GALGOTIAS UNIVERSITY

(Established under Galgotias University Uttar Pradesh Act No. 14 of 2011)

School of Mechanical Engineering

Program: B. Tech Automobile Engineering

Scheme: 2019 – 2023

Date of BoS: 15.06.2019

Curriculum

Semester 1							Assessment Pattern		
Sl. No.	**Course Code**	**Name of the Course**	**L**	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	BCSE1002	Computer Programming and Problem Solving	0	0	4	2	50	-	50
2	BEEE1002	Basic Electrical and Electronics Engineering	3	0	0	3	20	50	100
3	BEEE1003	Basic Electrical and Electronics Engineering Lab	0	0	2	1	50	-	50
4	BTME1003	Product Manufacturing	0	0	2	1	50	-	50
5	BTME1001	Introduction to Mechanical Engineering	0	0	2	1	50	-	50
6	ENVS1001	Environmental Science	3	0	0	3	20	50	100
7	MATH1001	Multivariable Calculus	3	0	0	3	20	50	100
8	MATH1002	Exploration with CAS-I	0	0	2	1	50	-	50
9	SLBT1001	Basic English	0	0	4	2	50	-	50
10	JAPA1001	JAPANESE -I	0	0	2	1	50	-	50
	FREN1001	FRENCH -I							
	GERN1001	GERMAN –I							
11	PHYS1001	Engineering Physics	3	0	0	3	20	50	100
12	PHYS1002	Engineering Physics lab	0	0	2	1	50	-	50
13	PSSO1001	Psychology and Sociology	2	0	0	2	20	50	100
		Total	**14**	**0**	**20**	**24**			

Semester 2							Assessment Pattern		
Sl. No.	**Course Code**	**Name of the Course**	**L**	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	BCSE1003	Application Oriented Programming using Python	0	0	4	2	50	-	50
2	BTME1002	Product Design using Graphics	0	0	4	2	50	-	50
3	MATH1003	Matrices and Differential equations	3	0	0	3	20	50	100
4	MATH1004	Exploration with CAS-II	0	0	2	1	50	-	50
5	SLBT1002	English Proficiency and Aptitude Building - 1	0	0	4	2	50	-	50
6	JAPA1002	JAPANESE -II	0	0	2	1	50	-	50
	FREN1002	FRENCH -II							
	GERN1002	GERMAN -II							
7	CHEM1001	General Chemistry	3	0	0	3	20	50	100
8	CHEM1002	General Chemistry Lab	0	0	2	1	50	-	50
9	PHYS1003	Physics of Materials	3	0	0	3	20	50	100
10	PHYS1005	Advance Physics Lab	0	0	2	1	50	-	50
11	UHVE1001	Universal Human Values and Ethics	0	0	4	2	50	-	50
		Total	**9**	**0**	**24**	**21**			

Semester 3							Assessment Pattern		
Sl. No.	**Course Code**	**Name of the Course**	**L**	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	BTME2001	Engineering Mechanics	3	0	0	3	20	50	100
2	BTME2002	Engineering Thermodynamics	3	0	0	3	20	50	100
3	BTME2003	Manufacturing Processes I	3	0	0	3	20	50	100
4	MATH2001	Functions of complex variables and Transforms	3	0	0	3	20	50	100
5	SLBT2001	English Proficiency and Aptitude Building – 2	0	0	4	2	50	-	50
6	BTME2004	Manufacturing Processes I Laboratory	0	0	2	1	50	-	50
7	BTME2005	Machine Drawing Laboratory	0	0	2	1	50	-	50
8	BTME2006	SKILL-1 (Solid Works)	0	0	2	1	50	-	50
9	BTME2007	PBL-1 (Machine Drawing / Mechanics)	0	0	2	1	50	-	50
		Total	**12**	**0**	**12**	**18**			
Semester 4							**Assessment Pattern**		
Sl. No.	**Course Code**	**Name of the Course**	**L**	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	BTME2008	Mechanics of Material	3	0	0	3	20	50	100
2	BTME2009	Fluid Mechanics	3	0	0	3	20	50	100
3	BTME2010	Manufacturing Processes II and Metrology	3	0	0	3	20	50	100
4	MATH2003	Probability and Statistics	3	0	0	3	20	50	100
5	BBAD 1003	Microeconomics	3	0	0	3	20	50	100
6	UE1	Management Course (from basket)	3	0	0	3	20	50	100
7	SLBT2002	English Proficiency and Aptitude Building – 3	0	0	4	2	50	-	50
8	BTME2011	Fluid Mechanics Laboratory	0	0	2	1	50	-	50
9	BTME2012	Mechanics of Material Laboratory	0	0	2	1	50	-	50
10	BTME2013	Manufacturing Processes II and Metrology Laboratory	0	0	2	1	50	-	50
11	BTME2014	PBL-2 (Material microstructures)	0	0	2	1	50	-	50
		Total	**18**	**0**	**12**	**24**			
Semester 5							**Assessment Pattern**		
Sl. No.	**Course Code**	**Name of the Course**	**L**	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	BAUT3001	Automotive Engines	3	0	0	3	20	50	100
2	BAUT3002	Heat Engineering	3	0	0	3	20	50	100
3	BTME3002	Kinematics of Machines	3	0	0	3	20	50	100
4	MATH3010	Numerical Methods	2	0	0	2	20	50	100

5	PE01	Program Elective - 1	3	0	0	3	20	50	100
6	PE02	Program Elective - 2	3	0	0	3	20	50	100
7	PE03	Program Elective - 3	3	0	0	3	20	50	100
8	SLBT3001	English Proficiency and Aptitude Building – 4	0	0	4	2	50	-	50
9	MAT252	MAT252 Numeric Methods Lab Practical	0	0	2	1	20	50	100
10	BAUT3003	Heat Engineering Lab	0	0	2	1	50	-	50
11	BTME3005	PBL-3 (Applied Thermodynamics)	0	0	2	1	50	-	50
12	BTME3016	IT Skill Development on OOPs and DBMS	0	0	2	1	50	-	50
		Total	**20**	**0**	**12**	**23**			

Semester 6							**Assessment Pattern**		
Sl. No.	**Course Code**	**Name of the Course**	**L**	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	BTME3007	Machine Design/PBL	4	0	0	4	20	50	100
2	BAUT3004	Automotive Chassis and Body Engineering	3	0	0	3	20	50	100
3	BTME3008	Dynamics of Machines	3	0	0	3	20	50	100
4	BAUT3005	Automotive Transmission Systems	3	0	0	3	20	50	100
5	PE04	Electric and Hybrid Vehicles	3	0	0	3	20	50	100
6	PE05	Aerodynamic Design of Vehicles	3	0	0	3	20	50	100
7	SLBT3002	Soft Skill - 6 (Campus to Corporate)	0	0	4	2	50	-	50
8	BTME3010	Dynamics of Machines Laboratory	0	0	2	1	50	-	50
9	BTME3017	AI & Machine Learning using Python	0	0	4	2	50	-	50
		Total	**19**	**0**	**10**	**24**			

Semester 7							**Assessment Pattern**		
Sl. No.	**Course Code**	**Name of the Course**	**L**	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	BAUT4001	CAD/CAM	3	0	0	3	20	50	100
2	BTME4002	Operation Research	3	0	0	3	20	50	100
3	UE2	Science Course (from basket)	3	0	0	3	20	50	100
4	UE3	Humanities Course (from basket)	3	0	0	3	20	50	100
5	BAUT9998	Project Work 1	-	-	-	3	50	-	50
6	BAUT4004	Energy systems Laboratory	0	0	2	1	50	-	50
7	BTME4005	Comprehensive Examination	0	0	0	0	-	-	-
8	UC28	Professional Ethics and Values	0	0	0	0	-	-	-
		Total	**12**	**0**	**2**	**16**			

Semester 8							**Assessment Pattern**		
Sl. No.	**Course Code**	**Name of the Course**	**L**	**T**	**P**	**C**	**IA**	**MTE**	**ETE**
1	BAUT9999	Project Work 2	-	-	-	9	50	-	50
		Total				**9**			

List of Electives

Elective 1

Sl No	Course Code	Name of the Electives					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	BAUT3055	Two And Three Wheeled Vehicles	3	0	0	3	20	50	100

Elective 2

Sl No	Course Code	Name of the Electives					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	BAUT3051	Vehicles Dynamics	3	0	0	3	20	50	100

Elective 3

Sl No	Course Code	Name of the Electives					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	BAUT3054	Alternative Fuels & Energy Systems	3	0	0	3	20	50	100

Elective 4

Sl No	Course Code	Name of the Electives					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	BAUT3058	Electric and Hybrid Vehicles	3	0	0	3	20	50	100

Elective 5

Sl No	Course Code	Name of the Electives					Assessment Pattern		
			L	T	P	C	IA	MTE	ETE
1	BAUT3063	Aerodynamic Design of Vehicles	3	0	0	3	20	50	100

Detailed Syllabus

Name of The Course	Introduction to Mechanical Engineering				
Course Code	BTME1001				
Prerequisite					
Corequisite					
Antirequisite					
		L	T	P	C
		0	0	2	1

Course Objectives:

1. To introduce the discipline of Mechanical Engineering, its fundamentals, its sub disciplines and their interaction.
2. To introduce the key mechanical engineering components such as an internal combustion engine, refrigerators, power plant machinery and machine elements.

Course Outcomes

CO1	Relate various manufacturing techniques and joining process.
CO2	Illustrate the power transmitting elements.
CO3	Describe the working of internal combustion engine.
CO4	Compare the principles of various power plants.
CO5	Illustrate the working principle of thermal power cycles and refrigeration.

Text Book (s)

1. Kumar, Pravin, Basic Mechanical Engineering, 1st Edition, Pearson India, 2013,ISBN: 978-9-332-50575-9

Reference Book (s)

1. Manglik, V. K., Elements of Mechanical Engineering, 1st Edition, PHI, 2013, ISBN: 978-8-120-34629-1

Course Content:

Unit I: Manufacturing Techniques and Machine Elements **7 Hours**
Introduction to Lathe and its operations, Drilling; metal joining processes – shielded metal arc & gas welding, Brazing and soldering; Sheet metal working, Smithy.
Unit II: Machine Elements **7 Hours**
Helical and leaf springs; Cams - types of cams and followers; Gears - Spur, helical and bevel gears, gear trains; Belt drives – types; chain drives; Introduction to clutch.
Unit III: Internal combustion engine **8 Hours**
Introduction to Otto cycle, diesel cycle, Principle of internal and external combustion engines; two strokes and four strokes engines; emission control.
Unit IV: Power Plant Engineering **9 Hours**

Introduction and classification of power plants – thermal, hydroelectric, diesel, nuclear power plants, Tidal power plants, Geo-thermal power plant; introduction to steam and gas turbines.
Unit V: Refrigeration cycles **9 Hours**
Introduction to Refrigeration – Principle of vapour compression refrigeration system – Principle of vapour absorption refrigeration system, Air-conditioning – Layout of typical domestic refrigerator – window and split, centralized type air conditioner.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Product Design using Graphics			
Course Code	BTME1002			
Prerequisite				
Corequisite				
Antirequisite				
L	**T**	**P**	**C**	
0	0	4	2	

Course Objectives:

1. To introduce the concept of product design.
2. To establish the usage of basics of engineering graphics in product design.
3. To introduce graphics software and apply graphics software for devloping product model.

Course Outcomes

CO1	Understand the concept and principles of engineering graphics in product design.
CO2	Make isometric and orthographic projection of solids along with free hand sketching.
CO3	Develop a solid model using AutoCAD
CO4	Make a solid model for a given assembly using AutoCAD.
CO5	Apply the concepts and techniques learnt in the course to make hands-on project.

Text Book (s)

1. Asimow, M. (1962). Introduction to design. Englewood Cliffs: Prentice-Hall.
2. K C John (2009), Engineering Graphics for Degree, Prentice Hall of India. ISBN: 978-8-120-33788-3.
3. P N Rao (2010), CAD/CAM Principles and Applications, 3rd Edition, Tata McGraw-Hill Education, ISBN: 978-0-070-68193-4.

Course Content:

Unit I: Introduction – Understanding the Concept of Product Design 10 Hours
Fundamentals of Design : Design by Evolution and Design by Innovation, Principles that govern any design, Morphology and Process of Design, Application of Graphics in Design, Engineering Graphics: An Overview, Introduction to Computer Aided Drafting, Lettering, Numerals and Dimensioning.
Unit II: Projection of Solids 13 Hours
Concept of Projection, Object in four quadrant, 2-D description of quadrants, Orthographic Projection of Solids, Isometric Projection of Solids, Free-hand sketching.
Unit III: Solid Modeling 12 Hours
Division of Engineering Solids- Polyhedra, Regular and Irregular polyhedral, solids of revolution, Geometric Modeling – Wireframe, B-Rep and Solid Modeling, Solid Modelling using AutoCAD.
Unit IV: Introduction to Assembly 11 Hours
Types of assembly drawings, Accepted Norms for Assembly Drawings, Sequences of Preparing the Assembly Drawing, Solid Modeling of assembly.

Unit V: Application of Design Concepts for Product Design **10 Hours**
Hands-on Project in Groups: Choose a specific objective for Product Design, Design the Product and Model it using AutoCAD, presentation.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	--	50	100

Name of The Course	Product Manufacturing Lab				
Course Code	BTME1003				
Prerequisite					
Corequisite					
Antirequisite					
		L	T	P	C
		0	0	2	1

Course Objectives:

1. To learn to make a product using different basic processes.
2. To get acquainted with assembling of two or more components to obtain a product.
3. To be trained to make a product out of wood.

Course Outcomes

CO1	Develop a product using Welding Process.
CO2	Develop a product out of a given sheet.
CO3	Assemble a product of wood in carpentry shop.
CO4	Create a product using casting and then machining.
CO5	Assemble different components to get final product with the help of welding

Text Book (s)

1. Product Manufacturing Manual prepared by faculties of School of Mechanical Engineering.

Reference Book (s)

1. A.K. Hajra Choudhury, S.K. Hajra Choudhury and Nirjhar Roy (2009), Elements of Workshop Technology, Vol. – I, Media Promoters, ISBN: 978-8-185-09914-9.
2. A.K. Hajra Choudhury, S.K. Hajra Choudhury and Nirjhar Roy (2010), Elements of Workshop Technology, Vol. – II, Media Promoters, ISBN: 978-8-185-09915-6.

List of Exercises

1. To prepare a given product using the knowledge gained in Product Manufacturing Lab while working in the lab. (To be submitted at the end of the session and evaluated in the external examination)

2. Welding Shop

Any two of the following

a. Prepare a Lap joint as per drawing using Oxy-Acetylene Gas welding
b. Prepare a T-joint as per drawing using Oxy-Acetylene Gas welding
c. Prepare a Butt-joint as per drawing using Oxy-Acetylene Gas welding
d. Prepare L- joint as per drawing using Oxy-Acetylene Gas welding
e. Prepare a Lap joint as per drawing using Electric Arc welding
f. Prepare a T-joint as per drawing using Electric Arc welding
g. Prepare a Butt-joint as per drawing using Electric Arc welding
h. Prepare L- joint as per drawing using Electric Arc welding

3. Fitting Shop

a. Prepare a Male/Female Parts as per drawing

4. Lathe Machine Shop

a. Preparation of Job as per drawing.

5. Sheet metal Shop

a. Preparation of funnel of given dimension. Use soldering to join lower part with upper and use riveting to join cylinder

6. Foundry Shop

a. Preparation of Job of aluminium as per drawing through casting.

7. Carpentry Shop

Any one of the following

a) Preparation of T-Joint of given dimension.
b) Preparation of Lap Joint of given dimension.
c) Preparation of Cross Joint of given dimension.
d) Preparation of Dove Tail Joint of given dimension.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	--	50	100

Name of The Course	Engineering Mechanics				
Course Code	BTME2001				
Prerequisite					
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

1. To calculate the reactive forces and analyse the structures.
2. To know the geometric properties of the different shapes.
3. To learn energy and momentum methods.

Course Outcomes

CO1	Solve the engineering problems involving equilibrium of paritcles and rigid bodies.
CO2	Solve the problems involving dry friction and virtual work.
CO3	Determine the centroid, centre of gravity and moment of inertia of various surfaces and solids.
CO4	Solve problems related to kinematics and kinetics of rigid body.
CO5	Solve problems using energy-momentum priniciple for a particle and rigid bodies in plane motion.

Text Book (s)

1. J. V. Rao, D. H. Young, S. Timoshenko, Sukumar Pati (2013), Engineering Mechanics, Tata McGraw Hill Education. ISBN: 978-1-259-06266-7.

Reference Book (s)

1. P. Ferdinand, E. Beer and J. Russell (2010), Vector Mechanics for Engineers, 9th Edition, McGraw-Hill International Edition. ISBN: 978-0-079-12637-5
2. Irving H. Shames (2012), Engineering Mechanics – Statics and Dynamics, 4th Edition, Prentice-Hall of India Private limited. ISBN: 978-8-131-72883-3

Course Content:

Unit I: Equilibrium of Particle, Rigid body and Trusses 9 Hours

Introduction to Mechanics – Fundamental Principles – Coplanar forces – Equilibrium of particles – Free body diagram – Equilibrium of particle in space – Single equivalent force - - Equilibrium of rigid bodies in two dimensions. Analysis of plane trusses – Method of joints – Method of sections – Zero-force member.

Unit II: Friction and Virtual work 7 Hours

Characteristics of dry friction – Problems involving dry friction – Ladder – Wedges – Square threaded screws. Definition of virtual work – Principle of virtual work – System of connected rigid bodies – Degrees of freedom – Conservative forces – Potential energy – Potential energy criteria for equilibrium.

Unit III: Properties of Surfaces and Solids 6 Hours

Centroid – First moment of area – Theorems of Pappus and Guldinus – Second moment of area – Moment and Product of inertia of plane areas – Transfer Theorems – Polar moment of inertia – Principal axes – Mass moment of inertia.

Unit IV: Kinematic and Kinetics **9 Hours**
Position, Velocity and Acceleration – Rectilinear motion – Curvilinear motion of a particle – Tangential and Normal components – Radial and Transverse components – Rotation of rigid bodies about a fixed axis – General plane motion – Absolute and relative motion method – Instantaneous centre of rotation in plane motion. Linear momentum – Equation of motion – Angular momentum of a particle and rigid body in plane motion – D'Alembert's principle.
Unit V: Energy and Momentum Methods **9 Hours**
Principle of work and energy for a particle and a rigid body in plane motion – Conservation of energy - Principle of impulse and momentum for a particle and a rigid bodies in plane motion – Conservation of momentum – System of rigid bodies – Impact - direct and central impact – coefficient of restitution.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Engineering Thermodynamics			
Course Code	BTME2002			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

1. To learn the basic principles of classical thermodynamics.
2. To study the laws of thermodynamics to various systems and analyze the significance of the results.
3. To analyze the performance of thermodynamic gas and vapour power cycles.

Course Outcomes

CO1	Outline the thermodynamic properties for different types of system.
CO2	Apply the first law of thermodynamics for a system undergoing a cycle.
CO3	Demonstrate basic understanding of the second law of thermodynamics and its application to open and closed systems.
CO4	Demonstrate basic understanding of entropy and its application to engineering systems.
CO5	Practice the basic thermal analysis of thermodynamic cycles.

Text Book (s)

1. P. K. Nag (2010), Basic and Applied Thermodynamics, Tata McGraw-Hill Publishing Company Ltd., ISBN 978-0-070-15131-4
2. R. K. Rajput, A Textbook of Engineering Thermodynamics, Laxmi Publications; Fifth edition, ISBN-13**:** 978-8131800584

Reference Book (s)

1. Yunus A. Cengel and Michael A. Boles, Thermodynamics, An Engineering Approach, 8th Ed., McGraw Hill, 20015, ISBN: 978-9-339-22165-2.
2. Jean-Philippe Ansermet, Sylvain D. Brechet, Principles of Thermodynamics, Ist Ed., Cambridge University Press; ISBN-13: 978-1108426091

Course Content:

Unit I: Basic Concepts of Thermodynamics **6 Hours**
Thermodynamics and Energy, Macroscopic and microscopic viewpoint, Closed and open systems, Thermodynamic properties of a system, State and equilibrium, Processes and cycles, Forms of energy , Temperature and its measurement, Zeroth law of thermodynamics.
Unit II: First Law of Thermodynamics **9 Hours**
Work transfer, pdV work, Types of work transfer, Net work done by a system, heat transfer, path function, Specific heat and latent heat, First law of thermodynamics for a closed system undergoing a cycle and change of state, Energy – a property of the system, enthalpy, specific heat at constant pressure and volume, PMM-I, Control volume, First law applied to steady flow process, Mass and energy balance.
Unit III: Second Law of Thermodynamics **9 Hours**

Limitations of the first law of Thermodynamics, Kelvin-Planck statement of the second law of thermodynamics, Clausius statement, Equivalence of Kelvin- Planck and Clausius statements, Heat engine, Refrigerators, Heat Pump, COP, Carnot's theorem, Corollary of Carnot's theorem, Reversible and Irreversible process, Efficiency of Reversible Heat engine, PMM-II, Carnot cycle.
Unit IV: Entropy and properties of pure sustances 8 Hours
Introduction, Clausius theorem, Entropy – property of the system, Clausius inequality, Entropy change in irreversible process, Entropy principle, Reversible adiabatic work in steady flow system, Availability and irreversibility, Second law efficiency, p-v, p-T and T-s diagrams for a pure substance, Quality, Introduction to steam tables.
Unit V: Thermodynamic Cycles 8 Hours
Carnot cycle, Otto cycle, Diesel and Dual cycles, Brayton and reversed Brayton Cycle, Rankine cycle.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Manufacturing Processes I**				
Course Code	**BTME2003**				
Prerequisite	BTME1003 Product Manufacturing				
Corequisite					
Antirequisite					
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1.To acquire basic knowledge about the behaviour and manufacturing properties of engineering materials and concepts of foundry and casting processes.
2. To acquire knowledge about various methods of welding, cold and hot working, and forming process.
3. To understand forging, moulding and powder metallurgy processes in detail and application of these in manufacture of a product.

Course Outcomes

CO1	Develop a simple shape of castings by using different casting methods.
CO2	Prepare the weld joints by using different welding methods.
CO3	Develop a product by using metal forming processes.
CO4	Demonstrate the powder metallurgy process for making a component.
CO5	Apply the knowledge in manufacturing a product from plastic or composite materials.

Text Book (s)

1. Manufacturing Technology – Foundry, Forging and Welding (Vol-1), P.N.Rao. (2008), 3rd Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, ISBN: 978-0-070-08798-9.

Reference Book (s)

1. A.K. Hajra Choudhury, S.K. Hajra Choudhury and Nirjhar Roy (2009), Elements of Workshop Technology, Vol. – I, Media Promoters, ISBN: 978-8-185-09914-9.
2. W.A.J.Chapman (2001), Workshop Technology, Vol 1, 5th Edition, CBS Publishers, ISBN: 978-8-123-90401-6.

Course Content:

Unit I: Metal Casting Processes **12 Hours**.
Manufacturing- selecting manufacturing process –Fundamentals of metal casting – Fluidity of molten metal – Solidification time – Sand casting – Shell mold casting - Investment casting - Plaster mold casting – Ceramic mold casting – Die casting - Centrifugal casting – Melting practice and furnaces - Defects in sand casting – Testing and inspection of casting.
Unit II: Joining Processes **10 Hours**
Metal fusion welding processes – Oxyfuel gas welding – Arc welding processes – Consumable electrode: SMAW- SAW – GMAW – FCAW – Non-consumable Electrode: GTAW- AHW- PAW – EBM – LBM – Solid state welding processes: Ultrasonic welding – Friction welding – Friction stir welding -Resistance welding – Weld quality – Testing welded joints.
Unit III: Metal Forming Processes **8 Hours**

Cold and Hot working: Rolling – Forging – Extrusion – Drawing – Sheet metal forming processes – High Energy Rate Forming Processes: Explosive Forming – Electro Hydraulic Forming – Electro Magnetic Forming.

Unit IV: Processing of Metal Powders, Ceramics and Glass 5 Hours

Production of metal powders: Compaction – Sintering and Finishing – Design considerations for powder metallurgy and Process capability
Shaping of ceramics – Forming and shaping of glass – Design considerations for ceramics and glass – Processing of superconductors.

Unit V: Processing of Plastics and Composite Materials 5 Hours

Types of Plastics – Types of Molding: Injection molding – Blow molding – Compression molding – Transfer molding – Thermoforming – Reinforced plastics – Metal Matrix Composites – Ceramic Matrix Composites.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Functions of complex variables and transform Calculus			
Course Code	**MATH 2001**			
Prerequisite	MATH 2003			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives:

In modern world, Functions of complex variables and transform Calculus has become an important tool extensively used in many fields such as science, engineering, business, industry. The objective of the course is familiarizing the prospective engineers with techniques in Transform Calculus and differentiation and integration of Complex variable. It aims to equip the students with standard concepts and tools to advance level that will serve them well towards tackling more advanced level of Mathematics and application that they would find useful in their discipline.

Course Outcomes

CO1	To understand the behavior of complex valued functions such as continuity/differentiability and analyticity.
CO2	To evaluate complex integral, singularities, residue of an analytic function, contour integral and an integral over the real line.
CO3	To apply Laplace transforms for solving initial value problems
CO4	To apply Fourier transforms for solving one dimensional heat and wave equations.
CO5	To apply Z-transforms for solving difference equations.

Text Book (s)

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley &Sons.
2. J W Brown and R V Churchill, Complex Variables and Applications ,7th Ed., Mc-GrawHill,2004

Reference Book (s)

1. Michael D. Greenberg, Advanced Engineering Mathematics, 2nd Edition, PearsonEducation
2. Peter V. O'Neil,Advanced Engineering Mathematics, 6th Edition, CengageLearning.
3. R. K. Jain and S. R. K. IyengarAdvanced Engineering Mathematics, 4th Edition, NarosaPublishers

Course Content:

Unit I: Complex Differentiation	**12 Hours**
Complex number system(A review), Limit, Continuity, Differentiability of function, Cauchy-Riemann Equations in Cartesian and Polar coordinates, Analytic function, elementary analytic functions (exponential, trigonometric, logarithm),Harmonic functions, harmonic conjugate, Conformal mappings and mobius transformations with their properties.	
Unit II: Complex Integration	**10 Hours**

Contour integral, Cauchy theorem (without proof), Cauchy Integral formula (withoutproof), Maximum-Modulus theorem (without proof), Taylor's and Laurent's series: radius and circle of convergence, Zeroes and singularities of analytic functions, Residues, Residue theorem (without proof), Evaluation of definite integrals involving sine and cosine, and real definite integrals around unit and semi circles.

Unit III: **Laplace Transform** **10 Hours**

Definition, existence condition, Properties, Laplace transform of Periodic, Unit step and Dirac Delta functions, Laplace transforms of derivatives and integrals, Evaluation of integrals using Laplace transforms, Convolution theorem, Inverse Laplace transform, Application of Laplace Transform in solving initial value problems.

Unit IV: Fourier Transform **7 Hours**

Fourier integrals, Complex Fourier transforms, Fourier sine and cosine transforms, Properties of Fourier transforms, Convolution theorem, Fourier transforms of derivatives, Applications of Fourier transform in solving one dimensional Heat and Wave equations.

Unit V: Z Transform: **6 Hours**

Definition and Elementary properties of Z-transform (Unilateral, Bilateral), Inverse Z–transform, Convolution theorem, Solution of difference equations using Z - transform.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Manufacturing Processes I Laboratory			
Course Code	BTME2004			
Prerequisite	BTME1003 Product Manufacturing			
Corequisite				
Antirequisite				
	L	T	P	C
	0	0	2	1

Course Objectives:

1. To learn to give initial shapes to a metal in foundry shop and to be processed further to make a product.
2. To train to join metal pieces using different welding techniques.

Course Outcomes

CO1	Prepare sand mould and it further used to produce casting.
CO2	Determine the characteristics of sand permeability number and fine grainness number.
CO3	Produce simple casting components using sand mould casting technique.
CO4	Prepare a weld joint by using different welding techniques.
CO5	Illustrate the relationship between cutting parameters of cutting speed, feed rate and depth of cut on forces generated in oblique cutting.

Text Book (s)

1. Manufacturing Processes I Lab manual prepared by faculties of School of Mechanical Engineering

Reference Book (s)

1. A.K. Hajra Choudhury, S.K. Hajra Choudhury and Nirjhar Roy (2009), Elements of Workshop Technology, Vol. – I, Media Promoters, ISBN: 978-8-185-09914-9.
2. W.A.J.Chapman (2001), Workshop Technology, Vol 1, 5th Edition, CBS Publishers, ISBN: 978-8-123-90401-6.
3. P.N.Rao. (2008), Manufacturing Technology – Foundry, Forging and Welding (Vol-1), 3rd Edition, McGraw Hill Publishing Company Ltd., New Delhi, ISBN: 978-0-070-08798-9.

List of Experiments

1. Preparation of green sand mould using wooden pattern.
2. Determination of grain fineness number.
3. Determination of permeability number.
4. Determination of compressive and shear strength of moulding sand.
5. Preparation of casting using non-ferrous metals with the help of tilting furnace.
6. Preparation of butt joint using gas oxy acetylene gas welding.
7. Welding of stainless steel specimen using TIG welding.
8. Preparation of butt joint with V-groove using MIG welding.
9. To establish the relationship between cutting parameters of cutting speed, feed rate and depth of cut on forces generated in oblique cutting.
10. Study and identification of various types of flames generated in oxy-acetylene gas welding.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	--	50	100

Name of The Course	Machine Drawing Laboratory				
Course Code	BTME2005				
Prerequisite	BTME1002 Product Design using Graphics				
Corequisite					
Antirequisite					
		L	T	P	C
		0	0	2	1

Course Objectives:

1. To introduce the students to the basics and standards of engineering drawing related to machine elements.
2. To enable the students to draw sectioned views, development of surfaces and orthographic views of machine elements.
3. To train the students technical skills regarding part drawings, production and assembly drawings.

Course Outcomes

CO1	Draw and interpret sectioned solids and development of surfaces.
CO2	Explain various standards and specifications related to standard machine components.
CO3	Apply the knowledge of fits and tolerances for various applications.
CO4	Draw orthographic views of machine elements.
CO5	Select, configure and synthesize mechanical components into assemblies.

Text Book (s)

1. N.D. Bhatt (2011), Machine Drawing, Published by R.C.Patel, 46th Edition, Charotar Publishing House Book Stall, ISBN: 978-9-380-35846-8.

Reference Book (s)

1. K C John (2009), Engineering Graphics for Degree, Prentice Hall of India. ISBN: 978-8-120-33788-3.
2. Warren Luzadder and Jon M. Duff (2009), Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production, 11th Edition, PHI Learning, ISBN: 978-8-120-30885-5.
3. P.S. Gill (2012), Machine Drawing, S. K. Kataria & Sons, ISBN: 978-8-185-74979-2.
4. Ajeet Singh (2012), Machine Drawing (with AutoCAD), 2nd Edition, Tata Mcgraw Hill Education, ISBN: 978-0-071-07294-6.
5. Barclay James and Griffiths Brian (2002), Engineering Drawing for Manufature, Butterworth-Heinemann, ISBN: 978-1-857-18033-6.

Course Content:

Unit I: Sectioning of Solids and Development of Surfaces **6 Hours**
Selection of Views-Parts not usually sectioned- Development of Surfaces and application in sheet metal industry.
Unit II: Machine Drawing Conventions **4 Hours**
Need for drawing conventions- introduction to BIS conventions-Reference to hand book for the selection of

standards-Conventional representation of material, common machine elements and parts -Methods and general rules of dimensioning of holes, centers, curved and tapered features.
Unit III: Limits, Fits and Tolerances **4 Hours**
Limits, Fits and tolerances – Allocation of fits for various mating parts – Tolerance data sheet – Tolerance table preparation –Geometric tolerance.
Unit IV: Drawing of Machine Elements **10 Hours**
Drawing of the following machine elements: threaded fasteners and joints, keys, cotters and pin joints, welded and riveted joints, pipe joints, shaft coupling and pulleys, journals and bearings.
Unit V: Assembly Drawings **4 Hours**
Drawings of assembled views for the part drawings of the Engine parts and and other machine parts- Screw jack, Machine Vice, single tool post. Valves: Steam stop valve, feed check valve.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	--	50	100

Name of The Course	**Skill-1 (Solid Works)**				
Course Code	**BTME2006**				
Prerequisite	BTME1002 Product Design using Graphics				
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	0	0	2	1	

Course Objectives:

1. To enable students to use a modern CAD software package for solid modeling.
2. To draw 3D views of various machine elements.
3. To apply the knowledge of software package to model any chosen prototype.

Course Outcomes

CO1	Use SolidWorks software package for solid modeling.
CO2	Draw solid models of various machine elements in SolidWorks.
CO3	Apply the knowledge of SolidWorks to model any chosen prototype.

Text Book (s)

1. Matt Lombard, : Solidworks 2013 Bible", 2013, ISBN: 978-1-118-50840-4

Reference Book (s)

1.Greg Jankowski, Richard Doyle, "SolidWorks For Dummies", 2nd Edition, 2011 ISBN: 978-1-118-05147-4

	Unit	**Unit Topics**
Week 1(2Hours)	**1.Introduction to SOLIDWORKS**	• Introduction to SOLIDWORKS 2016 • Getting Started with SOLIDWORKS • Menu Bar and SOLIDWORKS Menus • Command Manager • Toolbar • Dimensioning Standard and Units • Important Terms and Their Definitions • Hot Keys • Color Scheme
Week 1 (2Hours)	**2. Drawing Sketches for Solid Models**	• The Sketching Environment • Starting a New Session of SOLIDWORKS 2016 • Task Panes • Starting a New Document in SOLIDWORKS 2016 • Understanding the Sketching Environment • Setting the Document Options • Learning Sketcher Terms • Drawing Sketch Entities • Drawing Display Tools • Deleting Sketched Entities

Week2(2Hours)	**3. Editing and Modifying Sketches**	• Editing Sketched Entities • Creating Patterns • Editing Patterns • Writing Text in the Sketching Environment • Modifying Sketched Entities
Week2(2Hours)	**4. Adding Relations and Dimensions to Sketches**	• Applying Geometric Relations to Sketches • Design Intent • Dimension a Sketch • Concept of a Fully Defined Sketch • Deleting Overdefined Dimensions • Opening an Existing File
Week3(2Hours)	**5. Advanced Dimensioning Techniques and Base Feature Options**	• Advanced Dimensioning Techniques • Measuring Distances and Viewing Section Properties • Creating Base Features by Extruding Sketches • Creating Base Features by Revolving Sketches • Determining the Mass Properties of Parts • Dynamically Rotating the View of a Model • Modifying the View Orientation • Restoring the Previous View • Displaying the Drawing Area in Viewports • Display Modes of a Model • Additional Display Modes • Assigning Materials and Textures to Models
Week3(2Hours)	**6. Creating Reference Geometries**	• Importance of Sketching Planes • Reference Geometry • Advanced Boss/Base Options • Modeling Using the Contour Selection Method • Creating Cut Features • Concept of Feature Scope
Week 4 (2Hours)	**7. Advanced Modeling Tools-I**	• Creating Simple Holes • Creating Standard Holes Using the Hole Wizard • Adding External Cosmetic Threads • Creating Fillets • Selection Options • Creating Fillets Using the FilletXpert • Creating Chamfers • Creating Shell Features • Creating Wrap Features
Week 4 (2Hours)	**8. Advanced Modeling Tools-II**	• Creating Mirror Features • Creating Linear Pattern Features • Creating Circular Pattern Features • Creating Sketch Driven Patterns • Creating Curve Driven Patterns

Week 5 (2Hours)		• Creating Table Driven Patterns. • Creating Fill Patterns • Creating Variable Patterns • Creating Rib Features • Displaying the Section View of a Model • Changing the Display States
Week 5 (2Hours)	**9. Editing Features**	• Editing Using the Edit Feature Tool • Editing Sketches of the Sketch-based Features • Editing the Sketch Plane Using the Edit Sketch Plane Tool • Editing Using the Instant3D Tool • Editing Features and Sketches byUsing the Cut, Copy, and Paste Options • Cutting, Copying, and Pasting Features and Sketches fromOne Document to the Other • Copying Features Using Drag and Drop • Deleting Features • Deleting Bodies • Suppressing Features • Unsuppressing the Suppressed Features • Unsuppressing Features with Dependents • Hiding Bodies • Moving and Copying Bodies • Reordering the Features • Rolling Back the Feature • Renaming Features • Creating Folders in the FeatureManager Design Tree • What's Wrong Functionality
Week 6 (2Hours)	**10. Advanced Modeling Tools-III**	• Creating Sweep Features • Creating Cut-Sweep Features • Creating Loft Features • Adding a Section to a Loft Feature • Creating Lofted Cuts
Week 6 (2Hours)		• Creating 3D Sketches • Creating Grid Systems • Editing 3D Sketches • Creating Curves • Extruding a 3D Sketch • Creating Draft Features
Week 7 (2Hours)	**11. Advanced Modeling Tools-IV**	• Advanced Modeling Tools • Creating Fastening Features • Creating Freeform Features • Dimensioning a Part Using DimXpert
Week 7 (2Hou	**3D Modelling Project**	• Use the concept of Reverse Engineering and Redesign the parts by measuring them using the Measuring Instrument

Week 8 (2Hours)	**3D Modelling Project**	• Use the concept of Reverse Engineering and Redesign the parts by measuring them using the Measuring Instrument
Week 8 (2Hours)	**12. Assembly Modeling-I**	• Assembly Modeling • Creating Bottom-up Assemblies • Creating Top-down Assemblies • Moving Individual Components • Rotating Individual Components • Moving and Rotating Individual Components Using the Triad • Assembly Visualization
Week 9 (2Hours)	**13. Assembly Modeling-II**	• Advanced Assembly Mates • Mechanical Mates • Creating Sub-assemblies • Deleting Components and Sub-assemblies • Editing Assembly Mates • Editing Components • Editing Sub-assemblies • Dissolving Sub-assemblies • Replacing Components
Week 9 (2Hours)		• Creating Patterns of Components in an Assembly • Copying and Mirroring Components • Copying a Component along with Mates • Simplifying Assemblies using the Visibility Options • Checking Interferences in an Assembly • Checking the Hole Alignment • Creating Assemblies for Mechanism • Creating the Exploded State of an Assembly
Week 10 (2Hours)	**14. Working with Drawing Views-I**	• The Drawing Mode • Starting a Drawing Document • Types of Views • Generating Standard Drawing Views • Generating Derived Views • Working with Interactive Drafting in SOLIDWORKS • Editing and Modifying Drawing Views • Modifying the Hatch Pattern in Section Views
Week 10 (2Hours)	**15. Working with Drawing Views-II**	• Adding Annotations to Drawing Views • Adding the Bill of Materials (BOM) to a Drawing • Linking Bill of Materials • Adding Balloons to the Drawing Views • Adding Balloons Using the AutoBalloon Tool • Creating Magnetic Lines • Adding New Sheets to the Drawing Views • Editing the Sheet Format • Creating User-Defined Sheet Formats

Week 11 (2Hours)	**16. Surface Modeling**	• Creating an Extruded Surface • Creating a Revolved Surface • Creating a Swept Surface • Creating a Lofted Surface • Creating a Boundary Surface • Creating a Planar Surface • Creating a Fill Surface • Creating a Radiated Surface • Offsetting Surfaces, Trimming Surfaces • Untrimming Surfaces
Week 11 (2Hours)		• Extending Surfaces, Knitting Surfaces ,Filleting Surfaces • Creating a Mid-Surface, Deleting Holes from Surfaces • Replacing Faces, Deleting Faces • Moving and Copying Surfaces • Mirroring Surface Bodies • Adding Thickness to Surface Bodies • Creating a Thicken Surface Cut, Creating a Surface Cut
Week 12 (4Hours) + Week 13 (2Hours)	**3D Modeling, Assembly and Drafting Project (Minimum 10 parts)** **Project Display**	• Use the concept of Reverse Engineering and Redesign the parts by measuring them using the Measuring Instrument • Creating Assemblies of parts created earlier • Drafting of the assembly model created • Student needs to demonstrate his project

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	--	50	100

Name of The Course	**PBL-1 (Machine Drawing/Mechanics)**				
Course Code	**BTME2007**				
Prerequisite	BTME1002 Product Design using Graphics				
Corequisite	BTME2005 Machine Drawing Lab				
Antirequisite					
		L	**T**	**P**	**C**
		0	0	2	1

Course Objectives:

1. To enable the students to have a hands on experience of application of machine drawing in the field.
2. To enable the students to develop soft models of assemblies and components of machines and automobiles.
3. To help the students reflect on the inputs in machine drawing gained in the class room and explore associated areas.

Course Outcomes

CO1	Apply the concepts learnt in the machine drawing lab to design various machine components.
CO2	Model geometrically the mechanical devices and parts of machines/automobiles using modeling softwares.
CO3	Illustrate the measurement techniques for dimensions and curvatures for different views of the component.
CO4	Select the appropriate tools and their relevance to implement the project.
CO5	Summarize the design modifications based on the study of machine elements.

Text Book (s)

1.N.D. Bhatt (2011), Machine Drawing, Published by R.C.Patel, 46th Edition, Charotar Publishing House Book Stall, ISBN: 978-9-380-35846-8.

Reference Book (s)

1.K C John (2009), Engineering Graphics for Degree, Prentice Hall of India. ISBN: 978-8-120-33788-2.
2.Warren Luzadder and Jon M. Duff (2009), Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production, 11th Edition, PHI Learning, ISBN: 978-8-120-30885-5.
3.P.S. Gill (2012), Machine Drawing, S. K. Kataria & Sons, ISBN: 978-8-185-74979-2.
4.Ajeet Singh (2012), Machine Drawing (with AutoCAD), 2nd Edition, Tata Mcgraw Hill Education, ISBN: 978-0-071-07294-6.
5.Barclay James and Griffiths Brian (2002), Engineering Drawing for Manufacture, Butterworth-Heinemann, ISBN: 978-1-857-18033-6.

Thrust areas of projects in geometric modeling with tentative project titles

1. Lathe Machine Components and Assembly
2. Drilling Machine Components and Assembly

3. Automobile Components and Assembly
4. Household Appliances
5. Industrial Equipments
6. Construction Equipments
7. Electrical Machines
8. Computers and Accessories
9. Office Equipments
10. Gadgets
11. I.C. Engine Parts
12. ……..
13. ……..

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
50	--	50	100

Name of The Course	Mechanics of Materials				
Course Code	BTME2008				
Prerequisite	BTME2001-Engineering Mechanics				
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

1. To develop the relationship between the loads applied to a non-rigid body, the internal stresses and deformations induced in the body.
2. To study the general state of stresses and strains in a given loaded member and the magnitude and direction of the principal stresses
3. To understand the different approaches to calculate slope and deflection for various types of beams.
4. To analyze the columns with different edge conditions by using different theories.

Course Outcomes

CO1	Understand the basics of simple stress and strain
CO2	Draw Mohr's circle and solve problems involving biaxial state of stress.
CO3	Apply theory of simple bending for analysing problems.
CO4	Calculate deflection of various beams of different shapes.
CO5	Calculate torsion in shafts and buckling load of column.

Text Book (s)

1. S. S. Rattan (2011) Strength of material Tata McGraw Hill Education. ISBN: 978-0-071-07256-4.

Reference Book (s)

1. S.P. Timoshenko and D.H. Young (2011), Strength of Materials, 5th edition, East West Press Ltd, ISBN: 978-8-176-71019-0.

2. R.K. Bansal (2010), Strength of Materials, 5th Edition, Laxmi Publications, ISBN: 978-8-131-80814-6.

Course Content:

Unit I: Stresses and Strains **8 Hours**
Definition/derivation of normal stress, shear stress, and normal strain and shear strain – Stress-strain diagram- Elastic constants – Poisson's ratio – relationship between elastic constants and Poisson's ratio – Generalized Hook's law – Strain energy – Deformation of simple and compound bars – thermal stresses.
Unit II: Bi-axial Stress system **8 Hours**
Biaxial state of stress – Stress at a point – stresses on inclined planes – Principal stresses and Principal strains and Mohr's circle of stress, Theories of failure Thin cylinders and shells – deformation of thin cylinders and shells; Thick Cylinders, Shrink fits, Compounding. Fundamentals of theory of elasticity.

Unit III: Simple Bending **8 Hours**
Types of beams: Cantilever, Simply supported, Overhanging: Shear Force and Bending Moment Diagrams. Theory of simple bending – bending stress and shear stress in beams.
Unit IV: Deflection of Beams **8 Hours**
Deflection of beams by Double integration method – Macaulay's method – Area moment theorems for computation of slopes and deflections in beams – Conjugate beam method.
Unit V: Torsion and columns **8 Hours**
Introduction to Torsion – derivation of shear strain – Torsion formula – stresses and deformations in circular and hollow shafts – Stepped shafts – shafts fixed at the both ends Theory of columns – Long column and short column - Euler's formula – Rankine's formula - Secant formula - beam column.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Fluid Mechanics				
Course Code	BTME2009				
Prerequisite					
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

1. Understand fluid behaviour for engineering design and control of fluid systems.
2. Develop competence with mass, energy and momentum balances.
3. Study the development of boundary layers.

Course Outcomes

CO1	Explain the properties of fluid and its kinematics.
CO2	Categorize the types of flow and applications of governing equations in a fluid flow system.
CO3	Examine the losses of fluid flow through pipes and study about pipe network design.
CO4	Calculate the dependent and independent parameters of fluid flow.
CO5	Examine the boundary layer and no-slip boundary condition in the fluid flow.

Text Book (s)

1. R. K. Bansal (2010), A Textbook of Fluid Mechanics and Hydraulic Machines, 9thEdition, Laxmi Publication (P) Ltd., New Delhi. ISBN- 978-8-131-80815-3
2. G.K. Batchelor, An Introduction to Fluid Dynamics, Cambridge Mathematical Library, ISBN: 9780521663960

Reference Book (s)

1. Yunus A. Çengel (2010), Fluid Mechanics, Tata McGraw Hill, ISBN: 978-0-070-70034-5.
2. Frank M. White (2011), Fluid Mechanics, 7th edition, Tata McGraw-Hill Education, ISBN- 978-0-071-33312-2.

Course Content:

Unit I: Fluid Properties and Hydrostatics **6 Hours**
Density, Viscosity, Surface tension, compressibility, capillarity, Hydrostatic forces on plane, inclined and curved surfaces, buoyancy, centre of buoyancy, metacentre.
Unit II: Fluid Dynamics **6 Hours**
Control volume, Fluid Kinematics, Types of flows; Steady flow, Unsteady flow, Uniform and Non Uniform flow, Rotational flow, Irrotational flow, 1-D, 2-D, 3-D flows– Streamline and Velocity potential lines, Euler and Bernoulli's equations and their applications, moment of momentum, Momentum and Energy correction factors, Impulse, Momentum equation- Navier-Stokes Equations, Applications.
Unit III: Open & Closed Channel Flow **12 Hours**
Open Channels Flow, Laminar & turbulent flow through pipes, Darcy's law, Minor losses, Multi reservoir problems, Moody's diagram, Hagen Poiseuille equation, Turbulent flow, Specific Energy, Critical flow concept,

Hydraulic jump, uniform flow and gradually varying flow concepts, Pipe network design, Measurement of pressure and flow, Measurement of pipe flow, velocity through pipes and open channels.
Unit IV: Dimensional Analysis **10 Hours**
Dimensional homogeneity, Raleigh and Buckingham π theorems, Non-dimensional numbers, Model laws and distorted models, Module quantities, Specific quantities
Unit V: Boundary layers **6 Hours**
Boundary layers, Laminar flow and Turbulent flow, Boundary layer thickness, momentum- Integral equation, Drag and lift, Separation of boundary layer, Methods of separation of boundary layer.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Manufacturing Processes II and Metrology**				
Course Code	**BTME2010**				
Prerequisite	BTME2003- Manufacturing Processes I				
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	3	0	0	3	

Course Objectives:

1. To get acquainted with the theory of metal cutting, mechanism of machining and the parameters that influences the machining processes.
2. To get basic idea about different conventional and non conventional machining processes.
3. To gain knowledge of various instruments for linear measurement, angular measurement and surface finish etc

Course Outcomes

CO1	Explain the mechanism of chip formation in machining.
CO2	Describe the various machining processes such as turning, drilling, boring, shaping, slotting, milling and grinding.
CO3	Illustrate the principle of gear generation process.
CO4	Illustrate the working principle of Non-traditional machining processes.
CO5	Explain the principle of different metrology instruments.

Text Book (s)

1. P.C. Sharma, (2008), Text book of Production Technology, 7th Edition, S. Chand & Company Ltd, New Delhi, ISBN: 978-8-121-91114-6.
2. O.P. Khanna & M. Lal (2010), A Text book of Production Technology, Dhanpat Rai Publications, New Delhi, ISBN: 978-8-189-92832-2.

Reference Book (s)

1. S. Kapakjianand S.R. Schmid (2005), Manufacturing Engineering and Technology, 4thEdition, Pearson Education (Singapore) Pvt. Ltd. ISBN: 978-8-177-58170-6.

Course Content:

Unit I: Theory of Metal Cutting	**10 Hours**
Mechanism of chip formation – Tool Specification System- Tool signature for single point & Multi-point cutting Tools- Orthogonal and Oblique cutting – Single Point and Multipoint Cutting Tools-Machining forces - Merchant's Circle Diagram - Thermal aspects of metal machining - Cutting fluids - Machinability - Cutting tool materials - Tool wear and Tool life calculations.	
Unit II: Lathe and Basic Machine Tools	**08 Hours**
Lathe - Types - Operating Parameters - lathe operations – Tool nomenclature - Work holding devices. Shaping - Planing - Slotting – Drilling - Boring – Reaming – Tapping – Broaching.	
Unit III: Milling, Grinding Machines and Gear Generation	**08 Hours**

Milling machines - Cutters - Milling operations - Indexing. Grinding – Types of grinding machines - Grinding wheel designation and selection - Bond and Bonding processes. Gear generating principles - Gear Hobber - Gear finishing methods - Bevel gear generator
Unit IV: **Non-traditional Machining Processes** **07 Hours**
Classification of Nontraditional Machining process – Principle of AJM, WJM, USM, EDM, ECM, LBM - Process characteristics – Applications
Unit V: Metrology and Instrumentation **07 Hours**
Measurement standards - Linear, angular and form measuring instruments – Comparators – Gauge blocks – Gauges - Optical instruments – Profilometer – Coordinate measuring machine

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Probability and Statistics**				
Course Code	**MATH2003**				
Prerequisite					
Corequisite					
Antirequisite					
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

The aim of this course is to introduce students to the basic concepts of probability distributions and their applications. The course also serves as a foundation to analyze problems in Science and Engineering applications through statistical testing methods.

Course Outcomes

CO1	Define the basic concepts of Probability theory and Random variables.
CO2	Identify the type of distribution and Apply it in problem solving.
CO3	Apply the concept of correlation and Regression.
CO4	Explain the concepts of sampling distributions and estimation theory and apply it to estimate the confidence intervals.
CO5	Apply statistical tests to solve the hypothesis testing problems.

Text Book (s)

1. R. E. Walpole, R. H. Mayers, S. L. Mayers and K. Ye (2007), Probability and Statistics for Engineers and Scientists, 9th Edition, Pearson Education, ISBN:978-0-321-62911-1.
2. Sheldon M. Ross (2011), Introduction to Probability and Statistics for Engineers and Scientists, 4th Edition, Academic Foundation, ISBN:978-8-190-93568-5.

Reference Book (s)

1. Douglas C. Montgomery (2012), Applied Statistics and Probability for Engineers, 5th Edition, Wiley India, ISBN: 978-8-126-53719-8.
2. M. R. Spiegel, J. Schiller and R. A. Srinivasan(2010), Probability & Statistics, 3rd Edition, Tata-McGraw Hill, ISBN:978-0-070-15154-3.

https://nptel.ac.in/courses/111105041/

Course Content:

Unit I: Variables and probability Distributions	**12 Hours**
Review of Probability, Probability density function, Cumulative distribution function, Expectation and Variance. Binomial, Poisson and Geometric distributions, Probability density function, Cumulative distribution function, Expectation and Variance, Uniform, Normal, Exponential distributions, Joint distribution and joint density functions, Conditional distribution.	
Unit II: Correlation and Regression	**8 Hours**
Curve fitting by method of least squares, Fitting of straight lines, Polynomials, Exponential curves, Correlation, Rank correlation, Regression analysis, Linear and non-linear regression, Multiple regression.	

Unit III: Sampling and Estimation Theory	**10 Hours**
Population and sample, Statistical inference, Sampling with and without replacement, Random samples, Population parameters, Sample statistics, Sampling distributions, Sample mean, Sampling distribution of means, Sample variances, Sampling distribution of variances, Case where population variances is unknown, Estimators, Point and Interval Estimation, Confidence Interval estimates of population parameters, Confidence intervals for variance of a Normal distribution, Maximum likelihood estimates.	
Unit IV: Tests of Hypothesis and Significance	**10 Hours**
Statistical hypothesis, Null and Alternate hypothesis, test of hypothesis and significance, Type I and Type II errors, Level of Significance, Tests involving the Normal distribution, One-Tailed and Two-Tailed tests, P value, Special tests of significance for Large and Small samples (F, chi- square, z, t- test), one way ANOVA.	

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	**Organisation Behaviour**				
Course Code	**BBAD 1014**				
Prerequisite					
Corequisite					
Antirequisite					
		L	**T**	**P**	**C**
		3	0	0	3

Course Outcomes

CO1	Use the basic foundations of Organizational Behaviour and the knowledge of the concepts of perception and personality to illustrate their effects on individual behaviour in organizational settings.
CO2	Relate to the process of learning, attitude formation and pattern of individual values for effective management among employees in organizations.
CO3	Illustrate how interpersonal skills have an impact on groups and team work in an organization, explaining the behavioral patterns of human beings at individual and group levels for building high-performing teams.
CO4	Compare various motivational theories and identify the most effective leadership styles in different organizational settings.
CO5	Illustrate various techniques for managing conflicts within organizations and discuss the basic nature of organizational change while handling stress effectively.

Text Book (s)

1. Arora, M. N. (2012). A Textbook of Cost and Management Accounting, New Delhi
2. L.M. Prasad, 5th Edition, Sultan Chand and Sons, 2014.

Reference Book (s)

1. P.G. Aquinas, 2nd Edition, Excel Books, 2013.Horngren, C. T., Sundem, G. L., & Stratton, W. O. (2009). Introduction to Management Accounting,
2. John M. Ivancevich, Robert Konopaske and Michael T. Matteson, 9th Edition, Tata McGraw Hill Education Pvt. Ltd., 2012.

Course Content:

Unit I:Role of Individuals in understanding of Organisational Behaviour 8 Hours
The purpose of this module is to understand the nature of organizational behaviour and identify the research foundations of OB. Also the module analyzes the role of perception and personality of individual for managers and suggests measures of developing perceptual skills.
Unit II: Learning, Attitudes and Values 6 Hours
This module discusses the learning concept and its implications for organizational behaviour. The focus is to understand through classical and Operant conditioning theories how learning takes place in organizational settings. The module emphasises to understand the nature and role of attitudes and values in human behaviour. It makes students understand how attitudes and values are formed in an individual; also understand how attitudes and values can be managed effectively.
Unit III: Group & Team dynamics for effective Interpersonal Relationships 8 Hours

This module discusses the nature of group dynamics. It also examines the behaviour of different groups that exist in the organization-both formal and informal. Also it makes students understand the synergy in teams. The module also focuses on understanding the importance of interpersonal behaviour at workplace, analyze and improve interpersonal behaviour through transactional analysis.

Unit IV: Motivation and Leadership **6 Hours**

The module discusses the concept of motivation and the way it affects human behaviour, understand various theories of motivation for identifying how people are motivated. The module also discusses the contents of leadership as a process of influence, understand various theories so as to identify how leaders emerge and various leadership styles so that managers can adopt suitable styles.

Unit V: Stress and Conflict Management and Change Management **9 Hours**

The module discusses the nature and causes of stress, understand the impact of stress on behaviour and identify the strategies for coping stress effectively. Module also focuses on understanding the nature and causes of organizational conflicts, identify the levels at which conflicts emerge and adopt the strategies for minimising the negative consequences of conflicts. The module also discusses the basic nature of organizational change and reasons behind this. The module will acquaint students with the reasons for resistance to change and strategies to overcome it.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Microeconomics**				
Course Code	**BBAD1003**				
Prerequisite					
Corequisite					
Antirequisite					
		L	**T**	**P**	**C**
		3	0	0	3

Course Outcomes

CO1	Describe basic concepts and techniques of microeconomic analysis and their applications to managerial decision-making to sustain the business in long-run.
CO2	Explain how demand and supply analysis helps in clearing markets and understand the concepts and determinants of demand and supply elasticities.
CO3	Demonstrate how a consumer maximizes his utility subject to constraints and the concept of consumer surplus.
CO4	Use concepts of production, costs and revenue in determining equilibrium of the producer with the help of iso-quants and iso-cost lines.
CO5	Differentiate between different kind of market forms and their short run and long run equilibrium positions.

Text Book (s)

1.Microeconomics (Connect for McConnell), Campbell R. McConnell; Stanley L. Brue; Sean M. Flynn

Reference Book (s)

1. D. N. Dwivedi, (2012), 2e, Pearson Education., Microeconomics: Theory and Applications,
2. Neva Goodwin, Nelson 2nd edition.(2009), PHI Learning, Microeconomics in context
3. N. Gregory Mankiw, 4e, Thomson: South-Western, Principles of Microeconomics
4. Koutsoyiannis, ELBS, Modern Microeconomics
5. Geetika, Piyali Ghosh, 2e McGraw-Hill, Managerial Economics
6. S. Prusty, PHI., Managerial Economics
7. Paul A. Samuelson & William D. Nordhaus, 17e, McGraw-Hill, Economics

Course Content:

Unit I: Introduction to Microeconomics	**5 Hours**
Introduction to Microeconomics: Economics is a Social Science, Two Major Branches of Economics, Microeconomics As a positive Science, Microeconomics As a normative Science, The Uses of Microeconomic Theories, Limitations of Microeconomic Theories, Case study: Government Intervention	
Unit II: Supply-Demand Analysis	**10 Hours**
The Concept of Market, The Demand Side of the Market: Meaning, Law of Demand, The Demand Side of the Market: Factors behind the Law of Demand, The Supply Side of the Market: Meaning, Law of Supply, The Supply Side of the Market: Shifts in the Supply Curve, The Market Equilibrium: Market Mechanism, Graphical Illustration of Price Determination, The Elasticity of Demand, Price Elasticity of Demand: Measuring Arc and Point Elasticity of Demand Determinants of Price Elasticity of Demand, Price Elasticity of Supply: Definition and Measurement, Determinants of Price Elasticity of Supply, Mathematical Illustrations on Price Elasticity of Demand& Supply, Case Study.	

Unit III Consumer Behaviour **6 Hours**

Theory of Consumer Demand: Utility Approach, Cardinal utility approach, The Law of Diminishing Marginal utility, Consumer Equilibrium, Ordinal utility approach ,Properties of Indifference curves, consumer Equilibrium, Marshallian Concept of Consumer Surplus

Unit IV: Production Analysis, Cost of Production, and Profit Analysis of the Firm 10 Hours

Meaning of Production, Input and output, Theory of production in short-run [relationship among total, average and marginal productivity of labour, law of diminishing returns]
Theory of production in long-run [expansion path, and returns to scale], The Isoquant curve, Derivation and properties of Isoquant curve, Isoquant map and economic region of production, Cobb-Douglas production function and returns to scale, Types of costs in short-run [fixed, variable, total, average, marginal, break-even analysis, shut-down point]
Types of costs in long-run [total, average, marginal, and inter-relationships], Mathematical Illustrations

Unit V: Market structure **9 Hours**

Perfectly competitive market [characteristics, supply and demand curve] Case study: Outsourcing to India: Way to Fast Track, Perfectly competitive market [profit maximizing price determination in short-run and long-run], Monopoly [characteristics, demand curve], Cost and Revenue curves under monopoly, Price Discrimination under monopoly, Monopolistic Competition [characteristics, supply and demand curve, profit maximizing price determination in short-run and long-run, Monopolistic competitive market [product differentiation (advertising and brand names), solve problems], Excess Capacity under Monopolistic competition (solve problems]

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Financial Management				
Course Code	BBAD 2007				
Prerequisite					
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives

1. To acquire basic knowledge about the financial management practices in busienss organizations
2. To acquire knowledge about various methods of capital budgeting, captial structuring, dividend payouts and workign capital management.
3. To understand capital budgeting, dividend payment in detail and application of these in real world scenarios.

Course Outcomes

CO1	Describe the theory and practice of corporate finance techniques using Time value of Money.
CO2	Assess common investment criteria and project cash flows associated with corporate project evaluation.
CO3	Relate how risk and the cost of capital impact on investment appraisal, and understand how this cost is impacted by taxation, "leverage" and other factors.
CO4	Relate the theories of capital structure and Assess the external and internal influences on a corporation's capital structure, payout policy.
CO5	Apply techniques of working capital, receivables and investment management for long term financing of the firm.

Text Book (s)

1. Financial Management - I M Pandey, Vikas Publishing House Pvt. Ltd.

Reference Book (s)

1. Financial Management and Policy - Van Home, J.C, Prentice Hall of India.
2. Corporate Finance : Theory and Practice - Charles P Jones, John Wiley
3. Financial Management - Prasanna Chandra, Tata McGraw Hill
4. Financial Management - Khan & Jain, Tata McGraw Hill

Course Content:

Unit I: Introduction and Time Value of Money **6 Hours**
Introduction to Financial Management,Nature and scope of Financial Management, Finance functions, Role of finance manager, Financial goal: Profit maximization Vs wealth maximization, Concept of agency and agency problem. Time Preference for money, Future Value- Single Cash flow, Annuity, Sinking Fund ,Present Value- Single Cash flow, Valuation of Bonds and shares, Risk and Return, Exercises on Future Value, Present Value, and Bonds Valuation
Unit II: Investment Decisions **10 Hours**
Risk Analysis in Capital Budgeting. Investment Evaluation Criteria: NPV based numerical, IRR: Concept, Limitations and its significance, Payback: Meaning, and calculating payback periods, ARR: Meaning, Scope, and

calculating ARR, Profitability Index: Meaning, Nature, Significance, and functions, calculating Practical exercises having calculation of various capital budgeting decisions collectively like NPV, PI and PB simultaneously etc. Case Study: Hola-Kola-The Capital Budgeting Decision by Lena Booth
Unit III: Cost of Capital and Leverage Analysis **10 Hours**
Cost of capital: Concept, Significance, nature, and factors affecting cost of capital, Cost of Debt, Preference Shares, Equity Shares, Weighted Average Cost of Capital(WACC). EBIT-EPS Analysis, Leverage analysis-Operating, Financial and Combined Leverage.
Unit IV: Capital structure and Dividend Decisions **10 Hours**
Theories of Capital structure, Net Income (NI),Traditional, Net Operating Income(NOI) Approach, MM Hypothesis. Dividend: Concept, meaning, types, and significance for stakeholders, Theories/Models in dividend policy, Walter, Gordon MM (Miller Modigliani) Hypothesis and theory, Determinants of dividend policy.
Unit V: Working Capital Decisions **5 Hours**
Working Capital Management: Concept, meaning, objectives, types and significance, Principles of working capital management, Receivables Management, Inventory Management- EOQ, Reorder Level, Cash Management.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Fluid Mechanics Laboratory**				
Course Code	**BTME2011**				
Prerequisite	BTME2009 Fluid Mechanics				
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	0	0	2	1	

Course Objectives:

1. To provide practice in estimating friction losses.
2. To impart training to use various flow measuring devices for making engineering judgments.

Course Outcomes

CO1	Demonstrate the basic measurement techniques of fluid mechanics.
CO2	Apply the basic laws of fluid mechanics in flow measurement.
CO3	Calculate the frictional losses in fluid flow.
CO4	Experiment with flow measurement devices like venturimeter and orifice meter.
CO5	Predict the coefficient of discharge for flow through pipes.

Text Book (s)

1. R. K. Bansal (2010), A Textbook of Fluid Mechanics and Hydraulic Machines, 9thEdition, Laxmi Publication (P) Ltd., New Delhi. ISBN- 978-8-131-80815-3

Reference Book (s)

1.Yunus A. Çengel (2010), Fluid Mechanics, Tata McGraw Hill, ISBN: 978-0-070-70034-5

COURSE CONTENT

1. Conducting experiments to verify Bernoulli's theorem.
2. Determination of the Coefficient of discharge and coefficient of velocity for the given Orifice meter.
3. Determination of the Coefficient of discharge of given Venturi-meter.
4. Determination of the Coefficient of discharge of given Rectangular notch.
5. Determination of the Coefficient of discharge of given 'V' notch.
6. Comparative study of head loss in pipes connected series and parallel.
7. Study of fluid flow types using Reynolds apparatus.
8. Determination of drag force at different incidence angle in wind tunnel.
9. Determination of metacentric height.
10. Determination of the Reynolds no. in fluid flows.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	--	50	100

Name of The Course	Mechanics of Materials Laboratory				
Course Code	BTME2012				
Prerequisite					
Corequisite					
Antirequisite					
		L	T	P	C
		0	0	2	1

Course Objectives:

To supplement the theoretical knowledge gained in Strength of Materials with practical testing under applied loads. This would enable the student to have a clear understanding of the design for strength and stiffness.

Course Outcomes

CO1	Conduct tension and compression tests on standard specimens.
CO2	Calculate impact strength of standard specimen.
CO3	Determine spring constant of closed and open coil helical spring.
CO4	Calculate the fatigue strength of given specimens.
CO5	Calculate hardness of specimens, and determine the young's modulus of material by deflection test.

Text Book (s)

1. Lab Manual prepared by SOME

Reference Book (s)

1. S. S. Rattan (2011), Strength of Material, Tata McGraw Hill Education.
2. S.P. Timoshenko and D.H. Young (2011), Strength of Materials, 5th edition, East West Press Ltd.
3. R.K. Bansal (2010), Strength of Materials, 5th Edition, Laxmi Publications.

COURSE CONTENT

1. To determine Brinell Hardness Number (BHN) for the given material of the specimen.
2. To determine Rockwell Hardness Number (RHN) for the given material of the specimen.
3. To determine the stiffness and modulus of rigidity of open coil helical spring.
4. To determine the stiffness and modulus of rigidity of closed coil helical spring.
5. To determine the impact strength for the given specimen using Charpy test.
6. To determine the impact strength for the given specimen using Izod test.
7. To determine the Young's modulus of the given material by conducting the deflection test.
8. To study the fatigue strength for the given specimen using Fatigue test.
9. To determine the Young's modulus by conducting tension test on a given mild steel specimen.
10. To determine the Maximum compressive strength by conducting compression test on a given specimen on UTM.
11. To study the strain aging behavior of steel (associated with the yield-point phenomena) using load-elongation curve obtained from tensile test.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	--	50	100

Name of The Course	**Manufacturing Processes II and Metrology Laboratory**				
Course Code	**BTME2013**				
Prerequisite	BTME1003, Product Manufacturing				
Corequisite					
Antirequisite					
		L	**T**	**P**	**C**
		0	0	2	1

Course Objectives:

1. To learn and identify parts of a Lathe Machine and different operations on a Lathe.
2. To become skilled to handle and use drilling, lathe, milling and surface grinding machines.
3. To gain hands on practices in measurements and measuring instruments

Course Outcomes

CO1	Develop a component using basic operations of lathe and drilling machine.
CO2	Produce a component using milling and shaper machine.
CO3	Create a single point cutting tool with various angles using tool and cutter grinder
CO4	Measure the different measurements using measuring instruments and analyse the errors.

Text Book (s)

1. Manufacturing Processes II and Metrology Lab manual prepared by faculties of School of Mechanical Engineering.

Reference Book (s)

1. Manufacturing Practices Lab Manual, SOME, Galgotias University, Dr. P. Tamilchelvan, 2016.
2. Metrology Lab Manual, SOME, Galgotias University, Dr. P. Tamilchelvan, 2016.
3. A.K. Hajra Choudhury, S.K. Hajra Choudhury and Nirjhar Roy (2010), Elements of Workshop Technology, Vol. – II, Media Promoters, ISBN: 978-8-185-09915-6.
4. Manufacturing Engineering and Technology, S. Kapakjian and S.R. Schmid, 4th Edition, Pearson Education (Singapore) Pvt. Ltd. (2005) ISBN: 978-8-177-58170-6.

COURSE CONTENT

1.Lathe Exercise – Facing, Straight turning, knurling, chamfering, Thread cutting operations using Lathe Machine
2. Drilling - Countersinking and Tapping using Drilling Machine.
3. End milling and Gear cutting using Milling Machine.
4. Surface finishing using Surface Grinding Machine.
5. Grinding of single point cutting tool using Tool and Cutter Grinder.
6. Machining a block on shaper machine.
7. Study & working of simple measuring instruments like Vernier calipers and micrometer.
8. Measurement of effective diameter of a screw thread.
9. Measurement of angle using sine bar & slip gauges.
10. Study & angular measurement using bevel protector.
11. Measurement of various angles of SPCT (Single Point Cutting Tool-HSS) using Tool maker's Microscope.
12. Measurement of various dimensions of spur gear using Optical Profile Projector.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	--	50	100

Name of The Course	PBL – 2 (Material Microstructures)				
Course Code	BTME 2014				
Prerequisite	BTME 2015 Materials Science				
Corequisite					
Antirequisite					
		L	T	P	C
		0	0	2	1

Course Objectives:

1. To enhance the basic knowledge acquired by the students in the discipline of materials science and engineering by making it more project oriented.
2. To provide the knowledge about the micro structural characterisation and analysis of different engineering materials.
3. To introduce the concepts of structure-property relationships.

Course Outcomes

CO1	Describe the process to obtain microstructures.
CO2	Analyze the materials microstructure for different engineering materials.
CO3	Demonstrate the shape, size and arrangement of grains in materials.
CO4	Compare the microstructure grain size variation with the mechanical properties
CO5	Explain the grain growth and grain refinement of steel after heat treatment

Text Book (s)

1."ASM Handbook Volume 9: Metallography and Microstructures" by George F. Vander Voort

Reference Book (s)

1. "Characterization of Metals and Alloys (Materials Characterization Series)" by Paul H. Holloway and P.N. Vaidyanathan
2. "Materials Characterization: Introduction to Microscopic and Spectroscopic Methods" by Yang Leng
3. "An Introduction to Material Characterization" by Khangaonkar P R
4. "Characterization of Materials" by Mitra P.K
5. "Microstructural Characterization of Materials" by David Brandon and Wayne D. Kaplan
6. "Materials Characterization Techniques" by Sam Zhang and Lin Li
7. "Molecular Materials: Preparation, Characterization, and Applications" by Sanjay Malhotra and B. L. V. Prasad
8. "Characterization of Metals and Alloys (Materials Characterization Series)" by Paul H. Holloway and P.N. Vaidyanathan
9. "Materials Characterization: Introduction to Microscopic and Spectroscopic Methods" by Yang Leng

Thrust areas of projects with tentative project titles

1. Establish correlation of microstructure developed due to different heat treatment with tensile strength of plain carbon steel.

2. Develop relation of microstructure arises because of different heat treatment with hardness of plain carbon steel.
3. Establish correlation of microstructure developed due to different heat treatment with impact toughness of plain carbon steel.
4. To find effect of cutting parameters on microstructure of surface produced in case of planning.
5. To find effect of heat input on microstructure of weld produced in shielded metal arc welding.
6. To find effect of heat input on microstructure of weld produced in metal inert gas welding.
7. To find effect of heat input on microstructure of HAZ produced in shielded metal arc welding.
8. To find effect of heat input on microstructure of HAZ produced in shielded metal arc welding.
9. Compare the microstructure of weld and HAZ for weld joint of shielded metal arc welding and metal inert gas welding.
10. Compare the microstructure of austenitic, ferritic and martensitic stainless steel.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
50	--	50	100

Name of The Course	Kinematics of Machines				
Course Code	BTME3002				
Prerequisite	BTME2001 Engineering Mechanics				
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

1. To familiarize students with basic types of mechanisms, joints and degrees of freedom to perform position, velocity and acceleration analysis using graphical and analytical methods.
2. To provide students an understanding of different types of mechanisms.
3. To teach the basics of synthesis of simple mechanisms.
4. To teach students the kinematic analysis of cam-follower motion and gear train configurations.

Course Outcomes

CO1	Understand the concepts of various mechanisms and pairs.
CO2	Analyze the displacement, velocity and acceleration of different links in a simple mechanism.
CO3	Synthesize simple mechanisms based on the given input conditions.
CO4	Draw the profile of cam for different types of follower motions.
CO5	Apply kinematics principle to gears operation.

Text Book (s)

1. S.S. Rattan (2009), "Theory of Machines", 3rd Edition, Tata McGraw-Hill. ISBN: 978-0-070-14477-4.

Reference Book (s)

1. J. Uicker John, Gordon R. Pennock Jr. and Joseph E. Shigly (2011), Theory of Machines and Mechanisms, 4th Edition, Oxford University Press, ISBN: 978-0-199-77781-5.
2. Thomas Bevan (2009), Theory of Machines, 3rd Edition, Pearson Education, ISBN: 978-8-131-72965-6.
3. A. Ghosh (2009), Theory of Mechanisms and Machines, 3rd Edition, East-West Press Pvt. Ltd., New Delhi, ISBN: 978-8-185-93893-6.
4. Kenneth J Waldron and Gary L. Kinzel (2007), Kinematics, Dynamics, and Design of Machinery, 2nd Edition, John-Wiley and Sons Inc., New York, ISBN: 978-8-126-51255-3.

Course Content:

Unit I: Basics of Mechanisms **8 Hours**
Introduction to mechanisms and its terminologies - Degree of freedom – Mobility - Kutzbach criterion - Grubler's criterion for planar mechanisms - Grashoff's law - Kinematic InVersion 2.2s of 4-bar chain - Single slider and double slider crank chains - Quick return mechanism - Limiting positions - Mechanical advantage - Transmission angle - Ratchets and escapements – Indexing Mechanisms – Rocking Mechanisms – Straight line generators.
Unit II: Kinematic Analysis of Simple Mechanisms **8 Hours**
Displacement, velocity and acceleration analysis in simple mechanisms having turning, sliding and rolling pair -

Coriolis acceleration using graphical relative motion method - Instantaneous center method - Four bar and slider crank mechanisms - Analytical method for four bar and slider crank mechanisms.

Unit III: Synthesis of Simple Mechanisms **8 Hours**

Classification of kinematic synthesis problems - Two position synthesis of slider crank and crank rocker mechanisms - Three position synthesis of double rocker mechanism - Chebychev spacing - Freudenstein analytical method - synthesis of function generator using three precision positions, Graphical and analytical design of a four bar linkage for body guidance, path generation by graphical method.

Unit IV: Kinematics of CAMS **8 Hours**

Types of cams and followers - Definitions related cam profile - Derivatives of follower motion – High speed cams – Undercutting - Graphical disk cam profile design - Simple harmonic motion, Constant acceleration and deceleration, constant velocity, Cycloidal motion for knife edge and roller (in-line and offset), flat faced and oscillating followers - Tangent cam with roller follower - circular arc cam with flat faced follower.

Unit V: Kinematics of Gears and Gear Train **8 Hours**

Spur gear terminology and definitions - Law of toothed and involute gearing - Interchangeable gears - Gear tooth action - Interference and undercutting - Basics of nonstandard gear teeth -Helical – Bevel – Worm - Rack and pinion gears, cycloidal tooth properties - Comparison of involute and cycloidal tooth forms.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Machine Design**				
Course Code	**BETM3013**				
Prerequisite	BTME2008, BTME3002				
Corequisite					
Antirequisite					
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To understand the design methodologies for various machine elements.
2. To understand the various standards and methods of standardization
3. To produce working drawings of the system involving shafts, couplings, joints and bearings.

Course Outcomes

CO1	Understand and implement the design process in machine elements.
CO2	Apply fatigue failure criteria in the analysis and design of mechanical components.
CO3	Design and analyze the power transmission in shafts and couplings carrying different elements under various loading conditions.
CO4	Design and analyze the permanent and detachable structural joints under various loading conditions.
CO5	Design and analyze the sliding and rolling contact bearings.

Text Book (s)

1. V.B. Bhandari (2010), Design of Machine elements, 3rd Edition, Tata McGraw Hill.ISBN: 978-0-070-68179-8.

2. V.B. Bhandari (2014), Machine Design Data Book, 1st Edition, Tata McGraw Hill. ISBN: 978-9-351-34284-7

Reference Book (s)

1.Joseph Edward Shigley and Charles, R. Mischke (2011), Mechanical Engineering Design, 9th Edition,McGraw –Hill International Editions, ISBN: 978-0-071-07783

Course Content:

Unit I: Introduction to Design Process **9 Hours**
Introduction to Design process – Factors – Materials selection direct - Bending and Torsional stress equation - Impact and Shock loading - - Factor of safety - Design stress - Theories of failures — Design of Levers, Problems.
Unit II: Fatigue strength and design of springs **9 Hours**
Stress concentration factor - Size factor -Surface limits factor ,Variable and cyclic loads – Fatigue strength – S- N curve – Continued cyclic stress – Soderberg and Goodman equations – Design of Helical – Leaf - Disc springs under Constant loads.
Unit III:Design of Shafts and Coupling **7 Hours**
Design of Shafts carrying various elements with geometrical featuresunder various loading conditions,Design and drawings of couplings – Rigid – Flexible

Unit IV:Design of Joints	**9 Hours**
Design and Drawings of Cotter joints - Knuckle joints, Riveted joints, Welded joints and Screwed fasteners	
Unit V: Design of bearings	**6 Hours**
Design of sliding contact bearing using Sommerfield number – Design using Mckee'sequation – Selection of rolling contact bearings.	

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	Heat Engineering Lab				
Course Code	BAUT3003				
Prerequisite	BTME2002				
Corequisite	BTME3001, BTME3003, BTME3004				
Antirequisite					
		L	T	P	C
		0	0	2	1

Course Objectives:

1. Assess the existing thermal/hydraulic design.
2. Suggest improvement to the design.
3. Test the improved design using Matlab/CFD/Fluent

Course Outcomes

CO1	Describe the thermal and hydraulic design process, including the concept of design constraints and the iterative nature of design.
CO2	Specify appropriate tools and their relevance to implement the project.
CO3	Develop/deliver work/concept in an environment friendly..
CO4	Interpret the results and justify the variation of results with system operation.
CO5	Carry out initial research on a real-world design task and present it effectively

Text Book (s)

1. Dewitt Lavine, Bergmann and Incropera (2010), Fundamentals of Heat andMass Transfer, 6th Edition, John Wiley & Sons, ISBN: 978-8-126-52764-9.1.

2. Yunus A. Cengel and Michael A. Boles, Thermodynamics, Engineering Approach, 6th Ed., McGrawHill, 2006.

Reference Book (s)

1. J. P. Holman (2005), Heat Transfer, 9th Edition, McGraw-Hill Publishing Company Limited. ISBN: 978-0-070-29618-3.

Thrust areas of projects with tentative project titles

1. Design a new wall construction for renovation of old building by adding glass fiber insulation to the wood framed walls where no installation existed before. All insulating materials shall be designed and installed such that no vapor condensation shall occur in the building walls as a result of the insulation design. At your own initiative you decide to check if condensation will occur in the new wall construction of the buildings.

   The student should be able to answer:

a) What are the known facts and unknown relevant facts in this case?
b) Discuss the legality of what the engineering manager is suggesting.
c) Does it violate any professional codes (e.g. ASME, IS)?
d) Does it violate the engineer's conscience?
e) Develop positive and negative paradigms as well as problematic cases that would fall between them.
f) What are the possible choices of action for the engineer?
g) What are the consequences of the possible solutions?
h) Design alternate solutions to present to your engineering manager.

2. Rating of a heavy duty truck cooling system radiator
3. Pin fins of aluminium are to be compared in terms of their relative performance as a function of diameter. Three "pins" having diameters of 2, 5, and 10 mm with a length of 5 cm are exposed to a convection environment with T_∞ =20◦C, and h=40 W/m^2◦C. The base temperature is 200◦C. Develop a matlab code and plot the variation of heat transfer with pin diameter.
4. It is frequently represented that the energy savings resulting from installation of extra ceiling insulation in a home will pay for the insulation cost within a three-year period. You are asked to evaluate this claim. For the evaluation it may be assumed that 1 kW of electrical input to an air-conditioning unit will produce about 1.26×10^4 kJ/h of cooling and that electricity is priced at Rs. 8/kWh. Assume that an existing home has no ceiling insulation and is to be upgraded. Choose two alternative insulation materials from and calculate the allowable costs per unit volume of insulating material to accomplish the three-year payback with the two specified values. Make your own assumptions regarding (1) temperature difference between the interior of the house and the attic area and (2) the hours of operation for the air-conditioning system during an annual period. Comment on the results and assumptions.
5. A groundwater heat pump is a refrigeration device that rejects heat to the ground through buried pipes instead of to the local atmosphere. The heat rejection rate for such a machine at an Oklahoma location is to be 22 kW in a location where the ground temperature at depth is 17◦C. The thermal conductivity of the soil at this location may be taken as 1.6W/m· ◦C. Water is to be circulated through a length of horizontal buried pipe or tube with the water entering at 29◦C and leaving at 23.5◦C. The convection coefficient on the inside of the pipe is sufficiently high that the inner pipe wall temperature may be assumed to be the same as the water temperature. Select an appropriate pipe/tube material, size, and length to accomplish the required cooling. You may choose standard steel pipe sizes. Standard tubing or plastic pipe sizes are obtained from other sources. Examine several choices before making your final selection and give reasons for that selection.
6. ……
7. ……

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	--	50	100

Name of The Course	Dynamics of Machines				
Course Code	BTME3008				
Prerequisite	BTME3002 Kinematics of Machines				
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

1. To understand the concepts of turning moment diagrams, flywheel design and the dynamics of reciprocating engines.
2. To understand the balancing procedures for rotating and reciprocating masses, rotors and engines.
3. To understand the fundamentals of free and forced vibrations.
4. To understand the mechanisms for control.

Course Outcomes

CO1	Conduct dynamic force analysis of various systems.
CO2	Describe static and dynamic balancing of high speed rotary and reciprocating machines.
CO3	Analyze free and forced vibrations of machines, engines and structures.
CO4	Calculate the frequency of transverse and torsional vibration systems.
CO5	Calculate gyroscopic couple and its effect on various vehicles, and apply the concept of governors for speed control.

Text Book (s)

1. S.S. Rattan (2009), "Theory of Machines", 3rd Edition, Tata McGraw-Hill Publishing Company Ltd, ISBN: 978-0-070-14477-4.

Reference Book (s)

1. J. Uicker John, Gordon R. Pennock Jr., and Joseph E. Shigly (2009), Theory of Machines and Mechanisms, 3rd Edition, Oxford University Press, ISBN: 978-0-198-06232-5.
2. J. Peter Sadler and Charles E. Wilson (2008), Kinematics and Dynamics of Machinery, 3rdPearson Education, ISBN: 978-8-131-72022-6.
3. A. Ghosh (2009), Theory of Mechanisms and Machines, 3rd Edition, East-West Press Pvt. Ltd., New Delhi, ISBN: 978-8-185-93893-6.
4. T Thomson William, Dillon Dahleh Marie and PadmanabhanChandramouli (2008), Theory of Vibration with applications, 5th Edition, Pearson Education Publishers, ISBN: 978-8-131-70482-0.

Course Content:

Unit I: Dynamic Force Analysis **8 Hours**
D'Alembert's principle – Equivalent offset inertia force – Dynamic analysis of four bar mechanism – Dynamic Analysis of reciprocating engines – Piston effort, Crank effort, Turning moment on crankshaft, Inertia of connecting rod – Inertia force in reciprocating engines (Graphical method). Turning moment diagrams – Single and multi cylinder engines – Fluctuation of energy – Fly Wheels – Applications in engines and punching presses.
Unit II:Balancing **8 Hours**
Static and Dynamic balancing of rotating masses – Balancing of reciprocating masses – Balancing of locomotives

– Partial balancing of reciprocating masses – Multi cylinder Inline and radial engines.

Unit III: Vibration – Singh Degree of Freedom Systems **8 Hours**

Introduction to vibration – Terminology – Classification of vibrations –Undamped and Damped free vibration of single degree of freedom systems – Viscous damping – Introduction to coulomb damping. Forced vibration – harmonic excitation – Magnification factor – Vibration isolation and Transmissibility.

Unit IV: Transverse and Torsional Vibration Systems **8 Hours**

Transverse vibrations of shafts and beams – Rayleigh's and Dunkerley's method – Whirling of shafts. Torsional vibrations – Single rotor, two rotors and three rotors systems – Free vibration of geared systems.

Unit V: Mechanism for Control **8 Hours**

Functions of Governors – Gravity controlled and Spring controlled governor characteristics. Stability – Hunting and Isochronisms. Effect of friction – Calculation of equilibrium speeds and ranges of speed of governors. Gyroscopic couple – Gyroscopic effects on the movement of air planes and ships – Stability of two wheel drive and four wheel drive – Gyroscope stabilization.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Dynamics of Machines Laboratory**				
Course Code	**BTME3010**				
Prerequisite					
Corequisite	BTME3008 Dynamics of Machines				
Antirequisite					
	L	**T**	**P**	**C**	
	0	0	2	1	

Course Objectives:

1. To supplement the principles learnt in Kinematics and Dynamics of Machinery.
2. To understand how certain measuring devices are used for dynamic testing.

Course Outcomes

CO1	Calculate natural frequency of longitudinal vibration.
CO2	Determine torsional frequency of a single rotor system.
CO3	Measure the magnitude of gyroscopic couple in a motorized gyroscope.
CO4	Compare Tri–Filar / Bi-Filar system for determining moment of inertia of an object.
CO5	Calculate thecritical speed of a shaft and determine the performance characteristics of governors.

Text Book (s)

1.S.S. Rattan (2009), "Theory of Machines", 3rd Edition, Tata McGraw-Hill Publishing Company Ltd, ISBN: 978-0-070-14477-4.

Reference Book (s)

1.J. Uicker John, Gordon R. Pennock Jr., and Joseph E. Shigly (2009), Theory of Machines and Mechanisms, 3rd Edition, Oxford University Press, ISBN: 978-0-198-06232-5.

LIST OF EXPERIMENTS
1. To determine natural frequency of longitudinal vibration in spring mass system.
2. Determination of torsional frequency of a single rotor system.
3. To study nomenclature of cam and plotting the cam profile.
4. To determine gyroscopic couple on motorized gyroscope.
5. Comparative study of different types of clutches
6. To determine the frequency of un-damped free vibration of an equivalent spring mass system.
7. To perform experiment on Watt and Porter governors to determine performance
8. Comparative study of static and dynamic balancing in rotors.
9. To find out critical speed and to compare the whirling speed of a shaft.
10. To study TRI –FILAR / BI-FILAR System
11. Comparative study of different types of clutches

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
50	--	50	100

Name of The Course	Machine Design				
Course Code	BTME3007				
Prerequisite	BTME3013				
Corequisite					
Antirequisite					
		L	T	P	C
		4	0	0	4

Course Objectives:

Project based learning (PBL) is a teaching/learning technique in which students learn the courses by doing projects works in the related area. Although students do a major project in the last semester to apply their broad learning concept in real life world, the PBL gives them extra opportunity to apply concept in project development to have experience in 'learning by doing'.

Course Outcomes

CO1	Select the suitable material for machine element.
CO2	Design the basic machine elements from scratch.
CO3	Analyze the parts of the machine for suitable working condition.
CO4	Develop geometric model of designed product in CAD software.
CO5	Write brief project report.

Text Book (s)

1. V.B. Bhandari (2010), Design of Machine elements, 3rd Edition, Tata McGraw Hill. ISBN: 978-0-070-68179-8.
2. V.B. Bhandari (2014), Machine Design Data Book, 1st Edition, Tata McGraw Hill. ISBN: 978-9-351-34284-7.

Reference Book (s)

1. S. Tickoo (2017), Solidworks 2017 for designers, 15th Edition, CADCIM Technologies, ISBN: 978-1-942-68975-1

Thrust areas of projects with tentative project titles

1. Design of cotter joint
2. Design of Gib and Cotter joint for strap end connecting rod
3. Design of Gib and Cotter joint for rectangular rods
4. Design of knuckle joint
5. Design of crane hook
6. Design of screw jack
7. Design of turn buckle
8. Design of longitudinal butt joint for boiler shell
9. Design of circumferential lap joint for boiler shall
10. Design of geared power transmission system
11. Design of rigid coupling
12. Design of flexible coupling

13. Design of leaf spring
14. Design of multi-disk clutch
15. Design of flat belt transmission system
16. Design of V-belt transmission system
17. Design of Chain derive
18. Design of sliding contact bearing
19. Design of spur gear system
20. Design of helical gear system
21. Design of Bevel gear system
22. Design of flywheel
23. Design of pressure vessel
24. Design of wire ropes
25. Design of I.C. engine component

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	--	50	100

Name of The Course	**Energy systems and Technologies**				
Course Code	**BTME4001**				
Prerequisite	BTME2002 Engineering Thermodynamics, BTME 2009 Fluid Mechanics				
Corequisite					
Antirequisite					
	L	**T**	**P**	**C**	
	3	0	0	3	

Course Objectives:

1. To apply knowledge of basic laws of thermodynamics to compressors.
2. Describe the operating characteristics of hydraulic machinery (pumps and turbines), and the factors affecting their operation and specifications, as well as their operation in a system..
3. To understand the working of key components of conventional and non conventional power plants.

Course Outcomes

CO1	Calculate the thermal efficiencies of blowers and compressors, and identify the common problems in compressor working.
CO2	Evaluate the pump output and efficiencies of different hydraulic pumps.
CO3	Explain working of hydraulic turbines and its perfromance evaluation.
CO4	Demonstrate conventinal power generation systems and their components.
CO5	Demonstrate non conventinal power generation systems and their components.

Text Book (s)

1. S. S. Rattan (2011), Fluid Mechanics and Hydraulic Machines, Khanna Publishers, ISBN: 978-8-187-52246-1.
2. R. K. Rajput, (2008), A Text Book of Power Plant Engineering, 4th Edition Laxmi Publications (P) Ltd. ISBN: 978-81-318-0255-7.

Reference Book (s)

1. S.M. Yahya, (2010), Turbine, Fans and Compressors, TMH, 2010
2. P.K. Nag, Power Plant Engineering, Tata McGraw-Hill Publishing Company Ltd., ISBN: 9789339204044.

Course Content:

Unit I: Fans, Blowers and Compressors **9 Hours**
Construction details of Centrifugal fans, blowers and compressors, stage work, Stage pressure rise, Stage pressure co-efficient, Stage efficiency, Degree of reaction, Various slip factors, h-s diagram for centrifugal compressor. Axial flow Fans and Compressors, Stage velocity triangles, Blade loading and flow co- efficient, Static pressure rise, h-s diagram, Degree of reaction, Work done factors, Free and Forced Vortex flow performance, Stalling and Surging. Construction details of Reciprocating compressors, working, Effect of clearance volume, Multi staging, Volumetric efficiency, Isothermal efficiency.
Unit II: Hydraulic Pumps **8 Hours**

Centrifugal pumps, Work done, Head developed, Pump output and Efficiencies, priming, minimum starting speed, performance of multistage pumps, cavitation and methods of prevention, Pump characteristics, Constructional details of axial flow pumps, characteristics, Non-dimensional parameters, Efficiencies, Reciprocating pumps, Work done and efficiency, Vibration and Noise in hydraulic pumps.

Unit III: Hydraulic Turbines **9 Hours**

Classification of hydraulic turbines, Pelton wheel, Francis turbine, Kaplan and Propeller turbines, Velocity triangles, Specific speed, Theory of draft tube, Governing, Performance characteristics, Selection of turbines.

Unit IV: Introduction to power plants **8 Hours**

Classification, Selection of site, Steam power plants – Fire tube and Water tube boilers, Feed water treatment, Cooling Tower, Pulverized coal firing systems, Electrostatic precipitator, Nuclear power plants – working principle and basic components, pressurized water reactor, Hydro power plants – basic components, function and details of Reservoirs, Dam, Trash Rack, Forebay, Surge Tank, Penstock, Spillway, Prime Mover and Generator, Draft Tube.

Unit V: Non Conventional Power Plants **6 Hours**

Introduction to Non Conventional energy resources, Basic Components of Solar power plant, principle and working, Basic Components of Wind power plant, principle and working.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Operations Research				
Course Code	BTME4002				
Prerequisite					
Corequisite					
Antirequisite					
		L	T	P	C
		3	0	0	3

Course Objectives:

1. To provide students the knowledge of optimization techniques and approaches.
2. To enable the students to apply mathematical, computational and communication skills needed for the practical utility of Operations Research.

Course Outcomes

CO1	Apply operations research techniques in industrial optimization problems.
CO2	Calculate transportation problems using various operation research methods
CO3	Evaluate project using PERT and CPM techniques
CO4	Demonstrate various inventory models used in industries.
CO5	Illustrate the use of queuing models in practical applications and develop the basic knowledge game theory

Text Book (s)

1. Kanti Swarup, P.K. Gupta and Manmohan Lal (2010), Operations Research, 15th Edition, S.Chand & Sons, ISBN: 978-8-180-54771-3.
2. H. M. Wagner (2009), Principles of Operation Research, 2nd Edition, Prentice Hall of India Ltd ISBN: 978-8-120-30162-7.

Reference Book (s)

1. Hamdy Taha, (2008), Operations Research-An Introduction, 8th Edition, Pearson Education, ISBN: 978-8-131-71104-0.
2. R. Panneerselvan (2006), Operations Research, 2nd Edition, Prentice Hall of India Pvt Ltd ISBN: 978-8-120-31743-7.
3. J. K. Sharma (2013), Operations Research, 5th Edition, Macmillan Publications, ISBN: 978-9-350-59336-3.

Course Content:

Unit I: Linear programming problems **10 Hours**
Introduction to Operations Research – Linear Programming - Mathematical Formulation – Graphical method – Simplex method – Two Phase Simplex method – Big M Method – Duality
Unit II: Transportation and Assignment problems **8 Hours**
Transportation problems – Least cost method – Northwest Corner method – Vogel's Approximation method – MODI method – Transhipment problems, Assignment problems.
Unit III: Sequencing and Network Models **8 Hours**
Sequencing –Problem with N jobs and 2 machines using Johnson's method, Problems with N jobs - 3 machines

and ‘M’ machines.using modified Johnson’s method Network Models – Basic Concepts – Construction of Networks – CPM and PERT – Crashing of Network.
Unit IV: Inventory Models **6 Hours**
Deterministic Inventory Models – Various Costs and Concepts–EOQ–Deterministic inventory models with instenteneous production and finite rate of production.
Unit V: Queuing Models and Game Theory **8 Hours**
Queuing models – Characteristics of Queuing Model, M/M/1 & M/M/S system, cost consideration Game theory – Two person zero sum game – Graphic solution - Property of dominance – Algebraic solution

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	**Energy systems Laboratory**				
Course Code	**BTME4004**				
Prerequisite					
Corequisite	BTME4001 Energy system and Technologies				
Antirequisite					
	L	**T**	**P**	**C**	
	0	0	2	1	

COURSE OBJECTIVES

1. To impart the practical knowledge about the performance characteristics of pumps and turbines.
2. To impart knowledge of boilers.

Course Outcomes

CO1	Carryout the performance analysis of reciprocating pump.
CO2	Carryout the performance analysis of centrifugal pump.
CO3	Predict the efficiency of hydraulic turbines.
CO4	Explain the working of water and fire tube boilers.
CO5	Prepare a heat balance sheet by conducting the morse test

TEXT BOOKS

1. Lab manuals prepared by faculty.

REFERENCE BOOKS

1. NPTEL study materials

LIST OF EXPERIMENTS
1. To study the performance characteristics of Centrifugal pump
2. To study the performance characteristics of reciprocating pump.
3. To study the performance characteristics of Pelton wheel turbine
4. To study the performance characteristics of Francis turbine
5. To study the performance characteristics Kaplan turbine.
6. To study construction and working of water tube boiler.
7. To study construction and working of fire tube boiler.
8. To prepare heat balance sheet.

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
50	--	50	100

Name of The Course	**Project Work I**				
Course Code	**BAUT9998**				
Prerequisite					
Corequisite					
Antirequisite					
		L	**T**	**P**	**C**
		0	0	0	3

Course Objectives:

1. To develop the capacity of students in correlating theoretical knowledge into practical systems either to perform creative works or to perform analysis and hence to suggest solutions to problems, pertaining to mechanical engineering domain.
2. Foster collaborative learning skills.
3. Develop self-directed inquiry and life-long skills.
4. To enhance the communication skills of the students by providing opportunities to discuss in groups and to present their observations, findings and report in formal reviews both in oral and written format.

Course Outcomes

CO1	Explore as a team, the fundamentals, domain knowledge and skills in engineering to identify / conceive a problem.
CO2	Analyze and outline the various aspects of complex engineering systems to formulate the problem.
CO3	Select appropriate methodology using critical and creative thinking and design subsystems / systems.
CO4	Develop a functional product prototype highlighting its utility to society, environment, safety and address ethical concerns.
CO5	Present and demonstrate the product to peers, academicians, general and industry community.

CATALOGUE DESCRIPTION

The project work can be an investigative analysis of a technical problem in the relevant area, planning and/or design project, experimental project or computer application based project on any of the topics. Each project group will submit abstract of the project within three weeks from start of seventh semester. Project evaluation committee consisting of three or four faculty members specialized in the various fields of department, shall study the feasibility of each project work before giving consent.

COURSE CONTENT

The project group consisting of not more than four members is expected to fix any topic of mechanical engineering domain and complete preliminary studies like literature review, recent developments, description of a problem etc. in this semester. This work will be continued as a Project Work II during eighth semester.

Mode of Evaluation

The evaluation committee shall consist of faculty members constituted by the Dean of School which will comprise of at least three members comprising of the Division Chair/Program Chair a nominee of the Dean. The students guide would be a special invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the committee separately in a sealed envelope to the Dean. There will not be more than three students for a group for such project submission.

The assessment of all the projects should be done at the end of the seventh semester by the project evaluation committee formed. The students will present their project details and progress of their project to the committee.

The complete project report is not expected at the end of the seventh semester. However, a three-four page typed report based on the work done should be submitted by each student to the assessing committee.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	--	50	100

Name of The Course	**Project Work II**				
Course Code	**BAUT9999**				
Prerequisite					
Corequisite					
Antirequisite					
		L	**T**	**P**	**C**
		0	0	-	9

Course Objectives:

1. To develop the capacity of students in correlating theoretical knowledge into practical systems either to perform creative works or to perform analysis and hence to suggest solutions to problems, pertaining to civil engineering domain.
2. Foster collaborative learning skills.
3. Develop self-directed inquiry and life-long skills.
4. To enhance the communication skills of the students by providing opportunities to discuss in groups and to present their observations, findings and report in formal reviews both in oral and written format.

Course Outcomes

CO1	Implement the design using advanced engineering tools
CO2	Test and validate the proposed solution
CO3	Collect and interpret results ensuring that the concerns of utility to society, environment, safety and ethical issues are addressed
CO4	Compare performance with existing similar systems
CO5	Present and demonstrate the product to peers, academicians, general and industry community

CATALOGUE DESCRIPTION

The project work can be an investigative analysis of a technical problem in the relevant area, planning and/or design project, experimental project or computer application based project on any of the topics. The problem description done on the seventh semester shall be continued in this semester and solved with various tools or techniques needed for the project work.

COURSE CONTENT

Project work II is expected to be completed in the eighth semester with each student group consisting of not more than five members is expected to design and develop a complete system or make an investigative analysis of a technical problem in the relevant area. The project groups are expected to solve the problem chosen on Project Work I with various tools or techniques required for the project work.

Mode of Evaluation

The evaluation committee shall consist of faculty members constituted by the Dean of School which will comprise of at least three members comprising of the Division Chair/Program Chair a nominee of the Dean. The students guide would be a special invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the committee separately in a sealed envelope to the Dean. There will not be more than three students for a group for such project submission.

The assessment of all the projects should be done at the end of the eighth semester by the project evaluation

committee formed. The students will present their project details and progress of their project to the committee. The complete project report based on the work done should be submitted by each student to the assessing committee.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
50	--	50	100

Name of The Course	Automotive Engines				
Course Code	BAUT3001				
Prerequisite					
Corequisite					
Antirequisite					
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To study the working of engines.
2. To study Engine parts and their functions
3. To study the Different Engine technologies

Course Outcomes

CO1	Understand the Construction and operation of IC Engine
CO2	Perform a thermodynamic analysis of Otto, Diesel, andDual cycle models
CO3	Demonstrate knowledge of the characteristics of common liquid and gaseous fuels
CO4	Demonstrate an understanding the role of lubrication in reducing friction and wear
CO5	Demonstrate an understanding of technological, environmental, and social impacts of alternative fuels

Text Book (s)

1. William.H.Crouse (2006), Automotive Mechanics, 10th Edition, McGraw-Hill, ISBN: 978-0-07-063435-0.
2.Kirpal Singh (2011), Automobile Engineering, 12th edition, Standard Publications, ISBN: 978-8-180-14177-5.

Reference Book (s)

1. Joseph Heitner (1999), Automotive Mechanics: Principles and Practices, 2nd edition, Affiliated East West Pvt. Ltd, ISBN: 978-8-176-71015-2.
2. Bosch Automotive Hand Book (2007), 8th Edition, SAE Publications,ISBN:978- 0-7680-4851-3.
3. K. Newton and W. Steeds (2001), the motor vehicle, 13th Edition, Butterworth-Heinemann Publishing Ltd, ISBN: 978-0-080-53701-6.

Course Content:

Unit-1 Introduction **8 hours**
Classification of Automobiles, type of automobile engines, Constructional details and working principles of spark ignition (SI) and compression ignition (CI) engines, Two stroke SI and CI engines – construction and working, Comparison of SI and CI engines and fourstroke and two stroke engines, Engine classification, firing order, Otto, diesel and dual cycles, fuels for modern automobile engines like LPG, CNG, bio-diesel, national and international pollution norms
Unit-2 Engine parts and their functions **8 Hours**
Types of cylinder head, piston, special features in pistons, piston rings, types of piston rings, piston pin, connecting rod, special features of connecting rods, crank shaft, flywheel, cam and follower, camshaft, valve and valve mechanism, crank case
Unit-3 Fuel Supply Systems **8 Hours**
Fuel system in petrol engine, carburetion principle and carburetors, petrol injection system, MPFI fuel system, diesel engine- diesel fuel pump principle, types of fuel pumps, types of fuel injector nozzles, simple and multiple unit pumps, C. A. V. Bosch pump, types of fuel systems for diesel engines, modern distributers; Air cleaners

Unit-4 Cooling and Safety	**8 Hours**
Cooling system in Automobiles; air and water cooled engines; Lubricants system; lubrication Vehicle safety, safety features in modern automobiles like air bags, anti-lock braking system, crumple zones, introduction to power steering and power brakes	
Unit-5 Engine Types	**8 Hours**
Single Fuel & Multi Fuel Engine: Combustion in dual fuel engines, factors affecting combustion in duel fuel engines performance of dual fuel engines, advantages of dual fuel engines; multi-fuel engines, characteristics of Multi fuel engines, modification of fuel system, performance of multi-fuel engines, brief introduction to working of stratified charged engine, Sterling engine, Wankel engine, variable compression engine, Air cleaners &Silencers	

Continuous Assessment Pattern

Internal Assessment (IA)	**Mid Term Test (MTE)**	**End Term Test (ETE)**	**Total Marks**
20	30	50	100

Name of The Course	Heat Engineering				
Course Code	BAUT3002				
Prerequisite					
Corequisite					
Antirequisite					
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To enable the students understand the principles and performance of IC engines
2. To introduce students to the working of compressors, and various refrigeration and air-conditioning systems.
3. To teach students the principles of heat transfer

Course Outcomes

CO1	Solve problems on internal combustion engines and prepare heat balance sheet
CO2	Identify and analyse the different modes of heat transfer in engineering applications
CO3	Demonstrate the knowledge of refrigeration and air-conditioning
CO4	Get an insight of various components of thermal systems viz., compressors, evaporators, condensers etc
CO5	To compute heat exchanger effectiveness and plot temperature distribution.

Text Book (s)

1. J. K. Gupta and R.S. Khurmi, (2010), A Textbook of Thermal Engineering, S. Chand Publishers

Reference Book (s)

1. Onkar Singh, (2009), Applied Thermodynamics, New Age International.
2. C.P. Arora, (2009), Refrigeration and Air Conditioning, Tata McGraw-Hill Publishing Company Ltd.
3. V. Ganesan, (2008), Internal Combustion Engines, Tata McGraw-Hill Publishing Company Ltd.
4. J. P. Holman, (2005), Heat Transfer, 9th Edition, McGraw-Hill Publishing Company Limited.

Course Content:

Unit-1 Internal Combustion Engines **8 hours**
Review of Otto, Diesel and Dual thermodynamic cycles, Normal and abnormal combustion in SI engines, Factors affecting knocking. Normal and abnormal combustion in CI engines, Detonation factors and remedies. Performance parameters in IC engines, Measurement of brake power, indicated power, fuel consumption, air consumption, Morse test and Heat balance, effect of various parameters on the performance of the engines.
Unit-2 Heat Transfer –I **8 Hours**
Basic concepts: conduction, convection and radiation, General equation of heat conduction, One dimensional steady state heat conduction in simple geometries: plane wall, cylinder and sphere, Heat transfer in composite walls, composite cylinders and composite spheres, Critical thickness of insulation,Heat generation, Extended surfaces: general equations, types and applications of fins,fin efficiency and effectiveness, Fin performance.Transient heat flow: Lumped parameter system,significance of Biot and Fourier numbers.
Unit-3 Heat Transfer –II **8 Hours**
Convection: Dimensional analysis, Non dimensional numbers in forced and free convection, Thermal boundary layer,Heat transfer for laminar flow over a flat plate, Turbulent flow over a flat plate, Heat transfer in laminar tube flow, turbulent tube flow,free-convection heat transfer on avertical flat plate.Thermal

radiation: Laws of radiation, Black body concept, Emissive power, Radiation shape factor, Gray bodies, Radiation shields.
Unit-4 Introduction to Refrigeration and Air Conditioning **8 Hours**
Unit of refrigeration, vapour compression cycle,components andworking,p-h and T-s diagrams, Calculation of COP, Effect of sub-cooling, super-heating,evaporator pressure and condenser pressure. Actual vapour compression cycle, methods for improving COP. Refrigerants: classification, nomenclature, desirable properties.Psychrometry: properties, relations, chart and processes.Cooling load calculations: SHF, RSHF, GSHF, ESHF.
Unit-5 Compressors and Heat exchangers **8 Hours**
Reciprocating compressors:construction,working,effect of clearance volume,multi staging, volumetric efficiency,isothermal efficiency.Centrifugal compressors, velocity triangle, Axial flow compressors, surging, choking and stalling. Heat Exchangers – Types and practical applications, Use of LMTD, Effectiveness – NTU method, Compact heat exchangers, Plate heat exchangers, Fouling factor

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

ELECTIVE SUBJECTS

Name of The Course	**Two and Three Wheeled Vehicles**			
Course Code	BAUT 3055			
Prerequisite	BAUT3001			
Corequisite				
Antirequisite				
	L	**T**	**P**	**C**
	3	0	0	3

Course Objectives:

1. To discuss about various systems of different two and three wheeled vehicles.
2. To discuss about the recent trends in two wheeled and three wheeled vehicles

Course Outcomes

1. Understand the construction and working of two stroke engines
2. Understand the two wheeled vehicle chassis and chassis sub-systems.
3. Understand the construction and working of brakes, tyres of two wheeled vehicles
4. Understand the maintenance and servicing of common two wheeled vehicles
5. Understand the construction and working of common three wheeled vehicles

CO1	Understand the construction and working of two stroke engines
CO2	Understand the two wheeled vehicle chassis and chassis sub-systems
CO3	Understand the construction and working of brakes, tyres of two wheeled vehicles
CO4	Understand the maintenance and servicing of common two wheeled vehicles
CO5	Understand the construction and working of common three wheeled vehicles

Text Book (s)

1. Irving P E (1992), Motor cycle engineering, Temple Press Book, London.
2. Dhruv U. Panchal (2015), Two And Three Wheeler Technology, PHI Learning; 1 edition

Reference Book (s)

1. Newton Steed (2000), “The Motor Vehicle”, McGraw Hill Book Co. Ltd., New Delhi

Course Content:

Unit-1 The Power Unit **8 hours**
Two stroke SI engine, merits and demerits, symmetrical and unsymmetrical port timing diagrams, types of scavenging processes, merits and demerits, scavenging efficiency, scavenging pumps. Rotary valve engine, fuel system, lubrication system, magneto coil and battery coil spark ignition system, electronic ignition system, variable timing ignition system (VTI), starting system, kick starter system
Unit-2 Chassis and Sub-Systems **8 Hours**
Main frame, its types, chassis, shaft drive and chain drive, single, multiple and centrifugal clutches, gear box and gear controls, front and rear suspension systems, shock absorbers. Panel meters and controls on handle bar
Unit-3 Brakes and Wheels **8 Hours**
Drum brakes & Disc brakes Construction and Working and its Types, Front and Rear brake links layouts.Brake actuation mechanism, Spoked wheel, cast wheel, Disc wheel & its merits and demerits, Tyres

and tubes Construction & its Types, Steering geometry.
Unit-4 Two Wheelers **8 Hours**
Case study of popular Indian motor cycle models, scooters, scooterettes and mopeds, and their Servicing and maintenance
Unit-5 Three Wheelers **8 Hours**
Case study of Indian Three wheeler models, Front mounted engine and rear mounted engine types, Auto rickshaws, Pick up vans, Delivery vans and Trailers, E- Rickshaws,and their Servicing and maintenance.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Vehicle dynamics			
Course Code	BAUT 3051			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

1. To broaden the understanding of vehicle dynamics.
2. To understand tyre mechanics.
3. To understand performance characteristics of road vehicle and vehicle ride characteristics.
4. To broaden the understanding of stability

Course Outcomes

CO1	Understand mathematical Modeling methods in vehicle dynamics
CO2	Understand tyre dynamics
CO3	Design and analyze passive, semi-active and active suspension systems
CO4	Predict vehicle performance
CO5	Understand directional control of vehicles

Text Book (s)

1. Wong; Theory of Ground Vehicle; John Wiley & Sons
2. Jazar, Reza N. Vehicle dynamics: theory and application. Springer, 2008

Reference Book (s)

1. Ellis J.E.R; Vehicle Dynamics; Business Book London
2. Ramalingam KK; Automobile engineering; Scitech pub
3. Giri N.K.; Automotive Mechanics

Course Content:

Unit-1 Introduction to Vehicle Dynamics	**8 hours**
Definition by SAE, vehicle control loop, mathematical Modeling methods, multi-body system approach, Newtonian and Legrangian formulation, method of Investigation, stability concepts.	
Unit-2 Mechanics of Pneumatic Tyres	**8 Hours**
Tyre forces and moments, Tyre structure, Longitudinal and Lateral force at various slip angles, rolling resistance, Tractive and cornering property of tyre, Performance of tyre on wet surface, Ride property of tyres, Tyre model, Estimation of tyre road friction, Test on Various road surfaces, Tyre vibration, SAE recommended practice.	
Unit-3 Vertical Dynamics	**8 Hours**
Human response to vibration, Sources of Vibration. Design and analysis of Passive, Semi-active and active suspension using Quarter car, half car and full car model. Influence of suspension stiffness,suspension damping, and tire stiffness, Control law for LQR, H-Infinite, Skyhook damping, Airsuspension system and their properties	
Unit-4 Longitudinal Dynamics And Control	**8 Hours**
Aerodynamic forces and moments, Equation of motion, Tire forces, rolling resistance, Load distribution for three wheeler and four wheeler, Calculation of Maximum acceleration, Reaction forces for Different drives.	

Braking and Driving torque, Prediction of Vehicle performance, ABS, stability control, Traction control
Unit-5 Lateral Dynamics **8 Hours**
Steady state handling characteristics, Steady state response to steering input,Testing of handling characteristics, Transient response characteristics, Direction control of vehicles, Roll center, Roll axis,Vehicle under side forces, Stability of vehicle on banked road, during turn, Effect of suspension oncornering.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Alternative Fuels & Energy Systems				
Course Code	BAUT3054				
Prerequisite					
Corequisite					
Antirequisite					
		L	**T**	**P**	**C**

Course Objectives:

1. To study the properties of alternative fuels for automobiles.
2. To identify the appropriate alternative fuel system for automobile application

Course Outcomes

CO1	Understand the fuel economy, the fuel conservation and the air fuel ratio, carburettors and various types of fuel injection system.
CO2	Know the properties, performance and emission characteristics of liquid fuels like gasoline , alcohol , vegetable oils in both SI and CI engines.
CO3	Know the properties, performance and emission characteristics of gaseous fuels like LPG, CNG, and Hydrogen.
CO4	Know the modification of SI and CI engines for various alternative fuels
CO5	Demonstrate the knowledge of electric, hybrid and solar powered vehicle.

Text Book (s)

1. Richard L. Bechtold (1997), Alternative Fuels Guidebook: Properties, Storage, Dispensing, and Vehicle Facility Modifications, SAE International

Reference Book (s)

1. V. Ganesan (2004) , Internal Combustion Engines, Tata McGraw Hill Co.
2. SAE paper Nos.840367, 841156,841333,841334.
3. Mark L. Poulton, (1994) Alternative fuels for road vehicles, Computational Mechanics Publications

Course Content:

Unit-1 Introduction	**8 hours**
Important properties(Calorific value , Flash point, fire point, pour point, cloud point, viscosity, Cetane and Octane number etc) of a fuel. General characteristics of SI & CI Engines fuels, estimation of petroleum reserve, need for alternate fuel, availability of various alternative fuels, general use of Alcohols,LPG,Hydrogen,CNG, LNG, Vegetable oils and Biogas.	
Unit-2 Vegetable Oils & Bio-diesel	**8 hours**
Composition & Properties of various vegetable oils for engines; Transesterification reaction and bio-diesel production , Performance and emission characteristics of Bio-diesel.	
Unit-3 Alcohol Based Fuels	**8 hours**
Properties as engine fuels, merits and demerits, alcohol as SI and CI engine fuel, alcohols with gasoline& diesel blends, Combustion characteristics and emission characteristics in engines.	
Unit-4 Natural Gas and Hydrogen	**8 hours**

Source and composition of CNG, Properties, advantages &disadvantages, performance and emission characteristics of CNG, Introduction to Hydrogen as fuel, Safety and Performance of Hydrogen.
Unit-5 Solar Energy and Fuel Cells **8 hours**
Semiconductor and Photovoltaic effect, Solar Cell, advantages & disadvantages of Solar Energy, application of solar energy. Fuel Cells: Types of fuel cell, advantages & disadvantages and applications

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Aerodynamics Design of Vehicle			
Course Code	BAUT 3063			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

1. To broaden the understanding of aerodynamics.
2. Understand how to approach various industrial applications using CFD..
3. Hands on experience on many leading commercial

Course Outcomes

CO1	Understand basic fluid theory
CO2	Understand basics of CFD
CO3	Develop solutions using various commercial solvers and validate the results using standard solutions
CO4	Compare various types of grids for approaching accurate solution.
CO5	

Text Book (s)

1. John D Anderson, Jr., Computational Fluid Dynamics -The Basics with Applications, McGraw Hill, 1995

Reference Book (s)

1. Vehicle Aerodynamics, SAE, 1996.
2. Schlichting, H (1999), Boundary Layer Theory, McGraw Hill, New York

Course Content:

Unit-1 Fundamentals Of Aerodynamics **8 hours**
Scope – Development trends – Flow phenomena related to vehicles – External and Internal flow problems – Performance of cars and light vans – Resistance to vehicle motion – Drag –Types of drag – Flow field around car – Aerodynamic development of cars – Optimization of car bodies for low drag. Navier Stokes equation
Unit-2 Basics Of Cfd **8 hours**
Basic aspects of discretization, finite difference method, difference equations, Explicit and Implicit schemes, stability analysis One-dimensional steady state diffusion Steady one-dimensional convection and diffusion, pressure correction technique, SIMPLE algorithm.
Unit-3 ANSYS Software **8 hours**
An introduction to several commercial CFD software codes and their applications to the governing differential equations, solution procedures, interpretation of the results, visualization of the results and the built in graphics will be described.
Unit-4 Mesh Generation With Commercial Cfd Codes **8 hours**
Introduction of Gambit, ICEMCFD, FLUENT, CFX, Ansys Package to give students a taste of various commercial CFD software applications.
Unit-5 Aerodynamic Design **8 hours**
Simulation and case studies –cars, buses, trucks

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Electric and Hybrid Vehicles			
Course Code	BAUT3058			
Prerequisite				
Corequisite				
Antirequisite				
	L	T	P	C
	3	0	0	3

Course Objectives:

1. To study the properties of alternative fuels for automobiles.
2. To identify the appropriate alternative fuel system for automobile application

Course Outcomes

CO1	Describe the pros and cons of different types of EVs and HEVs
CO2	Perform basic designs of EV and HEV systems using series, parallel and series-parallel architectures.
CO3	Define the testing procedures for EVs and HEVs
CO4	Discuss the emerging technologies, engineering challenges, and development trends in EVs and HEVs.
CO5	Demonstrate the knowledge of electric, hybrid and solar powered vehicle.

Text Book (s)

1. Modern Electric,Hybrid Electric, andFuel Cell Vehicles, Fundamentals, Theory, and Design by Mehrdad Ehsani, Texas A&M University,Yimin Gao, Texas A&M University
2. Sebastien E. Gay, Texas A&M University,Ali Emadi, Illinois Institute of Technology

Reference Book (s)

1. Ron HodKinson, " light Weight Electric/ Hybrid Vehicle Design", Butterworth Heinemann Publication,2005
2. Lino Guzzella, " Vehicle Propulsion System" Springer Publications,2005.

Course Content:

Unit-1 Need for alternative system **8 hours**
Need of electric vehicles hybrid vehicles – comparative study of diesel, petrol, pure electric and hybrid vehicles. Limitations of electric vehicles. Specification of some electric and hybrid vehicles
Unit-2 Energy sources: Batteries and fuel cells **8 hours**
Battery Parameters-Power requirement of electric vehicles- Different types of batteries – Lead acid-Nickel based-Sodium based-Lithium based- Metal Air based. Battery charging- Charger design- Quick charging devices- Battery Modeling. Fuel Cell- Fuel cell characteristics- Fuel cell types-Hydrogen fuel cell-Connecting cell in series water management in the PEM fuel cell- Thermal Management of the PEM fuel cell
Unit-3 Alcohol Based Fuels **8 hours**
A characteristic of permanent magnet and separately exited DC motors. AC single phase and 3-phase motor – inverters – DC and AC motor speed controllers.
Unit-4 Vehicle design considerations for electric vehicles **8 hours**
Aerodynamic-Rolling resistance- Transmission efficiency- Vehicle mass- Electric vehicle chassis and Body design considerations- Heating and cooling systems- Controllers- Power steering- Tyre choice-Wing Mirror, Aerials and Luggage racks
Unit-5 Hybrid Vehicles **8 hours**
Types of Hybrid- Series, parallel, split – parallel, series - parallel - Advantages and Disadvantages. Power

split device – Energy Management System - Design consideration - Economy of hybrid vehicles

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Automotive Chassis and Body Engineering				
Course Code	BAUT3004				
Prerequisite					
Corequisite					
Antirequisite					
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To broaden the understanding of details of car body aspects.
2. To introduce car body and bus body details used.
3. To broaden the understanding of students in the structure of vehicle chassis.
4. To introduce students to steering, suspension and braking systems.

Course Outcomes

CO1	Understand the construction details of various types of automotive chassis and basic functions of subsystems in the chassis.
CO2	Demonstrate knowledgeof various types of suspension systems.
CO3	Demonstrate knowledgeof various types of brake system
CO4	Demonstrate knowledge of steering system, wheels &tyres in the vehicles
CO5	Understand various safety provisions

Text Book (s)

1. P.M. Heldt (2010), Automotive Chassis, Chilton & Co.
2. S. S. Rattan (2004), Automotive Mechanics, N.K. Giri , Khanna Publications, New Delhi.

Reference Book (s)

1. T.R. Banga&Nathu Singh, (1993), Automobile Engineering, Khanna Publications.

Joseph I Heintner, (1967), automotive mechanics, Affiliated East West press, New Delhi/Madras.

Course Content:

Unit-1 Introduction **8 hours**
General consideration relating to chassis layout, types of automobiles, layout of an automobile, weight distribution, stability, Terms used in body building construction, Angle of approach, Angle of departure, Ground clearance, Cross bearers, Floor longitudes, posts, seat rail, waist rail, cant rail, Roof stick, Roof longitude, Rub rail, skirt rail, truss panel, wheel arch structure.
Unit-2 Vehicle Body **8 hours**
Car Body: Types, Regulations, drivers visibility, tests for visibility, methods for improving visibility and space in cars, safety design, safety requirements for car, car body construction. Bus Body Details: Types, bus body layout, floor height, engine location, entrance and exit locations, seating dimensions, constructional details, frame construction.
Unit-3 Axle And Steering Systems **8 hours**
Axle parts and materials, loads and stresses, centre sections, section near steering head, spring pads, front axle loads, rear axles loads, types of rear axles, multi axles vehicles,steering heads, factors of wheel alignment,

wheel balancing, centre point steering, correct steering angle, steering mechanisms, cornering force, self righting torque, under steer and over steer, Steering linkages, steering gears, special steering columns, power steering
Unit-4 Brakes **8 hours**
Necessity, stopping distance and time, brake efficiency, weight transfer, brake shoe theory, determination of braking torque, classification of brakes, types, construction, function, operation, braking systems, bleeding of brakes, brake drums, brake linings, brake fluid, factors influencing operation of brakes such as operating temperature, lining, brake clearance, pedal pressure, linkages etc, Numerical problems. Brake compensation, Parking and emergency brakes
Unit-5 Suspension & Wheels and Tyres **8 hours**
Springs: Operation & materials, type leaf springs, air bellows or pneumatic suspension, hydraulic suspension, telescopic shock absorbers, independent suspension, front wheel independent suspension, rear wheel independent suspension, types, stabilizer, trouble shooting, Numerical problems. Types of wheels, construction, structure and function, wheel dimensions, structure and function of tyres, types of tyres, materials, tyre section & designation, factors affecting tyre life.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100

Name of The Course	Automotive Transmission Systems				
Course Code	BAUT3005				
Prerequisite					
Corequisite					
Antirequisite					
		L	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To study the working of engines.
2. To study Engine parts and their functions
3. To study the Different Engine technologies

Course Outcomes

CO1	Demonstrate the knowledge of different automotive axles
CO2	Demonstrate the knowledge of different automotive clutches
CO3	Understand the constructional details of gear boxes
CO4	Demonstrate the knowledge of wheel drives
CO5	Understand the automatic transmission systems

Text Book (s)

1. Chek Chart; Automotive Transmission; Harper & Row Publication.

Reference Book (s)

1. Heldt P.M.; Torque converters; Chilton Book Co.
2. Giri NK; Automobile Engineering; Khanna Publisher
3. Newton, Steeds & Garret; Motor Vehicles; B.H. Publication.
4. Judge, A.W., Modern Transmission Systems, Chapman & Hall Ltd.

Course Content:

Unit-1 Introduction **8 hours**
Transmission requirements: requirements of transmission system, general arrangement of power transmission, general arrangement of rear-engine vehicle with live axles, general arrangement of dead- axle and axles transmission; four-wheel-drive transmission
Unit-2 Automotive clutches **8 hours**
Clutches Requirements of clutches, principle of friction clutches, types of clutches and materials used- cone, single-plate, diaphragm-spring, multi-plate, centrifugal, over-running and ferro-electromagnetic clutch
Unit-3 Automotive Gear boxes **8 hours**
Need of gear boxes, types- sliding mesh, constant mesh and epicyclic, gear boxes; synchronizers: principle, early and later Warner synchronizer, Vauxhall synchronizer- gear materials lubrication and design of gear box; Hydrodynamic drive: Advantages and limitations, principle of fluid coupling, constructional details, torque-capacity performance characteristics, drag torque, methods of minimizing drag torque; Torque converter: performance characteristics; single, multistage and poly-phase torque converters, converter-coupling-performance characteristics, coupling-blade angle and fluid flow, converter fluid
Unit-4 Transmission systems-Drive line
Definition, forces & torques acting; types of drives-Hotchkiss, torque tube & radius rod drives; components-

propeller shaft, slip joint, universal joints & constant velocity universal joints; front wheel drive; Final drive: definition; types- worm-wheel, straight-bevel gear, spiral-bevel gear & hypoid-gear drives; double-reduction & twin-speed final drives; Differential: Function, principle, construction and working; non-slip differential; differential lock; rear axle- loads acting & types; multi-axled vehicles
Unit-5 Automatic transmission
Chevrolet turboglide transmission, power glide transmission, hydraulic control system of automatic transmission; Electric drive: advantages and limitations, principle of early and modified Ward-Leonard system, modern electric drive for buses; performance characteristics.

Continuous Assessment Pattern

Internal Assessment (IA)	Mid Term Test (MTE)	End Term Test (ETE)	Total Marks
20	30	50	100