Dr. Babasaheb Ambedkar Technological University

(Established as a University of Technology in the State of Maharashtra)

(under Maharashtra Act No. XXIX of 2014)

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Course Contents for

B. Tech. in Automobile Engineering

w.e.f. June 2018

From 3rd Semester - 8th Semester

Vision

The vision of the Department is to achieve excellence in teaching, learning, research and transfer of technology for the overall development of students.

Mission

Imparting quality education, looking after holistic development of students, and conducting need-based research and extension activities.

Graduate Attributes

The Graduate Attributes are the knowledge skills and attitudes which the students have at the time of graduation. These Graduate Attributes identified by National Board of Accreditation are as follows:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to

engage in independent and life-long learning in the broadest context of technological change.

Program Educational Objectives

PEO1	Graduates should excel in engineering positions in industry and other organizations that emphasize design and implementation of engineering systems and devices.
PEO2	Graduates should excel in best post-graduate engineering institutes, reaching advanced degrees in engineering and related discipline.
PEO3	Within several years from graduation, alumni should have established a successful career in an engineering-related multidisciplinary field, leading or participating effectively in interdisciplinary engineering projects, as well as continuously adapting to changing technologies.
PEO4	Graduates are expected to continue personal development through professional study and self-learning.
PEO5	Graduates are expected to be good citizens and cultured human beings, with full appreciation of the importance of professional, ethical and societal responsibilities.

Program Outcomes

At the end of the program the student will be able to:

PO1	Apply knowledge of mathematics, science and engineering to analyze, design and evaluate mechanical components and systems using state-of-the-art IT tools.
PO2	Analyze problems of automobile engineering including thermal, manufacturing and industrial systems to formulate design requirements.
PO3	Design, implement and evaluate automobile systems considering public health, safety, cultural, societal and environmental issues.
PO4	Design and conduct experiments using domain knowledge and analyze data to arrive at valid conclusions.
PO5	Apply current techniques, skills, knowledge and computer based methods and tools to develop mechanical systems.
PO6	Analyze the local and global impact of modern technologies on individual organizations, society and culture.
PO7	Apply knowledge of contemporary issues to investigate and solve problems with a concern for sustainability and eco-friendly environment.
PO8	Exhibit responsibility in professional, ethical, legal, security and social issues.
PO9	Function effectively in teams, in diverse and multidisciplinary areas to accomplish common goals.
PO10	Communicate effectively in diverse groups and exhibit leadership qualities.
PO11	Apply management principles to manage projects in multidisciplinary environment.
PO12	Pursue life-long learning as a means to enhance knowledge and skills.

Abbreviations

PEO:	Program Educational Objectives
PO:	Program Outcomes
CO:	Course Outcomes
L:	No. of Lecture hours (per week)
T:	No. of Tutorial hours (per week)
P:	No. of Practical hours (per week)
C:	Total number of credits
BSH:	Basic Science and Humanity
BSC:	Basic Sciences Course
PCC:	Professional Core Course
OEC:	Open Elective Course
PEC:	Professional Elective Course
BHC:	Basic Humanity Course
ESC:	Engineering Science Course
HSMC:	Humanity Science and Management Course
NCC:	National Cadet Corps
NSS:	National Service Scheme
CA:	Continuous Assessment
MSE:	Mid Semester Exam
ESE:	End Semester Exam

B. Tech. Automobile Engineering

Course Structure for Semester III [Second Year] w.e.f. 2018-2019

Course Code	Type of Course	Course Title	Weekly Teaching Scheme			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
BTBSC301	BSC 7	Engineering Mathematics-III	3	1	--	20	20	60	100	4
BTMEC302	ESC 11	Material Science and Metallurgy	3	1	--	20	20	60	100	4
BTAMC303	PCC 1	Fluid Mechanics and Machines	3	1	--	20	20	60	100	4
BTAMC304	PCC 2	Automotive Component Drawing and Computer Aided Drafting	2	--	--	20	20	60	100	2
BTPRC305	PCC 3	Theory of Machine	2	1	--	20	20	60	100	3
BTHM3401	HSMC 3	Basic Human Rights	2	--	--	50	--	--	50	Audit (AU/ NP)
BTAML307	ESC 12	Material Science and Metallurgy Lab	--	--	2	60	--	40	100	1
BTAML308	PCC 4	Fluid Mechanics and Machines Lab	--	--	2	60	--	40	100	1
BTAML309	PCC5	Automotive Component Drawing and Computer Aided Drafting Lab	--	--	4	60	--	40	100	2
BTAML310	PCC 6	Theory of Machine Lab	--	--	2	60	--	40	100	1
BTAMF311	Project 1	Field Training /Internship/Industrial Training I	--	--	--	--	--	50	50	1
		Total	15	4	10	380	100	420	900	23

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Course Structure for Semester IV [Second Year] w.e.f. 2018-2019

Course Code	Type of Course	Course Title	Weekly Teaching Scheme			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
BTAMC401	PCC 7	Theory of Automotive Engines	3	1	--	20	20	60	100	4
BTAMC402	PCC 8	Engineering Thermodynamics	3	1	--	20	20	60	100	4
BTMEC403	PCC 9	Strength of Materials	3	1	--	20	20	60	100	4
BTMEC404	BSC 8	Numerical Methods in Automobile Engineering	2	1	--	20	20	60	100	3
BTID405	PCC 10	Product Design Engineering	2	--	--	20	20	60	100	2
BTBSE406A	OEC 1	Physics of Engineering Materials	3	--	--	20	20	60	100	3
BTBSE3405A		Advanced Engineering Chemistry								
BTHM3402		Interpersonal Communication Skill & Self Development								
BTAML407	PCC 11	Theory of Automotive Engines Lab	--	--	2	60	--	40	100	1
BTAML408	PCC 12	Engineering Thermodynamics Lab	--	--	2	60	--	40	100	1
BTAML409	PCC 13	Strength of Materials Lab	--	--	2	60	--	40	100	1
BTAML410	BSC 9	Numerical Methods Lab	--	--	2	60	--	40	100	1
		Total	16	4	8	360	120	520	1000	24
Minimum 4 weeks training which can be completed partially in third and fourth semester or in at one time.										

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Course Structure for Semester V [Third Year] w.e.f. 2019-2020

Course Code	Type of Course	Course Title	Weekly Teaching Scheme			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
BTAMC 501	PCC 14	Design of Machine Element	3	1	--	20	20	60	100	4
BTAMC502	PCC 15	Automotive Transmission System	3	1	--	20	20	60	100	4
BTAMC503	PCC 16	Automotive Chassis and Suspension	2	1	--	20	20	60	100	3
BTAMC504	PCC 17	Manufacturing Processes	2	1	--	20	20	60	100	3
BTAMC505A	PEC 1	Mechanical Measurement	3	--	--	20	20	60	100	3
BTAMC505B		Sustainable Development								
BTAMC505C		Automotive Materials								
BTAMC506A	OEC 2	Knowledge Management	3	--	--	20	20	60	100	3
BTAMC506B		Nanotechnology								
BTAMC506C		Energy Conservation and Management								
BTAML507	PCC 18	Design of Machine Element Lab	--	--	2	60	--	40	100	1
BTAML508	PCC 19	Automotive Transmission System Lab	--	--	2	60	--	40	100	1
BTAML509	PCC 20	Automotive Chassis and Suspension Lab	--	--	2	60	--	40	100	1
BTAMF510	Project 2	Field Training /Internship/Industrial Training II	--	--	--	--	--	50	50	1
		Total	16	4	6	300	120	530	950	24

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Course Structure for Semester VI [Third Year] w.e.f. 2019-2020

Course Code	Type of Course	Course Title	Weekly Teaching Scheme			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
BTAMC601	PCC 21	Heat Transfer	3	1	--	20	20	60	100	4
BTAMC602	PCC 22	Automobile Electricals and Electronics	2	1	--	20	20	60	100	3
BTAMC603	PCC 23	Vehicle Dynamics	2	1	--	20	20	60	100	3
BTAMC604A	PEC 2	Entrepreneurship Developments	2	1	--	20	20	60	100	3
BTAMC604B		Quantitative Techniques in Project Management								
BTAMC604C		Alternative Fuels for IC Engines								
BTAMC605A	OEC 3	Biology for Engineers	3	--	--	20	20	60	100	3
BTAMC605B		Intellectual Property Rights								
BTAMC605C		Renewable Energy Sources								
BTAMC606A	OEC 4	Solar Energy	3	--	--	20	20	60	100	3
BTAMC606B		Wind Energy								
BTAMC606C		Human Resource Management								
BTAML607	PCC 24	Heat Transfer Lab	--	--	2	60	--	40	100	1
BTAML608	PCC 25	Automobile Electricals and Electronics Lab	--	--	2	60	--	40	100	1
BTAMM609	Project 3	Technical Project for Community Services	--	--	4	50	--	50	100	2
		Total	15	4	8	290	120	490	900	23

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Course Structure for Semester VII [Fourth Year] w.e.f. 2020-2021

Course Code	Type of Course	Course Title	Weekly Teaching Scheme			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
BTAMC701	PCC 26	Automobile Air Conditioning	2	1	--	20	20	60	100	3
BTAMC702	PCC 27	Vehicle Performance and Testing	2	1	--	20	20	60	100	3
BTAMC703	PCC 28	Automotive Emission and Control	2	1	--	20	20	60	100	3
BTAMC704A	PEC 3	Computer Integrated Manufacturing Systems	2	1	--	20	20	60	100	3
BTAMC704B		Finite Element Method and its Applications								
BTAMC704C		Computer Simulation of IC Engine Processes								
BTAMC705A	OEC 5	Design of Experiments	2	1	--	20	20	60	100	3
BTAMC705B		Plant Maintenance								
BTAMC705C		Manufacturing Automation								
BTAML706	PCC 29	Automobile Air Conditioning Lab	--	--	2	60	--	40	100	1
BTAML707	PCC 30	Vehicle Maintenance Management Lab	--	--	2	60	--	40	100	1
BTAML708	PCC 31	Vehicle Performance and Testing Lab	--	--	2	60	--	40	100	1
BTAMS709	Project 4	Seminar	--	--	2	50	--	50	100	1
BTAMF710	Project 5	Field Training /Internship/Industrial Training III	--	--	--	--	--	50	50	1
BTAMP711	Project 6	Project Stage-I**	--	--	6	50	--	50	100	3
		Total	10	5	14	380	100	570	1050	23

***In case of students opting for Internship in the eighth semester, the Project must be industry-based*

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Course Structure for Semester VIII [Fourth Year] w.e.f. 2020-2021

Course Code	Type of Course	Course Title	Weekly Teaching Scheme			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
BTAMC801A	PEC 4	Transport Management	2	1	--	20	20	60	100	3
BTAMC801B		Automobile Tribology								
BTAMC801C		Robotics								
BTAMC802A	PEC 5	Product Life Cycle Management (PLM)	2	1	--	20	20	60	100	3
BTAMC802B		Fundamentals of Computational Fluid Dynamics								
BTAMC802C		Ergonomics in Automotive Design								
BTAMC803A	PEC 6	Vehicle Aerodynamics	2	1	--	20	20	60	100	3
BTAMC803B		Virtual Reality								
BTAMC803C		Noise and Vibration								
BTAMC804A	PEC 7	Actuation System	2	1	--	20	20	60	100	3
BTAMC804B		Electric and Hybrid Vehicles								
BTAMC804C		Tractor and Farm Equipment								
BTAMC805A	PEC 8	Operation Research	2	1	--	20	20	60	100	3
BTAMC805B		Motor Insurance Practices								
BTAMC805C		Special Purpose Vehicle								
BTAMP806	Project 7	Project Stage-II	--	--	12	50	--	50	100	6
		Total	10	5	12	150	100	350	600	21

** In lieu of the Electives, Six months Internship in the industry including project*

Semester III

Engineering Mathematics-III

BTBSC301	Engineering Mathematics-III	BSC 7	3L-1T-0P	4 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week Tutorial: 1hr/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks(Duration 03 hrs)

Pre-Requisites: None

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

CO1	
CO2	
CO3	
CO4	
CO5	
CO6	
CO7	
CO8	

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												
CO7												
CO8												

Course Contents:

Unit 1: Laplace Transform [07 Hours]

Definition – conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives ; Evaluation of integrals by using Laplace transform ;

Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.

Unit 2: Inverse Laplace Transform [07 Hours]

Introductory remarks ; Inverse transforms of some elementary functions ; General methods of finding inverse transforms ; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms ; Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.

Unit 3: Fourier Transform [07 Hours]

Definitions – integral transforms ; Fourier integral theorem (without proof) ; Fourier sine and cosine integrals ; Complex form of Fourier integrals ; Fourier sine and cosine transforms ; Properties of Fourier transforms ; Parseval's identity for Fourier Transforms.

Unit 4: Partial Differential Equations and Their Applications [07 Hours]

Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation $\left(\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}\right)$, and two dimensional heat flow equation (i.e. Laplace equation : $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$).

Unit 5: Functions of Complex Variables (Differential calculus) [07 Hours]

Limit and continuity of f(z); Derivative of f(z) ; Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Mapping: Translation, magnification and rotation, inversion and reflection , bilinear transformation; Conformal mapping.

Unit 6: Functions of Complex Variables (Integral calculus)[07 Hours]

Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without proofs).

Text Books:

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.
2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.
3. A Course in Engineering Mathematics (Vol III) by Dr. B. B. Singh, Synergy Knowledge ware, Mumbai.
4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
5. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.

Reference Books:

1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.
2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd., Singapore.

3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.
4. Integral Transforms and Their Engineering Applications by Dr. B. B. Singh, Synergy. Knowledge ware, Mumbai.
5. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, New York.

General Instructions:

1. The tutorial classes in Engineering Mathematics-III are to be conducted batchwise. Each class should be divided into three batches for the purpose.
2. The Continuous Assessment of the students for 20 marks will be done based on assignments, surprise tests, quizzes, innovative approach to problem solving and percentage attendance.
3. The minimum number of assignments should be eight covering all topics.

Material Science and Metallurgy

BTMEC302	Material Science and Metallurgy	ESC 11	3L-1T-0P	4 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week Tutorial: 1hr/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs)

Pre-Requisites: None

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

CO1	Study various crystal structures of materials
CO2	Understand mechanical properties of materials and calculations of same using appropriate equations
CO3	Evaluate phase diagrams of various materials
CO4	Suggest appropriate heat treatment process for a given application
CO5	Prepare samples of different materials for metallography
CO6	Recommend appropriate NDT technique for a given application

Mapping of course outcomes with program outcomes

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

CO5	1	1	1	3	2		1		1			
CO6	1	1	2	2	2	1	2		1	1		

Course Contents:

Unit 1: Structure of Materials [08 Hours]

Crystal structures, indexing of lattice planes, Indexing of lattice directions, Imperfections in crystals - point defects, line defects, surface and bulk defects, Mechanism of plastic deformation, deformation of single crystal by slip, plastic deformation of polycrystalline materials

Unit 2: Mechanical Properties and their Testing [08 Hours]

Tensile test, engineering stress-strain curve, true stress-strain curve, types of stress-strain curves, compression test, bend test, torsion test, formability, hardness testing, different hardness tests- Vickers, Rockwell, Brinnel, Impact test. Fatigue test, creep test

Unit 3: Equilibrium Diagrams [09 Hours]

Definitions of terms, rules of solid –solubility, Gibb‘s phase rule, solidification of a pure metal, plotting of equilibrium diagrams, lever rule, Iron-iron carbide equilibrium diagram, critical temperatures, solidification and microstructure of slowly cooled steels, non-equilibrium cooling of steels, property variation with microstructures, classification and application of steels,, specification of steels, transformation products of austenite, TTT diagram, critical cooling rate, CCT diagram

Unit 4: Heat Treatment [07 Hours]

Heat treatment of steels, cooling media, annealing processes, normalizing, hardening, tempering, quenching and hardenability, surface hardening processes- nitriding, carbonitriding, flame hardening, induction hardening

Unit 5: Metallography [08 Hours]

Microscopy, specimen preparation, polishing abrasives and cloths, specimen mounting, electrolytic polishing, etching procedure and reagents, electrolytic etching, optical metallurgical microscope, macroscopy, sulphur printing, flow line observations, examination of fractures, spark test, electron microscope

Unit 6: Strengthening Mechanisms and Non-destructive Testing [08 Hours]

Refinement of grain size, cold working/strain hardening, solid solution strengthening, dispersion strengthening, Precipitation hardening

Magnetic particle inspection, dye penetrant inspection, ultrasonic inspection, radiography, eddy current testing, acoustic emission inspection.

Texts:

1. V. D. Kodgire and S.V. Kodgire, ―Material Science and Metallurgy for Engineers, Everest Publishing House, Pune, 24th edition, 2008.
2. W. D. Callister, Jr., ―Materials Science and Engineering: An Introduction‖, John Wiley and Sons, 5 th edition, 2001.
3. V. Raghvan, ―Material Science Engineering‖, Prentice Hall of India Ltd., 1992.

4. S. H. Avner, ―Introduction to Physical Metallurgy‖, Tata McGraw-Hill, 2nd edition, 1997.
5. R. A. Higgins, ―Engineering Metallurgy: Part I‖, ELBS, 6th edition, 1996.

References:

1. V. B. John, ―Introduction to Engineering Materials‖, ELBS, 6th edition, 2001.
2. G. F. Carter and D. E. Paul, ―Materials Science and Engineering‖, ASM International, 3rd edition, 2000.
3. T. E. Reed-Hill and R. Abbaschian, ―Physical Metallurgy Principles‖, Thomson, 3rd edition, 2003.

Fluid Mechanics and Machines

BTAMC303	Fluid Mechanics and Machines	PCC 1	3L-1T-0P	4 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week Tutorial: 1hr/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs)

Pre-Requisites: None

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

CO1	Define fluid, define and calculate various properties of fluid
CO2	Calculate hydrostatic forces on the plane and curved surfaces and explain stability of floating bodies
CO3	Explain various types of flow. Calculate acceleration of fluid particles
CO4	Apply Bernoulli's equation and Navier-Stokes equation to simple problems in fluid mechanics
CO5	Explain laminar and turbulent flows on flat plates and through pipes
CO6	Explain and use dimensional analysis to simple problems in fluid mechanics
CO7	Understand boundary layer, drag and lift
CO8	Evaluation of performance of compressors/turbines/pumps.

Mapping of course outcomes with program outcomes

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

CO7	2											
CO8	2	1										

Course Contents:

Unit 1: Basics [08 Hours]

Definition of fluid, fluid properties such as viscosity, vapour pressure, compressibility, surface tension, capillarity, Mach number etc., pressure at a point in the static mass of fluid, variation of pressure, Pascal‘s law, pressure measurement by simple and differential manometers using manometric expression.

Fluid Statics: Hydrostatic forces on the plane and curved surfaces, centre of pressure, Buoyancy, centre of buoyancy, stability of floating bodies, metacentre and meta centric height its application in shipping.

Unit 2: Fluid Kinematics [08 Hours]

Velocity of fluid particle, types of fluid flow, description of flow, continuity equation, Coordinate freeform, acceleration of fluid particle, rotational & irrotational flow, Laplace‘ equation in velocity potential and Poisson‘s equation in stream function, flow net.

Unit3: Fluid Dynamics [08 Hours]

Momentum equation, development of Euler‘s equation, Introduction to Navier-Stokes equation, Integration of Euler‘s equation to obtain Bernoulli‘s equation, Bernoulli‘s theorem, Application of Bernoulli‘s, venture meter, orifice meter, rectangular and triangular notch, pitot tube, orifices etc.

Unit 4: Types of Flow [08 Hours]

a) Laminar Flow: Flow through circular pipe, between parallel plates, Power absorbed in viscous flow in bearings, loss of head due to friction in viscous flow.

b) Turbulent Flow: Reynolds‘s experiment, frictional loss in pipe flow, shear stress in turbulent flow, major and minor losses, HGL and TEL, flow through series and parallel pipes.

Unit 5: Dimensional Analysis [08 Hours]

a) Dimensional Analysis: Dimensional homogeneity, Raleigh‘s method, Buckingham‘s

theorem, Model analysis, similarity laws and dimension less numbers.

b) Introduction to boundary layer theory and its analysis.

c) Forces on Submerged bodies: Drag, lift, Drag on cylinder, Development of lift in cylinder, Problems on submerged body.

Unit 6: Introduction to Fluid Machinery [08 Hours]

Principles of operations of centrifugal and axial pumps. Turbo blowers and turbines. Principles and working of gear, vane and reciprocating pumps.

Texts:

1. Modi and Seth, Fluid Mechanics and Hydraulic Machinery‖, Standard Book House, 10th edition, 1991.
2. Robert W. Fox and Alan T. McDonald, Introduction to Fluid Mechanics‖, John Wiley and Sons, 5th edition.

References:

1. V.L. Streeter, K. W. Bedford and E. B. Wylie, ―Fluid Dynamics‖, Tata McGraw-Hill, 9th edition, 1998.
2. S. K. Somand G. Biswas, ― Introduction to Fluid Mechanics and Fluid Machines, TataMcGraw-Hill, 2nd edition, 2003.

Automotive Component Drawing & Computer Aided Drafting

BTAMC304	Automotive Component Drawing & Computer Aided Drafting	PCC 2	2L-0T-0P	2 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 2 hrs/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs)

Pre-Requisites: None

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

CO1	Interpret the object with the help of given sectional and orthographic views.
CO2	Construct the curve of intersection of two solids
CO3	Draw machine element using keys, cotter, knuckle, bolted and welded joint
CO4	Assemble details of any given part. i. e. valve, pump, machine tool part etc.
CO5	Represent tolerances and level of surface finish on production drawings
CO6	Understand various creating and editing commands in Auto Cad

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	2								3	2		1
CO2	2	1							2	1		1
CO3	2								2	1		
CO4	2	2			1				2	1		1
CO5	1	1			1				2	1		1
CO6	1	1			1				2	2		1

Course Contents:

Unit 1: Sectional Views [04 Hours]

Full section, half section, partial section, off-set section, revolved sections, removed sections, auxiliary section, guidelines for hatching, examples on all above types of sections of machine elements.

Unit 2: Study of Machine Elements[04 Hours]

Study of simple machine elements and components such as screwed fasteners, shaftcouplings, pipe joints, riveted and welded joints, bearings, gears, etc.

Unit 3: Interpenetration of surfaces (emphasis on applied cases) [04 Hours]

Line or curve of intersection of two penetrating cylinders, Cone and cylinder, prism and a cylinder, cone and prism, Forged ends, etc.

Unit 4: Drawing of Assembly and Details [04 Hours]

Part drawing of standard machine components such as valves, components of various machine tools, pumps, shaft couplings, joints, pipe fittings, engine parts, etc.

Unit 5: Production Drawing[04 Hours]

Types of production drawings, size, shape and description; limits, fits and tolerances, surface roughness and surface roughness symbols,

Unit 6: Computer Aided Drafting [04 Hours]

Introduction to Computer Aided Design and Drafting, Advantaged of CADD, study of preliminary AutoCAD commands like drawing, dimensioning, viewing commands.Drawing3D views in AutoCAD, Introduction to Auto LISP programming.

Texts:

1. N.D. Bhatt, Panchal, ―Engineering Drawing‖, Charotar Publishing House, Anand, India.
2. N.D. Bhatt, Panchal, ―Machine Drawing‖, Charotar Publishing House, Anand, India
3. Ajeet Sing, ―WorkingwithAutoCAD2000‖, Tata McGraw Hill, New Delhi.
4. George Omura, ―ABC of Autolisp‖, BPB Publications, New Delhi.

References:

1. Narayana, Kannaiah, Reddy, ―Machine Drawing‖, New Age International Publishers.
2. AutoCAD and AutoLISP manuals from Autodesk Corp. U.S.A.
3. ISCode: SP46-1988, Standard Drawing Practices for Engineering Institutes.

Theory of Machines

BTPRC305	Theory of Machines	PCC 3	2L-1T-0P	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 2 hrs/week Tutorial: 1hr/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs)

Pre-Requisites: Applied Mechanics and Engineering Graphics

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

CO1	Select appropriate mechanism to design and develop a machine for an application
CO2	Analyze the mechanisms to determine velocity and acceleration of various links of the mechanism
CO3	Design and draw profile of the cam to obtain specified follower motion for an application
CO4	Analyze the governor to determine its height for the corresponding change in speed and sleeve displacement
CO5	Explain lower pair mechanisms and select them to meet the need where they are suitable
CO6	Explain and apply friction concepts in automotive and mechanical applications.

Mapping of course outcomes with program outcomes

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

Course Contents:

Unit 1 [06 Hours]
Definition of link, pair, kinematics chain, inversions, inversions of single and double slider crank chain, kinematic diagrams of mechanisms, equivalent linkage of mechanism, degree of freedom, Study of various mechanisms, Steering system & mechanism, suspension.

Unit 2 [06 Hours]
Velocity and acceleration analysis and its purpose, velocity and acceleration diagrams using relative velocity method, Corioli's component of acceleration
Classification of gears, Terminology of spur gears, Conjugate action, Involute and cycloidal profile.

Unit 3 [06 Hours]
Path of contact, contact ratio, Interference, Undercutting, Internal gears.
Helical gear terminology, Normal and transverse module, Torque transmitted by helical gears, Spiral gears, Efficiency of spiral gears, Worm and Bevel gear terminology.
Gear Trains: Velocity ratios, Types of gear trains, Tooth load, Torque transmitted and holding torque.

Unit 4 [06 Hours]
Cams and Followers: Types of cams and followers, Analysis of motion, Jump and ramp of cam, Determination of cam profiles for a given follower motion
Flywheel: Turning moment diagram, Fluctuation of energy and speed, Determination of flywheel size for different types of prime movers and machines.

Unit 5 [06 Hours]
Friction and Lubrication: Dry friction, friction between nut and screw with different types of threads, Uniform wear theory and uniform pressure theory, Frication at pivot and collars, Friction in turning pair,
Lubrication, Viscosity, Viscous flow, Boundary lubrication, Thick film lubrication, Hydrostatic and hydrodynamic lubrications.
Friction Clutches: Single plate and multiplate clutch, Cone clutch, Centrifugal clutch, Torque transmitting capacity, Clutch operating mechanism.

Unit 6 [06 Hours]
Brakes: Shoe brake, Internal and external shoe brakes, Block brakes, Band brakes, Band and block brakes, Braking torque.
Belt and Rope Drives: Flat belts, Effect of slip, Centrifugal tension, Crowing of pulley, Initial tension in belts. V- Belts

Text Books:

1. A. Ghosh and, A.K. Malik, "Theory of Mechanisms and Machines", Affiliated East-West Press Pvt. Ltd., New Delhi.
2. S. S. Rattan, "Theory of Machines", Tata-McGraw Hill, New Delhi.

Reference Books:

1. Thomas Beven, "Theory of Machines", CBS Publishers and Distributors", Delhi.
2. J.E. Shigely and J.J. Uicker, "Theory of Machines and Mechanisms", McGraw Hill, New York, International Student Edition,1995

Basic Human Rights

BTHM3401	Basic Human Rights	HSMC 3	2L-0T-0P	Audit

Teaching Scheme:	**Examination Scheme:**
Lecture: 2 hrs/week	Audit Course

Pre-Requisites: None

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

CO1	Understand the history of human rights.
CO2	Learn to respect others caste, religion, region and culture.
CO3	Be aware of their rights as Indian citizen.
CO4	Understand the importance of groups and communities in the society.
CO5	Realize the philosophical and cultural basis and historical perspectives of human rights.
CO6	Make them aware of their responsibilities towards the nation.

Mapping of course outcomes with program outcomes

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

Course Contents:

Unit 1: The Basic Concepts [04 Hours]

Individual, group, civil society, state, equality, justice. Human Values, Human rights and Human Duties: Origin, Contribution of American bill of rights, French revolution. Declaration of independence, Rights of citizen, Rights of working and exploited people

Unit 2: Fundamental rights and economic program [04 Hours]

Society, religion, culture, and their inter-relationship. Impact of social structure on human behavior, Social Structure and Social Problems: Social and communal conflicts and social harmony, rural poverty, unemployment, bonded labour.

Unit 3: Workers and Human Rights [04 Hours]
Migrant workers and human rights violations, human rights of mentally and physically challenged. State, Individual liberty, Freedom and democracy.

Unit 4: NGOs and human rights in India [04 Hours]
Land, Water, Forest issues.

Unit 5: Human rights in Indian constitution and law [04 Hours]
i) The constitution of India: Preamble
ii) Fundamental rights.
iii) Directive principles of state policy.
iv) Fundamental duties.
v) Some other provisions.

Unit 6: UDHR and Indian Constitution [04 Hours]
Universal declaration of human rights and provisions of India. Constitution and law. National human rights commission and state human rights commission.

Texts/References:

1. Shastry, T. S. N., "India and Human rights: Reflections", Concept Publishing Company India (P Ltd.), 2005.
2. C.J.Nirmal, "Human Rights in India: Historical, Social and Political Perspectives (Law in India)", Oxford India.

Material Science and Metallurgy Lab

BTAML307	ESC 12	Material Science and Metallurgy Lab	0L-0T-2P	1 Credit

Practical Scheme:	**Examination Scheme:**
Practical: 2 hrs/batch	Continuous Assessment: 60 Marks External Exam: 40 Marks

Pre-Requisites: None

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

CO1	
CO2	
CO3	
CO4	

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												

List of Practicals/Experiments/Assignments (any ten experiments from the list)

1. Brinell Hardness Test
2. Rockwell Hardness test
3. Erichson Cupping Test
4. Magnaflux Test
5. Dye Penetrant Test
6. Specimen Preparation for Microscopy
7. Sulphur Print Test
8. Spark Test
9. Study and drawing of microstructures of plain carbon steels of varying carbon percentage
10. Study and drawing of microstructures of heat treated steels
11. Jominy End Quench Test
12. Study and drawing of microstructures of cast irons
13. Study and drawing of microstructures of non-ferrous alloys
14. Hardening of steels of varying carbon percentage

Fluid Mechanics and Machines Lab

BTAML308	Fluid Mechanics and Machines Lab	PCC 4	0L-0T-2P	1 Credit

Practical Scheme:	**Examination Scheme:**
Practical: 2 hrs/batch	Continuous Assessment: 60 Marks External Exam: 40 Marks

Pre-Requisites: Mathematics, physics and Basic Mechanical Engineering.

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

CO1	Understand laminar and Turbulent flow and determine Critical Reynolds number using Reynolds Apparatus
CO2	Verify Bernoulli's theorem
CO3	Determine pressure drop in flow though pipes and pipe fittings
CO4	Verify momentum equation using impact of jet apparatus
CO5	Determine viscosity using viscometer
CO6	Do calibration of pressure gauges, rotameter
CO7	Use manometers for pressure measurement

Mapping of course outcomes with program outcomes

CourseOutcomes	Program Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	1	1	1	3	1				1	2		1
CO2	1	1	1	3	1				1	2		1
CO3	1	1	1	3	1				1	2		1
CO4	1	1	1	3	1				1	2		1
CO5	1	1	1	3	1				1	2		1
CO6	1	1	1	3	1				1	2		1
CO7	1	1	1	3	1				1	2		1
CO8												

List of Practical's/Experiments/Assignments (any eight)

1. Flow visualization technique: characteristics of laminar and turbulent flow patterns using Helleshaw Apparatus.
2. Verification of Bernoulli's theorem
3. Determination of Critical Reynolds number using Reynolds Apparatus
4. Determinations of pressure drop in pipes of various cross-sections
5. Determinations of pressure drop in pipes of various pipe fittings etc.
6. Viscosity measurement using viscometer (at least one type)
7. Verification of momentum equation using impact of jet apparatus
8. Determination of meta-centric height of a floating body
9. Calibration of a selected flow measuring device and Bourdon pressure gauge
10. Gauge and differential pressure measurements using various types of manometers, Bourdon type pressure gauge. Demonstration of measurement using these instruments.

Automotive Component Drawing & Computer Aided Drafting Lab

BTAML309	Automotive Component Drawing & Computer Aided Drafting Lab	PCC5	0L-0T-4P	2 Credits

Practical Scheme:	**Examination Scheme:**
Practical: 4 hrs/batch	Continuous Assessment: 60 Marks External Exam: 40 Marks

Pre-Requisites: None

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

CO1	Draw Conventional representation of standard machine components, welds, materials etc.
CO2	Draw sectional view of a given machine component.
CO3	Develop Assemble view from details of given component i.e. valve, pump, machine tool part, etc.

CO4	Combine details of given machine component and draw assembled view.
CO5	Use various Auto-Cad commands to draw orthographic projection
CO6	Draw sectional view from pictorial view of given machine component using Auto-Cad

Mapping of course outcomes with program outcomes

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

List of Practical's/Experiments/Assignments:

1. One full imperial drawing sheet consisting the drawing/ sketches of representation of standard components, symbols of pipe joints, weld joints, rivet joint etc., surface finish symbols and grades, limit, fit and tolerance sketches.
2. Two full imperial drawing sheets, one consisting of assembly and the other consisting of details of any one standard component such as valves, components of various machine tools, pumps, joints, engine parts, etc.
3. Two assignments of AutoCAD: Orthographic Projections of any one simple machine component such as bracket, Bearing Housing or Cast component for Engineers such as connecting rod, Piston, etc.; with dimensioning and detailing of three views of components.
4. 3-D model at least one simple machine component

Theory of Machine Lab

BTAML310	Theory of Machine Lab	PCC 6	0L-0T-2P	1 Credit

Practical Scheme:	**Examination Scheme:**
Practical: 2 hrs/batch	Continuous Assessment: 60 Marks External Exam: 40 Marks

Pre-Requisites: Engineering mathematics, Engineering graphics

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

CO1	Comprehend gyroscopic principle and effect of gyroscopic couple.
CO2	Apply balancing methods to balance rotating and reciprocating components
CO3	Identify and analyze vibrations of single degree of freedom systems.
CO4	Plot and interpret the polar diagram based on the experimental readings on Hooks joint.

CO5	Use principles of kinematics and dynamics in operation of various mechanisms and equipment.

Mapping of course outcomes with program outcomes

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

List of Practical's /Experiments/Assignments

1. **Four sheets** (half imperial size)
   Graphical solution of problems on velocity, acceleration in mechanisms by relative velocity method, instantaneous centre of rotation method and Klein's construction. At least one problem containing Coriolis component of acceleration.

2. **Experiments (any2)**
   a) Experimental determination of velocity and acceleration of Hooke's joint.
   b) Determination of displacement of slider-crank mechanism with the help of model and to plot velocity and acceleration curves from it.
   c) Experiment on Coriolis component of acceleration.

3. **Assignment**
   Develop a computer program for velocity and acceleration of slider crank mechanism.

Semester IV

Theory of Automotive Engines

BTAMC401	Theory of Automotive Engines	PCC 7	3L-1T-0P	4 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3hrs/week Tutorial: 1 hr/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks(Duration 03 hrs)

Pre-Requisites: None

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

CO1	Perform a primary thermodynamic analysis of Otto and Diesel cycle.
CO2	Select appropriate engine for specific application.
CO3	Select proper fuel system and subsystemsfor I C Engine. Compare mechanisms for variable valve timing.
CO4	Conduct performance testing of the I C Engine and portray operating characteristics of I C Engines.
CO5	Select proper lubricant and lubrication system for engine
CO6	Understand the latest developments in IC Engines and alternate fuels.

Mapping of course outcomes with program outcomes

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

Course Contents:

Unit 1: Fundamentals of IC Engines [08 Hours]

Nomenclature, engine components, Engine classification, firing order and four stroke cycle engines; fundamental difference between SI and CI engines; valve timing diagrams.

Power Cycles: Air standard Otto, Diesel and Dual cycles; Valve timing diagrams, Fuel-Air cycles, deviation of actual cycles from ideal cycles.

Unit 2: Combustion [08 Hours]

Introduction, important qualities and ratings of SI and CI Engines fuels; Combustion in S.I. Engines, flame speed, ignition delay, normal and abnormal combustion, effect of engine variables on flame propagation and ignition delay, Combustion in C.I. Engines, combustion of a fuel drop, stages of combustion, ignition delay, combustion knock; types of SI and CI Engine combustion chambers.

Unit 3: Engine Valve Mechanism [08 Hours]

Theoretical and actual valve timing diagram for 2 stroke/ 4 stroke and Petrol/Diesel Engines, Conventional Valve Mechanisms, Mechanisms for variable valve timings.

Unit 4: Various Engine Systems [08 Hours]

Starting systems, fuel supply systems, engine cooling system, ignition system, engine friction and lubrication systems, governing systems.

Unit 5: Engine Testing and Performance of SI and CI Engines [08 Hours]

Parameters, Type of tests and characteristic curves, Effect of load and Speed on mechanical, indicated thermal, break thermal and volumetric efficiencies, Heat balance sheet.
Super charging in IC Engine: Effect of attitude on power output, types of supercharging.

Unit 6: Alternative Potential Engines [08 Hours]
Stratified charge engine, VCR engine, Dual fuel engines, HCCI Engine, Green Engine,Engine Emissions & its effect on human being and environment. EURO and BHARAT emission norms, **Modern Trends in I C Engines.**

Texts:

1. V. Ganeshan, "Internal Combustion Engines", Tata McGraw-Hill Publications, New Delhi, 3rd edition.

References:

1. J. B. Heywood, "Internal Combustion Engine Fundamentals", Tata McGraw Hill Publications, New York, International Edition, 1988.
2. ASHRAE Handbook, "Fundamentals and Equipment", 1993.
3. ASHRAE Handbook – Applications, 1961.
4. ISHRAE Handbook
5. Prof. Ram Gopal, NPTL Lectures, www.nptel.com, IIT Kharagpur.
6. Carrier Handbook
7. R.C. Jordan and G. B.Priester, "Refrigeration and Air Conditioning", Prentice Hall of India Ltd., New Delhi, 1969.
8. J. L.Threlkeld, "Thermal Environmental Engineering", Prentice Hall, New York, 1970.

Engineering Thermodynamics

BTAMC402	Engineering Thermodynamics	PCC 8	3L-1T-0P	4 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week Tutorial:1 hrs/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks(Duration 03 hrs)

Pre-Requisites: Basic Mechanical Engineering, Engineering Mathematics, Engineering Chemistry

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

CO1	Illustrate the ideal gas, real gas, its deviation with compressibility chart.
CO2	Explain the use of Maxwell's relations.
CO3	Analysis thermodynamic second law for various processes.
CO4	Analyze gas turbine cycles.

Mapping of course outcomes with program outcomes

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

Course Contents:

Unit1: Fundamental Concepts and Definitions [08 Hours]

Thermodynamicsystems; properties, processes and cycles. Thermodynamic equilibrium, Quasi-static process, Macroscopic vs. Microscopic viewpoint, Work and heat Transfer: Work transferred and other types of work, Heat transfer, temperature and its measurement (principle of measurement, various instruments etc.)Zerothlaw of thermodynamics, specific heat and latent heat, point function, path function.

Unit2: First Law of Thermodynamics [08 Hours]

First law of thermodynamics for a closed system undergoing a cycle and change of state, Energy, different forms of energy, Enthalpy, PMM-I control volume, application of first law of steady flow processes (nozzle, turbine, compressor pump, boiler, throttle valve etc.

Unit-3: Second Law of Thermodynamics [08 Hours]

Limitation of first law of thermodynamics, cycle heat engine, refrigerator and heat pump, Kelvin- Plank and Clausius statements and their equivalence, Reversibility and Irreversibility, Carnot cycle, Carnot theorem, Absolute thermodynamic temperature scale.

Unit-4: Entropy [08 Hours]

Clausius inequality, entropy as a property of system.entropy of pure substance. T-sand h-s planes, entropy change in a reversible and irreversible processes, increaseof entropy principle, calculation of entropy changes of gases and vapours. Introduction to Available and unavailable energy:

P-v-t relations, equation of state, relation between Cp and Cv, other equations of state

Unit 5: Properties of Steam [08 Hours]

Dryness fraction, enthalpy, internal energy and entropy, steam table and Mollier chart, first law applied to steam processes.

Vapour Power Cycles:

Carnot vapour cycle, Rankine cycle, Ideal reheat, Rankine cycle, Introduction to cogeneration.

Introduction to Gas Power Cycles:

Air standard assumptions, Otto cycle, Diesel cycle, dual cycle, Stirling cycle, Ericsson cycle, Atkinson cycle, Brayton cycle.

Unit 6: Fuels and Combustion [08 Hours]

Types of fuels, calorific values of fuel and its determination, combustion equation for hydrocarbon fuel, determination of minimum air required for combustion and excess air supplied conversion of volumetric analysis to mass analysis, fuel gas analysis. Stoichiometric A/F ratio, lean and rich mixture, products of combustion, properties of engine fuels.

Texts:

1. P. K. Nag, " Engineering Thermodynamics", TataMcGrawHill,3rd edition, New Delhi, 2005.
2. Y.A.Cengel, M.A.Boles, "Thermodynamics–An Engineering Approach", Tata McGraw Hill, 5th edition, 2006.

References:

1. G.J. Van Wyle, R. E. Sonntag, " Fundamental of Thermodynamics", John Wiley & Sons, 5th edition, 1998.
2. M. J. Moran, H. N. Shaprio, "Fundamentals of Engineering Thermodynamics", John Wiley and Sons, 4th edition, 2004.

Strength of Materials

BTMEC403	Strength of Materials	PCC 9	3L-1T-0P	4 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week Tutorial: 1hr/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks(Duration 03 hrs)

Pre-Requisites: None

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

CO1	State the basic definitions of fundamental terms such as axial load, eccentric load, stress, strain, E, μ, etc.
CO2	Recognise the stress state (tension, compression, bending, shear, etc.) and calculate the value of stress developed in the component in axial/eccentric static and impact load cases.
CO3	Distinguish between uniaxial and multiaxial stress situation and calculate principal stresses, max. shear stress, their planes and max. normal and shear stresses on a given plane.
CO4	Analyse given beam for calculations of SF and BM
CO5	Calculate slope and deflection at a point on cantilever /simply supported beam using double integration, Macaulay's, Area-moment and superposition methods

CO6	Differentiate between beam and column and calculate critical load for a column using Euler's and Rankine's formulae

Mapping of course outcomes with program outcomes

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

Course Contents:

Unit 1: Simple Stresses and Strains[08 Hours]

Mechanical properties of materials, analysis of internal forces, simple stress and strain, stress-strain curve, Hooke's law, modulus of elasticity, shearing, thermal stress, Hoop stress, Poisson's ratio, volumetric stress, bulk modulus, shear modulus, relationship between elastic constants.

Unit 2:Principal Stresses and Strains [08 Hours]

Uni-axial stress, simple shear, general state of stress for 2-D element, ellipse of stress, principle stresses and principal planes, principal strains, shear strains, strain rosettes, Mohr's circle for stresses and strains. Strain energy and resilience: Load deflection diagram, strain energy, proof resilience, stresses due to gradual, sudden and impact loadings, shear resilience, strain energy in terms of principal stresses.

Unit 3:Combined Stresses [08 Hours]

Combined axial and flexural loads, middle third rule, kernel of a section, load applied off the axes of symmetry.

Shear and Moment in Beams: Shear and moment, interpretation of vertical shear and bending moment, relations among load, shear and moment.

Unit 4:Stresses in Beams [08 Hours]

Moment of inertia of different sections, bending and shearing stresses in a beam, theory of simple bending, derivation of flexural formula, economic sections, horizontal and vertical shear stress, distribution shear stress for different geometrical sections- rectangular, solid circular, I-section, other sections design for flexure and shear.

Unit 5:Beam Deflections [08 Hours]

Differential equation of deflected beam, slope and deflection at a point, calculations of deflection for determinate beams by double integration, Macaulay's method, theorem of area-moment

method (Mohr‘s theorems), moment diagram by parts, deflection of cantilever beams, deflection in simple supported beams, mid-span deflection, conjugate beam method, deflection by method of superstition.

Unit 6:Torsion [08 Hours]

Introduction and assumptions, derivation of torsion formula, torsion of circular shafts, stresses and deformation in determinate solid/homogeneous/composite shafts, torsional strain energy.

Columns and Struts: Concept of short and long Columns, Euler and Rankine‘s formulae, limitation of Euler‘s formula, equivalent length, eccentrically loaded short compression members.

Texts:

1. S. Ramamrutham, ―Strength of Materials, Dhanpat Rai & Sons, New Delhi.
2. F.L. Singer and Pytle, ―Strength of Materials‖, Harper Collins Publishers, 2002.
3. S. Timoshenko, ―Strength of Materials: Part-I (Elementary Theory and Problems), CBS Publishers, New Delhi.

References:

1. E. P. Popov, ―Introduction to Mechanics of Solid‖, Prentice Hall, 2nd edition, 2005.
2. S. H. Crandall, N.C. Dahl, T. J. Lardner, ―An introduction to the Mechanics of Solids, Tata McGraw Hill Publications, 1978.
3. S. B. Punmia, ―Mechanics of Structure, Charotar Publishers, Anand.
4. B. C. Punmia, Ashok Jain, Arun Jain, ―Strength of Materials, Laxmi Publications

Numerical Methods in Automobile Engineering

BTMEC404	Numerical Methods in Automobile Engineering	BSC 8	2L-1T-0P	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 2 hrs/week Tutorial: 1hr/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs)

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

CO1	Describe the concept of error
CO2	Illustrate the concept of various Numerical Techniques
CO3	Evaluate the given Engineering problem using the suitable Numerical Technique
CO4	Develop the computer programming based on the Numerical Techniques

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3		1	3							
CO2	3	3		1	3							
CO3	3	3		1	3							
CO4	3	3		1	3							

Course Contents:

Unit 1: Error Analysis [06 Hours]
Significant figures, round-off, precision and accuracy, approximate and true error, truncation error and Taylor series, machine epsilon, data uncertainties, error propagation, importance of errors in computer programming.

Unit 2: Roots of Equations [06 Hours]
Motivation, Bracketing methods: Bisection methods, Open methods: Newton Raphson method, Engineering applications.

Unit 3: Numerical Solution of Algebraic Equations [06 Hours]
Motivation, Cramer's rule, Gauss- Elimination Method, pivoting, scaling, engineering applications.

Unit 4: Numerical Integration and Differentiation [06 Hours]
Motivation, Newton's Cotes Integration Formulas: Trapezoidal Rule, Simpson's rule, engineering applications Numerical differentiation using Finite divide Difference method

Unit 5: Curve Fitting and Interpolation [08 Hours]
Motivation, Least Square Regression: Linear Regression, Polynomial regression.
Interpolation: Newton's Divide Difference interpolation, engineering applications.
Solution to Ordinary Differentiation Equations: Motivation**,** Euler's and Modified Euler's Method, Heun's method, Runge– Kutta Method, engineering applications.

Unit6: Computer Programming [04 Hours]
Overview of programming language, Development of at least one computer program based on each unit.

Texts:

1. Steven C Chapra, Reymond P. Canale, "Numerical Methods for Engineers", Tata McGraw Hill Publications, 2010.
2. E. Balagurusamy, "Numerical Methods", Tata McGraw Hill Publications, 1999.

References:

1. V. Rajaraman, "Fundamental of Computers", Prentice Hall of India, New Delhi, 2003.
2. S. S. Sastri, "Introductory Methods of Numerical Methods", Prentice Hall of India, New Delhi, 3rd edition, 2003.

3. K. E. Atkinson, “An Introduction to Numerical Analysis”, Wiley, 1978.
4. M.J. Maron, “Numerical Analysis: A Practical Approach”, Macmillan, New York, 1982

Product Design Engineering

BTID405	Product Design Engineering	PCC 10	2L-0T-0P	2 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 2 hrs/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs)

Unit 1: Creating Simple Products and Modules [04 Hours]

Unit 2: Document Creation and Knowledge Sharing [04 Hours]

Unit 3: Self and Work Management [04 Hours]

Unit 4: Team Work and Communication [04 Hours]

Unit 5: Managing Health and Safety [04 Hours]

Unit 6: Data and Information Management [04 Hours]

Reference:

1. Model Curriculum for “Product Design Engineer – Mechanical”, NASSCOM (Ref. ID: SSC/Q4201, Version 1.0, NSQF Level: 7)
2. Eppinger, S., & Ulrich, K.(2015). Product design and development. McGraw-Hill Higher Education.
3. Green, W., & Jordan, P. W. (Eds.).(1999).Human factors in product design: current practice and future trends. CRC Press.
4. Sanders, M. S., & McCormick, E. J. (1993). Human factors in engineering and design. McGRAW-HILL book company.
5. Roozenburg, N. F., & Eekels, J. (1995). Product design: fundamentals and methods (Vol. 2). John Wiley & Sons Inc.
6. Lidwell, W., Holden, K., & Butler, J.(2010). Universal principles of designs, revised and updated: 125 ways to enhance usability, influence perception, increase appeal, make better design decisions, and teach through design. Rockport Pub.

Physics of Engineering Materials

BTBSE406A	OEC 1	Physics of Engineering Materials	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks(Duration 03 hrs)

Pre-Requisites: None

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

CO1	Understand the different types of structures of solid, defects in solids and analysis of crystal structure by X-ray diffraction technique.
CO2	Understand the origin and types of magnetism, significance of hysteresis loo in different magnetic materials and their uses in modern technology
CO3	Understand the band structure of solids and conductivity, categorization of solids on the basis of band structure, significance of Fermi-Dirac probability functions
CO4	Understand the principles of superconductivity, their uses in modern technology
CO5	Understand the position of Fermi level in intrinsic and extrinsic semiconductors, Semiconductor conductivity
CO6	Understand the electric field in dielectric
CO7	Understand basics of Nano materials, synthesis methods and characterization techniques

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2		3	3		1					3
CO2	3	3			1		2		2		1	2
CO3	2	2			1		1					3
CO4	3	3			1		3		1		1	2
CO5	3	2		2	1		1					1
CO6	3	2			2		2		3		1	2
CO7	2	3	1		3	1	3	1				1

Course Contents:

Unit 1: Crystallography [06 Hours]

Crystal directions and planes, Diatomic Crystal (CsCl, NaCl, Diamond, $BaTiO_3$) Crystal imperfection, Point defects, Line defects, Surface and Volume defects, Structure properties relationship, structure determination by X-ray diffraction.

Unit 2: Magnetic Materials [06 Hours]
Origin of magnetization using atomic theory, classification of magnetic materials and properties, Langevin's theory of Dia, Para and ferromagnetism, Soft and Hard magnetic materials and their uses, Domain theory of ferromagnetism, Hysteresis loss, Antiferromagnetic and Ferrimagnetic materials, Ferrites and Garnets, magnetic bubbles, magnetic recording.

Unit 3: Conducting and Superconducting Materials [06 Hours]
Band theory of solids, Classical free electron theory of metals, Quantum free electron theory, Density of energy states and carrier concentration, Fermi energy, Temperature and Fermi energy distribution, Superconductivity, Factor affecting Superconductivity, Meissner effect, Type-I and Type-II superconductors, BCS theory, Josephson effect, High temperature superconductors, Application of superconductors (Cryotron, magnetic levitation)

Unit 4: Semiconducting Materials [06 Hours]
Band structure of semiconductor, Charge carrier concentration, Fermi level and temperature, Electrical conductivity, Hall effect in semiconductors, P-N junction diode, Preparation of single crystals, LED, Photovoltaic Cell

Unit 5: Dielectric Materials [06 Hours]
Dielectric constant and polarizability, types of polarization, temperature and frequency dependences of Dielectric parameter, internal fields in solids, Clausius-Mosotti equation, dielectric loss, dielectric breakdown, ferroelectric, pyroelectric and piezoelectric materials, applications of dielectric materials

Unit 6: Nano Materials [06 Hours]
Nano materials: Introduction and properties, synthesis of nano materials, Carbon Nano Tubes, Characterization techniques of nano materials- SEM, TEM, EDAX, FMR, XRD. Applications of Nano materials.

Texts:

1. Kittle, "Introduction to Solid state Physics", John Wiley and Sons, 8th edition, 2004.
2. M. Srivastava, C. Srinivasan, "Science of Engineering Materials and Carbon Nanotubes", New Age International Publication, 3rd edition, 2010.
3. A. J. Dekker, "Solid State Physics", Pan Macmillan and Co. Ltd., London, 01stJuly, 1969.

References:

1. V. Raghavan, "Material Science and Engineering", Prentice Hall Publication, 5th edition, 2007.
2. A. J. Dekker, "Electrical Engineering Materials", Prentice Hall Publication, 1st edition, 1959.

Advanced Engineering Chemistry

BTBSE3405A	OEC 1	Advanced Engineering Chemistry	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks

	End Semester Exam: 60 Marks(Duration 03 hrs)

Pre-Requisites: None

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

CO1	Classify and explain various types of Corrosion and should apply methods to minimize the rate of corrosion.
CO2	Understand and apply the concepts of Photochemical and Thermal reactions.
CO3	Understand the basic concepts of Polymers, Polymerization and Moulding techniques; Determine molecular weight of High-Polymers.
CO4	Understand and apply the basic techniques in Chemistry and capable to explain the concepts of Solvent Extraction.
CO5	Understand and apply various types of Spectroscopic, Chromatographic techniques and also able to explain the concepts of Thermo-Gravimetric Analysis (TGA).

Mapping of course outcomes with program outcomes

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

Course Contents:

Unit 1: Corrosion and Its Control [06 Hours]
Introduction, Fundamental reason, Electrochemical Corrosion, Direct Chemical Corrosion, Factors affecting the rate of corrosion, types of corrosion-Galvanic, Pitting Corrosion, Microbiological corrosion, Stress corrosion, methods to minimise the corrosion: Proper design, Cathodic and Anodic protection.

Unit 2: Metals and Alloys [06 Hours]
Metals: Introduction, Properties of metals and alloys. Occurrence, extraction, properties and uses of Ni, Cr and Ti Alloys: Introduction, Need for alloying Steel, Application of Alloy Steel.

Unit 3: Polymers and Its Characterization [06 Hours]
Introduction, molecular weight determination by osmotic pressure and viscosity method, polymers in medicines and surgery, inorganic polymers: silicones. Classes of polymerization (Synthesis and Characterization).Plastic, Moulding of plastic.

Unit 4: Basic Techniques in Chemistry [06 Hours]
Preparing substances for analysis, dissolving the samples, Precipitation, Filtration, Washing Precipitate, Drying and Igniting precipitate. Solvent Extraction: Aqueous and Organic phase liquid – liquid extraction.

Unit 5: Spectroscopy [06 Hours]
Brief introduction to spectroscopy, UV–Visible Spectroscopy: Laws of absorption, instrumentation and application. IR spectroscopy: introduction, theory, instrumentation and application. Brief discussion on NMR Spectroscopy and its Applications. Brief introduction of AAS (Atomic Absorption Spectroscopy)

Unit 6: Instrumental Methods of Analysis [06 Hours]
Introduction to Chromatography, Types of Chromatography (Adsorption and partition chromatography), Paper and Thin Layer Chromatography, Gas Chromatography – introduction, theory, instrumentation. Brief discussion of Thermo gravimetric analysis (TGA).

Texts:

1. Bhal and Bhal, "Advance Organic Chemistry", S. Chand and Company, New Delhi, 1995.
2. P. C. Jain, Monica Jain, "Engineering Chemistry", Dhanpat Rai and Sons, Delhi, 1992.
3. Bhal, Tuli, "Text book of Physical Chemistry", S. Chand and Company, New Delhi, 1995.
4. Chatwal Anand, "Instrumental Methods of analysis", Himalaya Publication.

References:

1. L. Finar, "Organic Chemistry", Vol. I and II, Longman Gr. Ltd and English Language Book Society, London.
2. G. M. Barrow, "Physical Chemistry", Tata McGraw Hill Publication, New Delhi.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and applications", Cambridge Publishers, 2015.
4. O. G. Palanna, "Engineering Chemistry", Tata McGraw Hill Publication, New Delhi.
5. WILEY, Engineering Chemistry, Wiley India, New Delhi 2014.
6. Willard, "Instrumental Methods of analysis", Merrit, Tata McGraw Hill Publications.
7. Glasstone, "Physical Chemistry", D. Van Nostrand Company Inc., 2nd edition, 1946.
8. Peter Atkins, "Physical Chemistry", W. H. Freeman and Co., 9th edition, 2009.

Interpersonal Communication Skill & Self Development

BTHM3402	OEC 1	Interpersonal Communication Skill & Self Development	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks(Duration 03 hrs)

Pre-Requisites: None

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

CO1	Acquire interpersonal communication skills
CO2	Develop the ability to work independently.
CO3	Develop the qualities like self-discipline, self-criticism and self-management.
CO4	Have the qualities of time management and discipline.
CO5	Present themselves as an inspiration for others
CO6	Develop themselves as good team leaders

Mapping of course outcomes with program outcomes

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

Course Contents:

Unit 1: Development of Proficiency in English [06 Hours]
Speaking skills, Feedback & questioning technique, Objectivity in argument (Both one on one and in groups). 5 Wsand 1 H and 7 Cs for effective communication.
Imbibing etiquettes and manners. Study of different pictorial expressions of non-verbal communication and their analysis

Unit 2: Self-Management [06 Hours]
Self-Management, Self-Evaluation, Self-discipline, Self-criticism; Recognition of one's own limits and deficiencies, dependency, etc.; Self-Awareness, Self-Management, Identifying one's strengths and weaknesses, Planning & Goal setting, Managing self-emotions, ego, pride. Leadership and Team Dynamics

Unit 3: Time Management Techniques [06 Hours]
Practice by game playing and other learning strategies to achieve the set targets Time Management Concept; Attendance, Discipline and Punctuality; Acting in time, Quality /Productive time.

Unit 4: Motivation/Inspiration [06 Hours]
Ability to shape and direct working methods according to self-defined criteria, Ability to think for oneself, Apply oneself to a task independently with self-motivation.
Motivation techniques: Motivation techniques based on needs and field situations

Unit 5: Interpersonal Skills Development [06 Hours]
Positive Relationship, Positive Attitudes, Empathise: comprehending others' opinions, points of views, and face them with understanding, Mutuality, Trust, Emotional Bonding, Handling Situations (Interview), Importance of interpersonal skills.

Unit 6: Effective Computing Skills [06 Hours]
Designing an effective Presentation; Contents, appearance, themes in a presentation, Tone and Language in a presentation, Role and Importance of different tools for effective presentation.

References:

1. Mitra, Barun, "Personality Development and Soft Skills", Oxford University Press, 2016.
2. Ramesh, Gopalswamy, "The Ace of Soft Skills: Attitude, Communication and Etiquette for Success", Pearson Education, 2013.
3. Stephen R. Covey, "Seven Habits of Highly Effective People: Powerful Lessons in Personal Change", Free Press Publisher, 1989.
4. Rosenberg Marshall B., "Nonviolent Communication: A Language of Life" 3rd edition, Puddle dancer Press, 1st September, 2003.

Theory of Automotive Engines Lab

BTAML407	Theory of Automotive Engines Lab	PCC 11	0L-0T-2P	1 Credit

Practical Scheme:	**Examination Scheme:**
Practical: 2 hrs/batch	Continuous Assessment: 60 Marks External Exam: 40 Marks

Pre-Requisites: None

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

CO1	Demonstrate the construction and working of fuels supply system and its components, lubrication, cooling systems.
CO2	Handle instruments like tachometer, thermometer, digital temperature indicator etc.
CO3	Conduct the test on single cylinder and multi cylinder petrol & diesel engines (Constant Speed & Variable Speed Tests) plot the engine performance characteristics curves and interpret the curves.
CO4	Calculate B.P., I.P., F.P., air/fuel ratios and various engine efficiencies. Conduct the test and prepare heat balance sheet

Mapping of course outcomes with program outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2				1							

CO2	1			1								
CO3	2	2		3		1						
CO4	2			2	1		2					

List of Practical's/Experiments/Assignments

A. Demonstration of physical systems in terms of constructional details and functions

1. 2 Stroke and 4 Stroke Engines
2. Carburetor.
3. Ignition system.
4. Fuel injection system.
5. Cooling System
6. 2 stage / 3 stage pressurised gas supply system. (LPG/CNG/Biogas/Hydrogen)
7. Visit to Industry related to automotive service station.

B. I C Engines (Any **Five** experiments from the list)

1. Trial on Diesel engine- variable speed/load test and energy balance.
2. Trial on Petrol engine- variable speed/load test and energy balance.
3. Trial on Petrol Engine- Morse Test.
4. Measurements of exhaust emissions of Petrol engine / Diesel engine.
5. Heat Balance test on diesel or petrol engines.
6. Experimental determination of Air fuel ratio.

Engineering Thermodynamics Lab

BTAML408	Engineering Thermodynamics Lab	PCC 12	0L-0T-2P	1 Credit

Practical Scheme:	**Examination Scheme:**
Practical: 2 hrs/batch	Continuous Assessment: 60 Marks External Exam: 40 Marks

Pre-Requisites: Engineering Thermodynamics

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

CO1	Determine the dryness fraction of steam and energy contained in a substance with the help of Bomb calorimeter.
CO2	Illustrate the function of Bosch fuel injection pump and boilers.
CO3	Estimate the performance of diesel/petrol engine.
CO4	Demonstrate reciprocating compressing.
CO5	Draw conclusions based on the results of the experiments
CO6	Draw performance curves of these machines.

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1		1								
CO2	1											
CO3	1	1		1								
CO4	1	1										
CO5	1	1		1								
CO6	1	1		1								

ListofPracticals/Experiments/Assignments

Any eight experiments from the list:

1. Determination of dryness fraction of steam.
2. Trial on bomb calorimeter.
3. Study of MPFI and Bosh fuel injection pump
4. Study of High Pressure Boilers.
5. Test on Diesel/Petrol engine to determine BP, bsfc, Brake thermal efficiency.
6. Trial on reciprocating air compressor
7. Trial on convergent/convergent-divergent type nozzle
8. Flue gas analysis using emission measuring instruments
9. Trial on centrifugal blower

Strength of Materials Lab

BTAML409	Strength of Materials Lab	PCC 13	0L-0T-2P	1 Credits

Practical Scheme:	**Examination Scheme:**
Practical: 2 hrs/batch	Continuous Assessment: 60 Marks External Exam: 40 Marks

Pre-Requisites: None

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

CO1	
CO2	
CO3	
CO4	

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												

CO4												

List of Practicals/Experiments/Assignments (any ten experiments from the list)

1. Tension test on ferrous and non-ferrous alloys (mid steel/cast iron/aluminum, etc.
2. Compression test on mild steel, aluminum, concrete, and wood
3. Shear test on mild steel and aluminum (single and double shear tests)
4. Torsion test on mild steel and cast iron solid bars and pipes
5. Flexure test on timber and cast iron beams
6. Deflection test on mild steel and wooden beam specimens
7. Graphical solution method for principal stress problems
8. Impact test on mild steel, brass, aluminum, and cast iron specimens
9. Experiments on thermal stresses
10. Strain measurement in stress analysis by photo-elasticity
11. Strain measurement involving strain gauges/ rosettes
12. Assignment involving computer programming for simple problems of stress, strain computations.

Numerical Methods Lab

BTAML410	BSC 9	Numerical Methods Lab	0-0-2	1 Credit

Practical Scheme:	**Examination Scheme:**
Practical: 2 hrs/batch	Continuous Assessment: 60 Marks External Exam: 40 Marks

Pre-Requisites: None

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

CO1	
CO2	
CO3	
CO4	

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												

Student should develop the computer programme along with the results on following topics. (Any six)

1. Programme to demonstrate the effect of round off error and significant number
2. Programme to find real single root of an Equation by Bisection Method
3. Programme to find real single root of an Equation by Newton- Raphson Method
4. Programme to solve linear simultaneous algebraic equations
5. Programme to solve the integration using Multi Trapezoidal Rule
6. Programme to solve the integration using Simpson's 1/3 rule
7. Programme to solve simple practical problem using finite difference method
8. Programme to solve ODE

It is expected that student should take up the simple real life problem for writing the programme.

Student should maintain a file containing all the programmes with results in printed form and also submit a CD containing all the programmes in soft form.