfactory			Non-Credit
Total					**32**	**300**	**400**	**700**	**24**

8th Semester; Contact Hours: 33

Code	Subjects	L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit Points
BTAE801-18	Vehicle Maintenance and Diagnostics	4	0	0	4	40	60	100	4
BTAE802-18	Vehicle Safety Engineering	4	0	0	4	40	60	100	4
BTAE803-18	Automotive Electronics System	3	0	0	3	40	60	100	3
	Elective-II	3	0	0	3	40	60	100	3
	Elective-III	3	0	0	3	40	60	100	3
BTAE804-18	Project -III	0	0	10	10	40	60	100	5
BTAE805-18	Vehicle Maintenance and Diagnostics Lab	0	0	2	2	30	20	50	1
BTAE806-18	Automotive Electronic System Lab	0	0	2	2	30	20	50	1
BMPD801-18	Mentoring and Professional Development	0	0	2	2	Satisfactory / Unsatisfactory			Non-Credit
Total					**33**	**300**	**400**	**700**	**24**

LIST OF ELECTIVE PAPERS

Elective-I (Any one subject out of the following)

BTAE708-18	Computer Aided
BTAE709-18	Computer Integrated manufacturing
BTAE710-18	Automotive Design
BTAE711-18	Advances in Material Processing
BTAE712-18	Automotive Aerodynamics
BTAE713-18	Hydraulic & Pneumatics
BTAE714-18	System for Automobiles

Elective-II (Any one subject out of the following)

BTAE807-18	Tractors & Farms Equipment
BTAE808-18	Off Road Vehicles
BTAE809-18	Ethics in engineering Profession
BTAE810-18	Total life cycle Management
BTAE811-18	Industrial Engineering

Elective-III (Any one subject out of the following)

BTAE812-18	Automotive fuels & Emission
BTAE813-18	Computers Simulator of I-C Engines
BTAE814-18	Alternate fuels and energy systems
BTAE815-18	Quality Control & reliability Engineering
BTAE816-18	Internal Computation Engineering
BTAE817-18	Mechatronics

DETAILED SYLLABUS FOR 3rd, 4th AND 5th SEMESTER

3rd Semester; Contact Hours: 30

Code	Subjects	L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
BTAE301-18	Strength of Materials	3	1	0	4	40	60	100	4
BTAE302-18	Engineering Thermodynamics	3	1	0	4	40	60	100	4
BTAE303-18	Fluid Mechanics and Fluid Machines	3	1	0	4	40	60	100	4
BTAE304-18	Machine Drawing	1	0	6	7	40	60	100	4
BTAE305-18	Automotive Materials	3	0	0	3	40	60	100	3
BTAE306-18	Strength of Materials Lab	0	0	2	2	30	20	50	1
BTAE307-18	Fluid Mechanics and Fluid Machines Lab	0	0	2	2	30	20	50	1
BTAE308-18	Engineering Thermodynamics Lab	0	0	2	2	30	20	50	1
BMPD301-18	Mentoring and Professional Development	0	0	2	2	Satisfactory / Unsatisfactory			Non-Credit
Total					**30**	**290**	**360**	**650**	**22**

BTAE301-18 STRENGTH OF MATERIALS

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
3	1	0	4	40	60	100s	4

Objectives:

1. To understand the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres for various types of simple loads.
2. To calculate the elastic deformation occurring in various simple geometries for different types of loading.

Detailed Contents:

Deformation in solids-Hooke's law, stress and strain-tension, compression and shear stresses-elastic constants and their relations-volumetric, linear and shear strains-principal stresses and principal planes-Mohr's circle. **(8)**

Beams and types, transverse loading on beams-shear force and bending moment diagrams-Types of beam supports, simply supported and over-hanging beams, cantilevers, theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution, point and distributed loads. **(8)**

Moment of inertia about an axis and polar moment of inertia, deflection of a beam using double integration method, computation of slopes and deflection in beams, Maxwell's reciprocal theorems. **(8)**

Torsion stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, stresses and deflection of helical springs. **(8)**

Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders, deformation in spherical shells subjected to internal pressure **(8)**

Course Outcomes:

1. After completing this course, the students should be able to recognise various types loads applied on machine components of simple geometry and understand the nature of internal stresses that will develop within the components
2. The students will be able to evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading

Suggested Readings/Books:

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2001.

2. R. Subramanian, Strength of Materials, Oxford University Press, 2007.

3. Ferdinand P. Been, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGrawHill Publishing Co. Ltd., New Delhi 2005.

4. S. S. Rattan, "Strength of Materials", Tata McGraw Hill, New Delhi.

5. R. K. Bansal, "A Text Book of Strength of Materials", Laxmi Publications, New Delhi.

6. D. K. Singh, "Strength of Materials", Ane Books Pvt. Ltd., New Delhi.

7. Sadhu Singh, Strength of Materials, Khanna Publishers, Delhi.

BTAE302-18 ENGINERING THERMODYNAMICS

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
3	1	0	4	40	60	100	4

Objectives:

1. To learn about of 1st law for reacting systems and heating value of fuels
2. To learn about gas and vapor cycles and their first law and second law efficiencies
3. To learn the about reciprocating compressors, refrigeration and air conditioning systems.

Detailed Contents:

Introduction to solid, liquid and gaseous fuels–Stoichiometry, exhaust gas analysis-First law analysis of combustion reactions-Heat calculations using enthalpy tables-Adiabatic flame temperature-Chemical equilibrium and equilibrium composition calculations using free energy. **(8)**

Vapor power cycles Rankine cycle with superheat, reheat and regeneration, exergy analysis. Super-critical and ultra-super-critical Rankine cycle-Gas power cycles, Air standard Otto, Diesel and Dual Cycles-Air standard Brayton cycle, effect of reheat, regeneration and intercooling-Combined gas and vapor power cycles-Vapor compression refrigeration cycles, refrigerants and their properties. Refrigeration and Air-Conditioning: Principles of refrigeration, air-conditioning and heat pumps, vapour compression and vapour absorption systems, co-efficient of performance, Properties of refrigerants. **(15)**

Properties of dry and wet air, use of pschyrometric chart, processes involving heating/cooling and humidification/dehumidification, dew point. **(4)**

Basics of compressible flow. Stagnation properties, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows- normal shocks- use of ideal gas tables for isentropic flow and normal shock flow- Flow of steam and refrigerant through nozzle, supersaturation- compressible flow in diffusers, efficiency of nozzle and diffuser. **(8)**

Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of intercooling, minimum work for multistage reciprocating compressors. **(5)**

Course Outcomes:

1. The students will get a good understanding of various practical power cycles and heat pump cycles.
2. They will be able to analyze energy conversion in various thermal devices such as combustors, air coolers, nozzles, diffusers, steam turbines and reciprocating compressors
3. They will be able to understand phenomena occurring in high speed compressible flows
4. The students will be able to understand principal of refrigeration and air conditioning and their applications.

Suggested Readings/Books:

1. Nag.P.K, Engineering Thermodynamics, Tata McGraw Hill Co Ltd., Seventh Edn, 1993.
2. Mayhew and Rogers, Engineering Thermodynamics, Longman Green & Co Ltd., London, E.L.B.S. Edn, 1990.
3. Van Wylen.G.J. and Sonntag. R.E., Fundamentals of Classical Thermodynamics (SI Version) 2nd Edn, 1986
4. D.H.Bacon, Engineering Thermodynamics, Butterworth & Co., London, 1989.
5. M.A.Sadd Thermodynamics for Engineers, Prentice Hall of India Pvt Ltd., 1989

BTAE303-18 FLUID MECHANICS AND FLUID MACHINES

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
3	1	0	4	40	60	100	4

Objectives:

1. To learn about the application of mass and momentum conservation laws for fluid flows
2. To understand the importance of dimensional analysis
3. To obtain the velocity and pressure variations in various types of simple flows
4. To analyze the flow in water pumps and turbines.

Detailed Contents:

Definition of fluid, Newton's law of viscosity, Units and dimensions-Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, Control volume- application of continuity equation and momentum equation, incompressible flow, Bernoulli's equation and its applications. **(9)**

Exact flow solutions in channels and ducts, Couette and Poiseuille flow, laminar flowthrough circular conduits and circular annuli- concept of boundary layer–measures of boundary layer thickness–Darcy Weisbach equation, friction factor, Moody's diagram. **(9)**

Need for dimensional analysis–methods of dimension analysis–Similitude–types of similitude Dimensionless parameters–application of dimensionless parameters–Model analysis. **(6)**

Euler's equation–theory of rotodynamic machines–various efficiencies–velocity components at entry and exit of the rotor, velocity triangles–Centrifugal pumps, working principle, work done by the impeller, performance curves–Cavitation in pumps-Reciprocating pump – working principle. **(8)**

Classification of water turbines, heads and efficiencies, velocity triangles- Axial, radial and mixed flow turbines-Pelton wheel, Francis turbine and Kaplan turbines, working principles–draft tube- Specific speed, unit quantities, performance curves for turbines – governing ofturbines. **(8)**

Course Outcomes:

1. Upon completion of this course, students will be able to mathematically analyze simple flow situations
2. They will be able to evaluate the performance of pumps and turbines.

Suggested Readings / Books:

1. S.K. Som, G. Biswas and S. Chakraborty, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill Publications, 3rd edition, 2011.
2. D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", S.K. Kataria and Sons Publishers, 1st Edition, 2009.
3. C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, "Fluid Mechanics and Machinery", Oxford University Press,1st Edition, 2010.
4. Y.A. Cengel and J.M. Cimbala, "Fluid Mechanics - Fundamentals and Applications", Tata McGraw Hill Publications, 3rd Edition, 2013.
5. Frank M. White, "Fluid Mechanics", Tata Mc Graw Hill Publications, 5th Edition, 2012.

BTAE304-18 MACHINE DRAWING

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
1	0	6	7	40	60	100	4

Objectives:
The student will acquire a knowledge of fastening arrangements such as welding, riveting the different styles of attachment for shaft. The student also is enabled to prepare the assembly of various machine or engine components and miscellaneous machine components; from the individual part drawing.

Note:

1. Drawing Practice is to be done as per IS code SP 46:2003 by Bureau of Indian Standards.
2. The Question paper shall have following structure/weightage:
   Section A – Short answer type Questions based upon whole syllabus – 10 question of 02 marks each (All questions are compulsory).
   Section B – Free hand sketching of machine parts etc.; – out of 03 questions of 05 marks each, 02 Questions are to be attempted.
   Section C – Assembly drawing (from Unit-III) of machine parts with at least two views (with bill of materials) – out of 02 questions of 30 marks each; 01 question is to be attempted.

Detailed Contents:

1. Introduction: Classification of drawings, Principles of drawing, Requirements of machine Drawing, sectional views and conventional representation, dimensioning, concept of limits, fits & tolerances and their representation, machining symbols, various types of screw threads, types of nuts and bolts, screw fasteners, welded joints and riveted joints, introduction and familiarization of code SP 46:2003 by Bureau of Indian Standards. **(15)**

2. Free hand sketches of:

- **a. Couplings**: solid and rigid couplings, protected type flange coupling, pin type flexible coupling, muff coupling.
- **b.** Knuckle and cotter joints.
- **c. Pipe and Pipe fittings**: Flanged joints, spigot and socket joint, union joint, hydraulic and expansion joint. **(15)**

3. Assembly of:

- **a. IC Engine Parts:** piston and connecting rod.
- **b. Boiler Mountings**: Steam stop valve, blow off cock, feed check valve and spring-loaded safety valve.
- **c. Bearing:** Swivel bearing, Plummer Block and Foot Step bearing.
- **d. Miscellaneous:** Screw jack, Tail Stock and crane hook. **(20)**

4. Practice using Computer Aided Drafting (CAD) tools for:

(a) Machine components, screw fasteners, Keys cotters and joint, shaft couplings, Pipe joints and fittings, riveted joints and welded Joints.

(b) Assemblies: - Bearings (Plumber Block, Footstep, Swivel), boiler mountings, screw jack, Exercise in computer Plots of drawing

(c) Case studies in computer plots and industrial blueprint **(10)**

Course Outcomes:

After studying this course; the student will be able to:

1. Read, draw and interpret the machine drawings and related parameters.
2. Use standards used in machine drawings of machine components and assemblies.
3. Learn the concept of limits, fits and tolerances in various mating parts.
4. Visualize and generate different views of a component in the assembly.
5. Use CAD tools for making drawings of machine components and assemblies.

Suggested Reading/Books:

1. P.S Gill, "Machine Drawing", S K Kataria and sons, 18th edition, 2017 reprint
2. N.D.Bhatt, "Machine Drawing". Charotar publications, 49th edition, 2014
3. Ajeet Singh, "Machine Drawing (including Auto CAD)", Tata McGraw Hill, 2nd edition,2012
4. G. Pohit, "Machine Drawing with Auto CAD", Pearson Education Asia, 2007.
5. IS code SP 46(2003): Engineering Drawing Practice for schools and colleges by Bureau of Indian Standards.

Topic for Self-Learning (TSL)

1. Conventional representation of common feature like Springs, Gear Assembly, Braking of shaft, Pipe, Screw threads etc.
2. Drawing of special Types of bolts, nuts and washers.
3. Importance of bill of materials (BOM)
4. Free hand sketch of bearings (i.e. ball bearing and roller bearing).

BTAE305-18 AUTOMOTIVE MATERIALS

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
3	0	0	3	40	60	100	3

Objectives:
To present a problem oriented in depth knowledge of automotive materials and manufacturing. To address the underlying concepts and methods behind automobile materials and manufacturing including the surface treatment of the materials.

Detailed Contents:
Introduction: Engineering materials, material classifications, mechanical, thermal, electrical, magnetic, chemical, optical and physical properties of materials, effects of alloying elements on properties of steel, carbon steel, low alloy steels, stainless steel, tool steels and die steels. Alloys of Ni, Al, Cu, Mg; properties and their applications, recrystallization temperature, their effect on the properties of materials**. (4)**

Ceramic Materials: Introduction, nature of ceramic materials, types, products, properties developments in ceramics. **Glass:** Introduction, composition, structure, types of glass and their properties, use of glass, fracture in glass**. (3)**

Rubber: Introduction, characteristics of rubbers, structure of elastomers, types of elastomers, vulcanization of rubber, uses of rubber and applications. (2)

Plastics Materials: Introduction, definition and concept, properties of plastics, thermoplastics, thermosetting plastics, deformation of plastics, plastic alloys. (2)

Fundamentals of Composites- need for composites–Enhancement of properties -classification of composites – Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Fiber reinforced composites, Applications of various types of composites. (3)

Polymer Matrix Composites Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibres –various types of fibres, Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GRP). (4)

Ceramic Matrix Composites Engineering ceramic materials–properties–advantages–limitations–Monolithic ceramics-Need for CMC– Ceramic matrix -Various types of Ceramic Matrix composites- oxide ceramics–non oxide ceramics–aluminum oxide–silicon nitride – reinforcements – particles- fibres whiskers. Sintering - Hot pressing – Cold isostatic presses–Hot isostatic pressing. (4)

Advances in Composites Carbon / carbon composites–Advantages of carbon matrix–limitations of carbon matrix Carbon fibre. (2)

Heat Treatment and Surface Treatment: Heat treatment of steel–Annealing, Normalizing, Hardening and tempering with their types and application to automotive components, (3)

Surface Hardening Techniques: Induction, flame and chemical hardening, coating of wear and corrosion resistance, Electroplating, Phosphating, Anodizing, hot dipping, thermal spraying, hard facing and thin film coatings. (4)

Selection of Materials: Factors affecting the selection of materials, Cryogenic wear, corrosion, fatigue, creep and oxidation resistance application. Criteria of selecting materials for automotive components viz cylinder block, Cylinder head, piston, piston ring, Gudgeon pin, connecting rod, crank shaft, crank case, cam, cam shaft, engine valve, gear wheel, clutch plate, axle, bearings, chassis, spring, body panel - radiator, brake lining etc. Materials for heavy duty vehicles: special alloys, plastics, seat fabrics and materials for bumpers. (6)

Course Outcomes:

1. The students can identify different areas of automobile materials and manufacturing.
2. The students can find the applications of all the areas in day to day life.

Suggested Readings / Books:

1. Khanna.O.P., “Material Science and Metallurgy ", Dhanpat Rai and Sons.
2. Agarwal B.K., “Introduction to Engineering Materials”, Tata McGraw-Hill.
3. Dogra Rakesh, “Advances in Material Science”, Katson Books.
4. Mathews F.L. and Rawlings R.D., “Composite Materials”, Chapman and Hall, London, England, 1st edition, 1994.
5. Chawla K.K., “Composite materials”, Springer – Verlag, 1987.
6. Strong A.B., “Fundamentals of Composite Manufacturing”, SME, 1989.
7. Sharma S.C., “Composite materials”, Narosa Publications, 2000.
8. Daniel Yesudian C., “Materials Science and Metallurgy”, Scitech Publications (India), 2004.

BTAE306-18 STRENGTH OF MATERIALS LAB

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
0	0	2	2	30	20	50	1

Course Outcomes:

After studying this course, students shall be able to:

1. Measure the various mechanical properties such as tensile and compressive strength, impact strength, torsion strength and fatigue strength and hardness of brittle and ductile materials.
2. Calculate load carrying capacity of long columns and their buckling strength.

List of Experiments:

1. To perform tensile and compression test in ductile and brittle materials and to draw stress-strain curve and to determine various mechanical properties.
2. To perform any hardness tests (any one; from Rockwell, Brinell &Vicker's test).
3. To perform impact test to determine impact strength.
4. To perform torsion test and to determine various mechanical properties.
5. To perform Fatigue test on circular test piece.
6. To perform bending test on beam and to determine the Young's modulus and modulus of rupture.
7. Determination of Bucking loads of long columns with different end conditions.

BTAE307-18 FLUID MECHANICS AND FLUID MACHINES

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
0	0	2	2	30	20	50	1

Course Outcomes:

After studying this course, students shall be able to:

1. Distinguish various type of flows and flow measurement methods and concept of statics and dynamics of liquids.
2. Determine discharge and head loss, hydraulic and friction coefficient, for different types of flow in pipe and open channels.

List of Experiments:

1. To determine the metacentric height of a floating vessel under loaded and unloaded conditions.
2. To study the flow through a variable area duct and verify Bernoulli's energy equation.
3. To determine the coefficient of discharge for an obstruction flow meter (venturi meter/ orifice meter)
4. To determine the friction coefficients, head loss in pipes.
5. To determine the velocity distribution for pipeline flow with a pitot static probe.
6. Determination of various efficiencies of Hydraulic Ram
7. To draw characteristics of Francis turbine/Kaplan Turbine, Pelton Turbine and Centrifugal pump.

BTAE308-18 ENGINEERING THERMODYNAMICS LAB

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
0	0	2	2	30	20	50	1

Course Outcomes:

After studying this course, students shall be able to:

1. Understand the construction and working of IC engines, and evaluate their performance.
2. Understand to prepare the heat balance sheet for IC Engines.

List of Experiments:

1. Study of construction and operation of 2 stroke and 4 stroke Petrol and Diesel engines and to plot actual valve timing diagram of 4 stroke petrol and diesel engines and study its impact on the performance of engine.

2. Determination of dryness fraction of steam and estimation of brake power, Rankine efficiency, relative efficiency, generator efficiency, and overall efficiency of an impulse steam turbine and to plot a Willian's line.

3. Determine the brake power, indicated power, friction power and mechanical efficiency of a multi cylinder petrol engine running at constant speed (Morse Test).

4. Performance testing of a Petrol and Diesel engine from no load to full load (at constant speed) for a single cylinder/ multi- cylinder engine in terms of brake power, indicated power, mechanical efficiency and specific fuel consumption and to measure the exhaust emission. Draw/obtain power consumption and exhaust emission curves. Also make the heat balance sheet.

4th Semester; Contact Hours: 30

Code	Subjects	L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
BTAE401-18	Manufacturing Processes	4	0	0	4	40	60	100	4
BTAE402-18	Kinematics and Theory of Machines	3	1	0	4	40	60	100	4
BTAE403-18	Heat Transfer and Combustion	4	0	0	4	40	60	100	4
BTAE404-18	Automotive Electrical and Electronics Systems	4	0	0	4	40	60	100	4
BTAE405-18	Transport Management and Automobile Industry	3	1	0	4	40	60	100	4
EVS101-18	Environment Science	2	0	0	2	Non-Credit Mandatory Course			
BTAE406-18	Manufacturing Processes Lab	0	0	2	2	30	20	50	1
BTAE407-18	Automotive Electrical and Electronics Systems Lab	0	0	2	2	30	20	50	1
BTAE408-18	Kinematics and Theory of Machines Lab	0	0	2	2	30	20	50	1
BMPD401-18	Mentoring and Professional Development	0	0	2	2	Satisfactory / Unsatisfactory			Non-Credit
Total					**30**	**290**	**360**	**650**	**23**

BTAE401-18 MANUFACTURING PROCESSES

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
4	0	0	4	40	60	100	4

Objectives:

To motivate and challenge students to understand and develop an appreciation of the processes in correlation with material properties which change the shape, size and form of the raw materials into the desirable product by conventional or unconventional manufacturing methods.

Detailed Contents:

Conventional Manufacturing processes: Casting and Moulding: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses. **(5)**

Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming (forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending) principles of powder metallurgy. **(4)**

Metal Cutting: Single and multi-point cutting; Orthogonal cutting, various force components: Chip formation, Tool wear and tool life, Surface finish and integrity, Machinability, cutting tool materials, cutting fluids, Coating; Turning, Drilling, Milling and finishing processes, Introduction to CNC machining. **(8)**

Additive Manufacturing: Rapid prototyping and rapid tooling. **(3)**

Joining/Fastening Processes: Physics of welding, brazing and soldering; design considerations in welding, Solid and liquid state joining processes; Adhesive bonding. **(4)**

Unconventional Machining Processes:

Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and process parameters. **(5)**

Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits, wire EDM; Electro-chemical machining (ECM), etchant &maskant, process parameters, MRR and surface finish. **(8)**

Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining. **(3)**

Course Outcomes:

Upon completion of this course, students will be able to understand the different conventional and unconventional manufacturing methods employed for making different products

Suggested Readings/Books:

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)- Pearson India, 2014
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems
3. Degarmo, Black &Kohser, Materials and Processes in Manufacturing

BTAE402-18 KINEMATICS AND THEORY OF MACHINES

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
3	1	0	4	40	60	100	4

Objectives:

1. To understand the kinematics and rigid- body dynamics of kinematically driven machine components.
2. To understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link.
3. To be able to design some linkage mechanisms and cam systems to generate specified output motion and to understand the kinematics of gear trains.

Detailed Contents:

Classification of mechanisms- Basic kinematic concepts and definitions- Degree of freedom, mobility- Grashof's law, Kinematic inversions of four bar chain and slider crank chains-Limit positions- Mechanical advantage- Transmission angle- Description of some common mechanisms- Quick return mechanism, straight line generators- Universal Joint- Rocker mechanisms **(8)**

Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations- kinematic analysis of simple mechanisms- slider crank mechanism dynamics Coincident points- Coriolis component of acceleration- introduction to linkage synthesis three position graphical synthesis for motion and path generation **(8)**

Classification of cams and followers- Terminology and definitions- Displacement Diagrams-Uniform velocity, parabolic, simple harmonic and cycloidal motions- derivatives of follower motions- specified contour cams- circular and tangent cams- pressure angle and undercutting, sizing of cams, graphical and analytical disc cam profile synthesis for roller and flat face followers **(8)**

Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting- helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics **(8)**

Surface contacts- sliding and rolling friction- friction drives- bearings and lubrication friction clutches- belt and rope drives- friction in brakes **(8)**

Course Outcomes:

The students can design various types of linkage mechanisms for obtaining specific motion and analyse them for optimal functioning.

Suggested Readings/Books:

1. Thomas Bevan, Theory of Machines, 3rd edition, CBS Publishers & Distributors, 2005.
2. Cleghorn W.L. , Mechanisms of Machines, Oxford University Press, 2005.
3. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGrawHill, 2009.
4. Ghosh A. and Mallick A.K., Theory of Mechanisms and Machines, Affiliated East-West Pvt. Ltd, New Delhi, 1988.

BTAE403-18 HEAT TRANSFER AND COMBUSTION

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
4	0	0	4	40	60	100	4

Objectives:

1. The aim of the course is to build a solid foundation in heat transfer exposing students to the three basic modes namely conduction, convection and radiation.
2. Rigorous treatment of governing equations and solution procedures for the three modes will be provided, along with solution of practical problems using empirical correlations.
3. The course will also briefly cover boiling and condensation heat transfer, and the analysis and design of heat exchangers

Detailed Contents:

Conduction: Fourier law of heat conduction for isotropic material. Thermal conductivity. Derivation of the energy equation in three dimensions including transient effect, Non dimensional-thermal diffusivity and Fourier number, Types of boundary conditions- (Dirchlet, Neumann, mixed type), One-dimensional solution with and without heat generation, Analogy with electrical circuits. (10)

Fins: rectangular and pin fins. Fin effectiveness and efficiency.Critical thickness of insulation. (2)

Radiation: Physical mechanism of thermal radiation, laws of radiation, definition of black body emissive power, intensity of the radiation,emissivity, reflectivity, transmittivity, irradiation, radiosity. Radiation exchange between black bodies. Concept of Gray-Diffuse Isotropic (GDI) surface. Radiation exchange between GDI surfaces. (8)

Convection: Introduction, Newton's law of cooling and significance of the heat transfer co-efficient. Momentum and energy equations in two dimensions, non dimensional, importance of non dimensional quantities and their physical significance. Order of magnitude analysis for flow over a flat plate. Velocity and Analogies between momentum, heat and mass transfer. Natural convection. (9)

Heat exchangers: Types of heat exchangers, parallel and counter flow types, Introductions to LMTD. Correction factors, fouling factor. (4)

Combustion Analysis: Fuels, HCV and LCV, Air requirements, excess air, analysis of products of combustion. Enthalpy of formation, adiabaticflame temperature, enthalpy of combustion, heat of reaction. Analysis of fuels and flue gas, Orsat's apparatus. (7)

Course Outcomes:

1. After completing the course, the students will be able to formulate and analyze a heat transfer problem involving any of the three modes of heat transfer.
2. The students will be able to obtain exact solutions for the temperature variation using analytical methods where possible or employ approximate methods or empirical correlations to evaluate the rate of heat transfer
3. The students will be able to design devices such as heat exchangers and also estimate the insulation needed to reduce heat losses where necessary.

Suggested Readings/Books:

1. A. Bejan, Heat Transfer John Wiley, 1993
2. J.P.Holman, Heat Transfer, Eighth Edition, McGraw Hill, 1997.
3. F.P.Incropera, and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley, Sixth Edition, 2007.

4. Massoud Kaviany, Principles of Heat Transfer, John Wiley, 2002
5. Yunus A Cengel, Heat Transfer: A Practical Approach, McGraw Hill, 2002
6. D.S. Kumar. Heat and Mass Transfer, S.K. Kataria & Sons, 2013

BTAE404-18 AUTOMOTIVE ELECTRICAL AND ELECTRONIC SYSTEMS

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
4	0	0	4	40	60	100	4

Objectives:

The students should be able to

1. Acquire the knowledge of Electrical and Electronics engineering concepts.
2. Understand the construction and applications of Electrical and electronics components in various automotive electrical circuits.
3. Understand the construction and working of various automotive electrical systems and components.
4. Identify, demonstrate and compare the various components and systems of Auto electrical systems.

Detailed Contents:

Introduction Earth returns and insulated return systems, 6, 12, and 24-volt systems. Positive & negative earth systems, Fusing of circuits, relays, switches, low and high voltage automotive cables, wiring diagram for typical automotive wiring systems, maintenance and servicing. (2)

Batteries Principles of lead acid cells and their characteristics-construction and working of lead acid battery, types of batteries, testing of batteries, effect of temperature on: capacity and voltage, battery capacity, voltage, efficiency, charging of batteries, sulphation and desulphation, maintenance and servicing, Battery failures & checking, Maintenance free Batteries, High energy and power density batteries for electric vehicles. (4)

Charging system Principle of generation of direct current. Shunt generator characteristics. Armature reaction. Third brush regulation. Cut-out. Voltage & current regulators, compensated voltage regulator. Alternators - principle, constructional and working aspects, bridge rectifiers. Principle of Magneto, Flywheel Magneto, Maintenance and servicing. Trouble shooting in charging systems. (3)

Starting system Condition at Starting–starting torque and power requirements, behavior of starter during starting, Series motor and its characteristics, Principle & construction of starter motor, working of different starter drive units, care & maintenance of starter motor, Starter switches, safety mechanism, maintenance, servicing and trouble shooting. (3)

Ignition system Types, construction & working of battery & coil and magneto ignition systems. Relative merits, Ballast Resistor, Ignition coil, Distributor, Contact breaker Point, centrifugal and vacuum advance mechanisms, Limitations of conventional ignition systems, Transistorized Ignition systems, Spark plugs - construction, different types, plug fouling, maintenance, servicing and fault diagnosis, Electronic Ignition system. Programmed ignition, distributor less ignition. (5)

Lighting system Principle of automobile illumination, headlamp construction and wiring, reflectors–types, signaling devices flashers, stop lights, fog lamps, auxiliary lighting-engine, passenger, reading lamp, rear-plate lamps. Automatic illumination system, head light leveling devices. Study of a modern headlight system with improved night vision. (4)

Electrical Equipment and Accessories Oil pressure gauge, fuel level gauge, engine temperature gauge, electrical fuel pump, speedometer, odometer, trip meter, engine rpm meter, Headlamp & Windshield washer and wiper, heaters and defrosters, horns, stereo/radio, power antennae. Central locking, power window winding. Sun/Moon Roof. Motorized rear view mirrors, reverse warning, Bumper collision warning. Other accessories in modern vehicles. (4)

Fuel Cells Thermodynamic aspects; types-hydrogen and methanol, power rating and performance, various components and working of fuel cell, heat dissipation. (2)

Drive Motors and controllers: Drive arrangements in Hybrid and Electric vehicles, Drive motors: types and construction, Controlling of motor operations, Motor-generator in hybrid vehicles and its controls (2)

Basic electronics: Semiconductors- P type-N type, diode-introduction-half wave rectification-full wave bridge rectifier-full wave bridge rectifier with capacitor filter, zener diode-introduction, zener diode as voltage regulator, LED and photo diode-introduction-applications, transistor-introduction NPN and PNP transistor-applications-transistor as switch. (7)

Course Outcomes:

After studying this course, students shall be able to:

1. Explain basic terminologies, components and concepts of electrical and electronics engineering.
2. Understand the purpose, construction and working of different batteries, electrical systems, components of charging and starting system used in Automobiles.
3. Understand purpose, circuits, construction and working of components of ignition system, lighting and accessories system.
4. Explain purpose, circuits, construction and working of components of lighting and accessories system.

Suggested Readings/Books:

1. Kohli P.L., “Automotive Electrical Equipment ", Tata McGraw-Hill.
2. Chapman, “Principles of Electricity and Electronics for the Automotive Technician”, Thomson Asia, 2000.
3. Judge A.W., "Modern Electrical Equipment of Automobiles", Chapman & Hall, London.
4. Vinal G.W., "Storage Batteries ", John Wiley & Sons Inc.
5. W.H. Crouse, “Automobile Electrical Equipment ", McGraw Hill Book Co. Inc.

BTAE405-18 TRANSPORT MANAGEMENT AND AUTOMOBILE INDUSTRY

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
3	1	0	4	40	60	100	4

Objectives:

1. To learn about management training and operations
2. To learn about vehicle maintenance and vehicle parts.
3. To learn the about motor vehicle acts.

Detailed Contents:

Management Training and Operations: Basic principles of supervising. Organizing time and people. Job instruction training, training devices and techniques. Driver and mechanic hiring. Driver checklist, Lists for driver and mechanic. Trip leasing. Vehicle operation and types of operation. Automobile Industry: History and development of the automobile industry, market trends, current scenario in Indian auto industry, Auto ancillary industries, Role of the automobile industry in national growth. (10)

Vehicle Maintenance: Scheduled and unscheduled maintenance Planning and scope. Evaluation of PMI program, Work scheduling, Overtime, Breakdown analysis, Control of repair backlogs, Cost of options. Scheduling and Fare Structure: Route planning, Scheduling of transport vehicles, Preparation of timetable, Costs, fare structure, methods of the fare collection, Preparation of fare table. (10)

Vehicle Parts, supply management and budget: Cost of inventory, balancing inventory cost against downtime, Parts control, Bin tag systems, Time management, Time record keeping, Budget activity, Capital expenditures, Classification of vehicle expenses, Fleet management and data processing, Data processing systems- Software, Models–Computer controlling of fleet activity, energy management. (10)

Motor Vehicle Act: Schedules and sections, Registration of motor vehicles, Licensing of drivers, Control of permit, Limits of speed, traffic signs. Constructional regulations. Description of goods carrier, delivery van, tanker, tipper, Municipal, fire fighting and break down service vehicle. (8)

Course Outcomes:

After completing this course, the students will get a good understanding of various management training operations and will able to understand vehicle maintenance techniques and methodologies.They will be able to understand supply management and budget for the production.They will be able to understand the motor \vehicle acts.

Suggested Readings/Books:

1. John Dolu, Fleet Management, McGraw Hill Co., 1984
2. Government Publication, The Motor Vehicle Act, 1989
3. Kitchin. L. D., Bus Operation, IIIiffe and Sons Ltd., London, III Edition, 1992
4. Kadiyali. L.R., Traffic Engineering and Transport Planning.

EVS101-18 ENVIRONMENT SCIENCE

L	T	P	Total	Credit points
3	0	0	3	Non-Credit

Objectives:

1. To learn about management training and operations
2. To learn about vehicle maintenance and vehicle parts.
3. To learn the about motor vehicle acts.

Detailed Contents:

Module 1: Natural Resources: Renewable and non-renewable resources

Natural resources and associated problems.

a) Forest resources: Use and over-exploitation, deforestation, case studies, Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resource for sustainable lifestyles.

Module 2: Ecosystems

Concept of an ecosystem. Structure and function of an ecosystem. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystems:

a. Forest ecosystem
b. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Module 3: Biodiversity and its conservation

- Introduction – Definition: genetic, species and ecosystem diversity.
- Biodiversity at global, National and local levels.
- Inida as a mega-diversity nation
- Hot-sports of biodiversity.
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India

Module 4: Social Issues and the Environment

- From Unsustainable to Sustainable development
- Resettlement and rehabilitation of people; its problems and concerns.
- Environmental ethics: Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, Nuclear accidents and holocaust. Case Studies.

- Public awareness.

***ACTIVITIES**

Nature club (bird watching, recognizing plants at institute/at home, recognizing local animals, appreciating biodiversity. Impart knowledge and inculcate the habit of taking interest and understanding biodiversity in and around the college campus. The students should be encouraged to take interest in bird watching, recognizing local plants, herbs and local animals. The students should be encouraged to appreciate the difference in the local biodiversity in their hometown, in the place of their study and other places they visit for vacation/breaks etc.

Following activities must be included.

I. Identify a tree fruit flower peculiar to a place or having origin from the place.
II. Making high resolution big photographs of small creatures (bees, spiders, ants. mosquitos etc.) especially part of body so that people can recognize (games on recognizing animals/plants).
III. Videography/ photography/ information collections on specialties/unique features of different types of common creatures.
IV. Search and explore patents and rights related to animals, trees etc. Studying miracles of mechanisms of different body systems.

1*(A) Awareness Activities:*

a) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste
b) Slogan making event
c) Poster making event
d) Cycle rally
e) Lectures from experts
f) Plantation
g) Gifting a tree to see its full growth
h) Cleanliness drive
i) Drive for segregation of waste
i) To live with some eminent environmentalist for a week or so to understand his work vi) To work in kitchen garden for mess
j) To know about the different varieties of plants
k) Shutting down the fans and ACs of the campus for an hour or so
l) Visit to a local area to document environmental assets river/forest/grassland/hill/mountain/lake/Estuary/Wetlands
m) Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
n) Visit to a Wildlife sanctuary, National Park or Biosphere Reserve

Course Outcomes:

Students will enable to understand environmental problems at local and national level through literature and general awareness. The students will gain practical knowledge by visiting wildlife areas, environmental institutes and various personalities who have done practical work on various environmental Issues.

Suggested Readings

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)
3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
4. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p

BTAE406-18 MANUFACTURING PROCESSES LAB

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
0	0	2	2	30	20	50	1

Course Outcomes:

After studying this course, students shall be able to:

1. Understand the basics of various welding process and will be able to prepare joints using welding process i.e. MIG, Arc welding and spot welding.
2. Understand the working of various machines.

List of Experiments:

1. Study of Arc welding equipment and making a weld joint by this process.
2. Study of MIG welding equipment and making a weld joint by this process.
3. Study of Spot welding and preparing a weld joint by this process.
4. Study of constructional features of following machines through drawings/ sketches and an exercise based on them: -a) Universal milling machine b) Grinding machines (Surface, cylindrical) c) Hydraulic Press d) Lathe e) Shaper
5. Industrial Visit for demonstration of Machines

BTAE407-18 AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS LAB

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
0	0	2	2	30	20	50	1

Course Outcomes:

After studying this course, students shall be able to:

1. Understand the construction and applications of Electrical and electronics components in various automotive electrical circuits.
2. Understand the construction and working of various automotive electrical systems and components.

List of Experiments:

1. To study of rectifier and filters
2. Testing of starting motors and generators
3. To Study of SCR and IC timer, D/A and A/D.
4. Diagnosis of ignition system faults
5. Study of Automobile electrical wiring.
6. Study of logic gates, adder and flip-flops
7. Interfacing A/D converter and simple data acquisition
8. Micro controller programming and interfacing

BTAE408-18 KINEMATICS AND THEORY OF MACHINE LAB

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
0	0	2	2	30	20	50	1

Course Outcomes:

After studying this course, students shall be able to:

1. Determine gyroscopic couple, balancing of rotating masses and Cam profile analysis.
2. Determine gear- train value of compound gear trains and epicyclic gear trains.

List of Experiments:

1. Conduct experiments on various types of governors and draw graphs between height and equilibrium speed of a governor.
2. Determination of gyroscopic couple (graphical method).
3. Balancing of rotating masses (graphical method).
4. Cam profile analysis (graphical method)
5. Determination of gear- train value of compound gear trains and epicyclic gear trains.
6. To draw circumferential and axial pressure profile in a full journal bearing.

5th Semester; Contact Hours: 28

Code	Subjects	L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit Points
BTAE501-18	Automotive Chassis system	4	0	0	4	40	60	100	4
BTAE502-18	Numerical Methods	3	1	0	4	40	60	100	4
BTAE503-18	Automotive Petrol and Diesel Engines	3	0	0	3	40	60	100	3
BTAE504-18	Vehicle Body Engineering	4	0	0	4	40	60	100	4
HSMC101-18 /HSMC102-18*	Humanities-I	3	0	0	3	40	60	100	3
BTMC102-18	Essence of Indian Knowledge Traditions	3	0	0	3	100	00	100	Non-Credit
BTAE505-18	Automotive chassis System Lab	0	0	2	2	30	20	50	1
BTAE506-18	Numerical Methods Lab	0	0	2	2	30	20	50	1
BTAE507-18	Vehicle Body Engineering Lab	0	0	2	2	30	20	50	1
BMPD501-18	Mentoring and Professional Development	0	0	2	2	Satisfactory / Unsatisfactory			Non-Credit
Total					**28**	**390**	**360**	**750**	**21**

BTAE501-18 AUTOMOTIVE CHASSIS SYSTEMS

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit Points
4	0	0	4	40	60	100	4

Detailed Contents:

Introduction Types of chassis layout with reference to power plant locations and drive, Vehicle frames. Load acting on vehicle frame due to different systems**.**

Front Axle & Steering System Types of front axles, Constructional details, materials. Front wheel geometry viz. Castor, Camber, King pin inclination, Toe. Wheel Alignment. Steering geometry. Ackerman and Davis steering system. Different types of steering gear boxes. Steering linkages and their layouts. Power and power assisted steering. Steering of crawler tractors. Multi axle steering systems.

Driveline and Differential Effects of driving thrust and torque reactions. Hotch kiss drive, torque tube drive and radius rods.Transverse rods. Propeller shaft, Universal joints. Constant velocity universal joints. Drive Shaft. Front wheel drive. Different types of final drives. Spiral bevel gear and hypoid gear final drives. Double reduction and twin speed final drives. Differential principles. Constructional details of a differential gear unit. Non-slip and Limited slip differential. Differential locks -Differential housings. Comparison of front wheel, rear wheel and all-wheel drive arrangement.

Drive axles Construction of rear axles. Types of loads acting on rear axles. Fully floating, three quarter floating, and semi floating rear axles. Rear axle housing. Construction of different types of axle housing, multi axle vehicles. Construction details of multi drive axle vehicles. Dead axles.

Suspension system Need of suspension system, Types of suspension, Suspension springs, Constructional details and characteristics of leaf, coil and torsion bar springs, Independent suspension, Types: Mc Pherson strut, Double wishbone, Five link type, etc, Rubber suspension, Pneumatic suspension, Shock absorbers.

Wheels and Tires Types of wheels – wire spoke, disc – solid and split type, alloy type, offset, onset & zero set, denomination of rim. Tires, materials, construction, structure, denomination and function of tires, types of tires, comparison of radial and bias ply tires. Tubes – construction and types, Tubeless tires. Tire inflation, effects of tire pressure on tire performance. Tire wears patterns and their causes. Rolling Resistance and self-aligning torque, Wheel Balancing – need, procedure. All season tires, tire quality grading, changing tire sizes. Run flat tires (RFT), new heat resistant tires for better mileage, fuel efficient handling and safety.

Braking System Weight transfer during braking and stopping distances. Classification of brakes - drum brakes and disc brakes. Constructional details. Theory of braking, Brake split and proportioning. Mechanical, hydraulic and pneumatic brakes - Servo brake, power and power-assisted brakes -Different types of brake retarders like eddy current and hydraulic retarder. Skidding of wheels on braking and remedies, Anti-lock braking systems:- types, system components, operations, fluids. Power Brakes and Parking Brakes, Additive, self-energizing brakes, regenerative and emergency braking system.

Suggested Readings/Books:

1. Reimpell and Betzler, “The Automotive Chassis: Engineering Principles”, Second Edition Butterworth Heinemann London.
2. Giancarlo Genta, “The Automotive Chassis volume I and volume II”, Springer.
3. Heinz Heisler, “Advanced Vehicle Technology”, Second Edition Butterworth Heinemann London.
4. Gilles T., “Automotive Chassis Brakes Steering and Suspension”, Thomson USA.
5. Newton Steeds and Garrot, “Motor vehicles ", Butterworths, London.
6. Judge A.W., “Mechanism of the car ", Chapman and Halls Ltd., London.

BTAE502-18 NUMERICAL METHODS

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit Points
3	1	0	4	40	60	100	4

Course objectives:
This course deals with the basic concepts of mathematical statistics and numerical analysis. The objective of this course is to introduce these concepts and focus on application of these for handling the problems arising in science, engineering and technology.

Course Outcomes:
After completing the course, the students will be able to

1. Apply the concepts of mathematical statistics in modeling processes and decision making.
2. Apply the concepts of numerical methods for solving problems arising in science, engineering and technology.
3. Solve continuous problems numerically which are difficult to deal with analytically.

Detailed Contents:

Unit-I

Probability and Probability Distributions: Population, Sample space, Events, Random Variables; Definitions of probability, conditional Probability, expectation, Binomial, Poisson and Normal distributions.

Testing of Hypothesis: Types of Error, Power of a test, Goodness of a fit, Student t and Chi-Square tests.

Unit-II

Floating-Point Numbers: Floating-point representation, Rounding, Chopping, Error Analysis. Condition and instability.

Solution of Algebraic and Transcendental Equations: Errors in numerical computation, bisection method, Newton-Raphson's method and method of false position, System of nonlinear equations: Newton-Raphson's method.

Unit-III

Linear System of Equations: Gauss elimination method and Gauss Jordan method. Eigenvalue Problem: Power Method.

Interpolation: Interpolation with Unevenly Spaced Points: Lagrange Interpolation, Newton's Divided Difference Interpolation; Interpolation with Evenly Spaced Points: Newton's Forward Difference Interpolation Formula, Newton's Backward Difference Interpolation Formula, Spline interpolation

Unit-IV

Numerical Differentiation and Integration: Numerical differentiation: Newton's Forward Difference Formula, Newton's Backward Difference Formula, Newton's Divided Difference Formula; Numerical Integration: Trapezoidal rule, Simpson's 1/3-rule and Simpson's 3/8 rule.

Numerical solution of ordinary differential equations (ODEs):
Initial Value Problems of ODEs: Taylor series method, Euler's methods, Runge-Kutta methods and linear multi-step methods (Adams-Bashforth & Adams-Moulton).

Text/Reference Books:

1. Gupta S.C., Kapoor V.K. (2014), Fundamentals of Mathematical Statistics, Sultan Chand & Sons, Delhi.
2. Jain M. K., Iyengar S. R. K, Jain R. K. (2007), Numerical methods for Scientific and Engineering Computation, New Age International Publishers, New Delhi.
3. Sastry S. S. (2012), Introductory Methods of Numerical Analysis, Prentice Hall of India, Delhi.

BTAE503-18 AUTOMOTIVE PETROL AND DIESEL ENGINES

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit Points
3	0	0	3	40	60	100	03

Detailed Contents:

Fundamentals Engine terminology, classification. Working principle of two stroke and four stroke engine, scavenging, scavenging processes. Thermodynamic cycles for automobile engine- Air standard cycle, Otto cycle, Diesel cycle, Dual cycle, Comparison between different cycles, Valve timing diagram for engine under different conditions, Firing order, Factors affecting on selection of firing order, Square Engine, Wankel engine, Engine Mountings.

Constructional Details Cylinder block, Engine cylinder, Cylinder liner, Cylinder Head and cover, Piston for C.I. and S.I. engine, Piston rings, Piston pin, Connecting rod, Crank shaft, Main bearings, Cam shaft, Oil pan, Engine mountings and Engine balancing, Vibration Damper, Cam shafts & drives, Inlet and exhaust valves, Valve actuating mechanism including variable control system, Air cleaner, Manifold & gasket – intake and exhaust, silencer, tail pipe.

Combustion in S.I. Engine Ignition limits, Stages of combustion in petrol engine, Ignition lag, Effect of engine variables on ignition lag, Effect of engine variables on flame propagation, Abnormal combustion, Detonation, Effects of detonation, Theories of detonation, Effects of engine variables on knock, Control of knock. Surface ignition, Pre ignition, Post ignition, S.I. engine combustion chamber design, Types of combustion chambers for S.I. engine, Very high output combustion chamber engines

Combustion in C.I. Engine Air fuel ratio in C.I. engine, Stages of combustion in C.I. engine, Delay period, Variables affecting on delay period, Diesel knock, Methods of controlling diesel knock, C.I. engine combustion chamber, Direct injection type, Open type, Turbulent type, Pre chamber, M combustion chamber, Cold starting of C.I. engine- decompression devices, heater plug, inlet manifold heater, Chemical spray

Petrol Engine Fuel Supply System Methods of fuel supply system- gravity system, pressure system, Vacuum system, pump system, Components of fuel supply system –Fuel tank, fuel pump (Mechanical and Electrical) Vapor return line, Air cleaner, Fuel filters, Carburetion, Functions of carburetor, simple carburetor, Limitations of simple carburetor, Types of Carburetor-Solex and SU carburetor, Special features of modern carburetor. Benefits of electronic fuel injection system.

Diesel Engine Fuel Supply System Comparison of diesel engine with petrol engine, Requirements of diesel injection system, Fuel feed pump, Types of injection system, fuel injection pump, and fuel injectors. Fuel filter, air cleaner, Phasing and calibration of fuel injection pump, Injector Testing (pressure test, leak test) Electronic control of fuel injection system

Engine Friction, Lubrication and Lubricants Total engine friction, Effects of engine variables on engine friction, Lubrication- Objectives of lubrication, Lubricants used, Requirements & selection of lubricants, Viscosity rating, Multi grade oil, Additives used in lubricant, Effects of engine variables on lubricating oil, Oil consumption, Different parts of engine to be lubricated, Types of lubrication system- petrol system, Wet sump method, Dry sump method, fully and partially pressurized lubrication system, Components of lubrication system-oil strainer, Oil filter and its types.

Engine Cooling System: Distribution of heat supplied to engine, Necessity of engine cooling, Piston and engine Cylinder temperatures, Factors affecting on piston temperature, Types of cooling system, Air cooling system, Water cooling system, Thermosyphon cooling, Cooling with thermostatic regulator. Components of water cooling system-Radiator, Pressure Cap, Expansion Reservoir, Coolants, Thermostat, Water Pump, Viscous coupling, Comparison between water cooling and air cooling. Effects of over and under cooling.

Supercharging Objects of supercharging, Relative power with and without supercharging, Supercharging of spark ignition engine, Supercharging of C.I. engine, Effects of supercharging on performance of engine, Supercharging limits for S.I. and C.I. engine, Methods of super charging, Supercharges, Turbo charging, Comparison with supercharging, Methods of turbo charging, Limitations of turbo charging**.**

Performance Testing of Engine Losses in the engine, Performance parameters, Performance curves, Methods of improving performance of engine, Testing of engine, Classification of testing, Basic measurement- Speed, Fuel consumption, Air consumption, Mean effective pressure, Brake power, Indicated power, Frictional power (with different methods), Mechanical efficiency, Thermal efficiency, volumetric efficiency, Heat balance sheet, Engine analyser.

Modern technologies in I.C. engines: HCCI Engines – construction and working, CRDi injection system, GDI

Technology, E - Turbocharger, Variable compression ratio engines, variable valve timing technology, Hybrid vehicle Technology

Suggested Readings/Books:

1. Ganesan.V., “Internal Combustion Engines ", Tata-McGraw Hill.
2. Ramalingam K.K., "Internal Combustion Engines Theory and Practice", Scitech Publications (India).
3. Gupta H.N., “Fundamentals of Internal Combustion Engines”, PHI Learning.
4. Willard W. Pulkrabek, “Engineering fundamentals of the Internal combustion engine”, Pearson Prentice Hall.
5. Maleev.V.M., “Diesel Engine Operation and Maintenance ", McGraw Hill.
6. William H. Crouse, “Automotive Engines ", McGraw Hill.
7. Hua Zhao, “HCCI and CAI engines for the automotive industry”, Woodhead Publishing

BTAE504-18 VEHICLE BODY ENGINEERING

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit Points
4	0	0	4	40	60	100	4

Detailed Contents:

Introduction: Classification of automobiles on different basis, Types of vehicle bodies, requirements of automobile body, constructional details.

Car body details: Types: Saloon, hatchback, convertibles, Limousine, Estate Van, racing and sports car, etc. Car body construction types – frame and unitary (monocoque), various body panels and their constructional details

Bus body details: Types: Mini bus, single and double Decker, split level and articulated bus, Bus body lay out, Floor height, Engine location, Entrance and exit location, Seating dimensions, Constructional details: Frame construction, Double skin construction, Types of metal section used, Regulations, Conventional and integral type construction.

Commercial vehicle details: Types of commercial vehicles. Commercial vehicle body details, flat platform, drop side, fixed side, tipper body, tanker body, tractor trailer.

Body loads: Idealized structure, structural surface, shear panel method, symmetric and asymmetric vertical loads in a car, longitudinal load, and different loading situations.

Body materials, trim and mechanisms: Carbon fibers, plastics, timber, GRP; ferrous and non-ferrous materials used in vehicle. Corrosion and anticorrosion method. Paint and painting process, Corrosion, Anticorrosion methods, Body trim items, Body mechanisms.

Special Purpose vehicle details: Various types, Needs and constructional details - Fire station vehicle, tankers, pumping vehicles, ladder vehicle, Concrete mixer transport vehicles; Ambulance, Towing vehicle, Road trains, Off road vehicles, cement trucks.

Safety in vehicle design: Basics of impacts protection, design for crashworthiness, front impact and side impact analysis, bumper system, energy absorbent forms. Indian Motor acts and its application- The motors vehicle acts 1988, Driving license, Registration of vehicles, Rules of the road, Motor Insurance.

Suggested Readings/Books:

1. J Powloski, “Vehicle Body Engineering”, Business Books Ltd., London.
2. Kirpal Singh, “Automobile Engineering Vol-1”, Standard Publishers distributors
3. Braithwaite J.B., “Vehicle Body building and drawing ", Heinemann Educational Books Ltd., London.
4. Sydney F. Page “Body Engineering” Chapman & Hill Ltd., London,
5. John Fenton, “Handbook of Automotive Body and Systems Design”, Wiley.
6. Heinz Hezler “Advance vehicle Technology”

BTAE505-18 AUTOMOTIVE CHASSIS SYSTEMS LAB

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
0	0	2	2	30	20	50	1

List of Experiments:

1. Study of layout of a chassis and its different components, of a vehicle.
2. Trouble shooting in different types of steering systems mechanical and power and various steering linkages.
3. Measurement of steering geometry angles – Wheel Alignment.
4. Study of impact of steering geometry angles on vehicle
5. Study of different types of wheels (rims) and tires and their defects
6. Conducting Wheel balancing of a given wheel assy.
7. Trouble shooting in Propeller Shafts and Drive shafts including constant velocity joints.
8. Trouble shooting in different types of dead axles (front or rear)
9. Trouble shooting in different types of live axles and Differential systems.
10. Trouble shooting in suspensions of following types:

a) Leaf Spring

b) Double Wishbone with Torsion Bar or Coil Spring

c) McPherson Strut Type

d) Five Bar Link type

e) Air Suspension system

f) A shock absorber (damper)

Trouble shooting in braking system in master and wheel cylinder, drum and disc brakes, overhauling and adjusting of system and its testing on brake tester

BTAE506-18 NUMERICAL METHODS LAB

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
0	0	2	2	30	20	50	1

List of Experiments:

1. Make a program of bisection method for solving algebraic/transcendental equations and implement it on some problems.
2. Develop a program of Newton-Raphson's method for solving algebraic/transcendental equations and implement it on some problems.
3. Develop and implement a program of Method of False Position for solving algebraic/transcendental equations.
4. Develop and implement a program of Gauss-elimination method for solving a system of linear equations.
5. Develop and implement a program of trapezoidal rule to approximate a definite integral.
6. Develop and implement a program of Simpson's rule to approximate a definite integral.
7. Develop and implement a program of Euler's method for solving initial value problems of ordinary differential equations.
8. Develop and implement a program of fourth order Runge-Kutta method for solving initial value problems of ordinary differential equations.
9. Develop and implement a program of two-step Adams-Bashforth method for solving initial value problems of ordinary differential equations.
10. Develop and implement a program of two-step Adams-Moulton method for solving initial value problems of ordinary differential equations.

Note. Use any programming language/computer algebra system to develop and implement the following programs.

BTAE507-18 VEHICLE BODY ENGINEERING LAB

L	T	P	Total	Internal (Maximum Marks)	External (Maximum Marks)	Total Marks	Credit points
0	0	2	2	30	20	50	1

List of Experiments:

1. Study of typical car body construction and propose new design sketches.
2. Study driver's seat position, passenger seat position, its requirement and construction of typical truck/bus body and propose new design sketches.
3. To prepare the analysis of the vehicle body weight and the weight distribution in different conditions and its effect on tractive performance.
4. Measurement of drag, lift force of a scaled model in wind tunnel
5. Study the anti-corrosion and body painting and repainting procedures.
6. Study the construction of a special purpose vehicle.
7. To prepare the analysis of the vehicle body weight and the weight distribution in different conditions and its effect on steering performance.