



NEW HORIZON COLLEGE OF ENGINEERING



Permanently affiliated to VTU, approved by AICTE & ISO 9001:2008 certified

The Trust is a Recipient of Prestigious Rajyotsava State Award 2012 Conferred by the Government of Karnataka
Awarded Outstanding Technical Education Institute in Karnataka-2014

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(An Autonomous Institution Affiliated to VTU)

Accredited by NAAC with 'A' Grade

Department of AutomobileEngineering

Academic Year 2016-17

Third and Fourth Semesters B.E

Syllabus

CYCLE A
(SYLLABUS)

LIFE SKILLS FOR ENGINEERS

Course Code : 16HS321/421

L:P:T:S : 2:0:0:1

Exam Hours : 03

Credits : 03

CIE Marks : 50

SEE Marks : 50

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

CO1	To transform as stronger individuals to handle life challenges of professional life.
CO2	To apply the concept of Personality development & Grooming in real life.
CO3	Understand the concept of self and Creativity so that they can align with their life better.
CO4	To understand the role of motivation and leadership on behavior
CO5	To enhance holistic development of personality to equip the student with employability skills.
CO6	Determine the significance of goal setting & decision making in their professional life

Mapping of Course Outcomes to Program Outcomes:

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

Sl no	Contents of Module	Hrs	
1	Personality development & Grooming: Expectations from the industry & Career Planning / Reality Check; Building personal presence; Corporate grooming; Corporate etiquettes; Developing personal work code.	6	CO1
2	Self Analysis & Creativity: SWOC analysis, Who am I attributes, Importance of Self Confidence, Self Awareness, Self Management, Social Awareness, Emotional Intelligence, out of box thinking, lateral Thinking & Johari windows.	4	CO2, CO3
3	Motivation & Leadership: Basic concepts & theories, factor, types of Motivation, Good Leadership skill, Traits of a leader & Assessment of Leadership Skill.	4	CO4, CO5
4	Interpersonal Skill: Assessment of interpersonal skills, situation detail of interpersonal skill, Team Working, leading a team, and Strategies for influencing people. Understanding the relationship among motivation, leadership and team work	4	CO5
5	Goal Setting and Decision Making: identifying goals like (short term, long	4	CO6

	term, lifetime goals), Time management, importance of work scheduling, importance and necessity of decision making.		
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Text Books:

1. Soft Skill, 2015, Career development Centre, Green Pearl Publication

Reference books:

1. The 7 – Habits of Highly Effective People, Stephen R Covey, Neha Publishers.
2. Convey Sean, Seven Habits of Highly Effective Teens, New York, Fireside Publishers, 1998.
3. Daniel Coleman, Emotional Intelligence, Bantam Book, 2006.

Assessment Pattern

CIE- Continuous Internal Evaluation (50 Marks)

Bloom’s Category	Tests	Assignments	Quizzes
Marks (out of 50)	-	-	-
Remember	-	-	5
Understand	5	-	5
Apply	10	5	-
Analyze	5	-	-
Evaluate	5	-	-
Create	5	5	-

SEE- Semester End Examination (50 Marks)

Bloom’s Category	Tests
Remember	5
Understand	10
Apply	15
Analyze	10
Evaluate	5
Create	5

COMPUTER AIDED MACHINE DRAWING

Course Code : 16AUT331/431
 L:P:T:S : 3:0:0:1
 Exam Hours : 03

Credits : 03+01
 CIE Marks : 50
 SEE Marks : 50

Course Outcomes: At the end of the Course, the student will be able:

CO1	Evaluate problems on sections of regular solids
CO2	Sketch the pictorial views to orthographic views
CO3	Draw 2D views of machine elements
CO4	Assemble the components of mechanical systems in 3D environment.
CO5	Students would be able to sketch the CAM profiles for different follower motions.
CO6	Differentiate between different types of threads which are used in industries.

Mapping of Course Outcomes to Program Outcomes:

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

Module No	Module Contents	Hours	Cos
1	<p>Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on axis inclinations, spheres and hollow solids), True shape of sections</p> <p>Orthographic Views: Conversion of pictorial views into orthographic projections of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings) Hidden line conventions, Precedence of lines</p>	09	CO1,C O2
2	<p>Thread Forms: Thread terminology, sectional views of threads, ISO Metric (Internal & External) BSW Internal & External) square and Acme, Sellers thread, American Standard thread.</p> <p>Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.</p>	09	CO3,C O6
3	<p>Cams & Followers: Types of cams and followers, follower motions of SHM, Uniform acceleration & retardation, uniform velocity and cycloidal motion. Disc cams with reciprocating follower having knife edge, roller (inline and offset) and flat face follower (inline). Disc cams with oscillating roller follower</p>	09	CO5
4	<p>Assembly Drawings 1 (only 2D) Fuel Injector, Tailstock of lathe, Tool head of a shaper, Rams bottom safety valve, Feed Check Valve.</p>	09	CO4

5	Assembly Drawings – 2:- Screw jack, Machine vice, Plummer block (Pedestal Bearing), Piston, I.C. Engine connecting rod.	09	CO4
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SELF STUDY:

Students are required to submit a detailed 2-D drafting for the machine component by using solid-edge software.

TEXT BOOKS:

1. 'Machine Drawing', N.D.Bhat &V.M.Panchal, Charotar Publishing House Ltd, 53rd edition, 2014, ISBN - 9789380358468
2. 'Machine Drawing', K.R. Gopala Krishna, Subhash Publication, 20th Edition, 2014

REFERENCE BOOKS:

1. 'A Primer on Computer Aided Machine Drawing', Published by VTU, 2007, Belgaum
2. 'A text book of machine drawing' by R K Dhawan, S CHAND Publication, 2nd revised edition, 2014, ISBN - 978-8121908245.
3. Theory of Machines, S S Rattan, Tata McGraw – Hill Publishing Company Limited, Third Edition, 2009, ISBN – 13: 978-0-07-014477-4

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes	Self – Study
Marks (out of 50)	30	05	05	10
Remember	05	-	-	05
Understand	05	05	-	05
Apply	05	-	-	-
Analyze	05	-	-	-
Evaluate	05	-	-	-
Create	05	-	05	-

SEE – Semester End Examination (50 Marks)

Bloom's Category	Tests
Remember	10
Understand	15
Apply	5
Analyze	5
Evaluate	5
Create	10

CASTING AND FORGING TECHNOLOGY

Course Code : 16AUT341/441

L:P:T:S : 3:2:0:0

Exam Hours. : 03+03

Credits : 05

CIE Marks : 50+25

SEE Marks : 50+25

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

CO1	Gain the basic knowledge of manufacturing process.
CO2	Know the basics of sand moulding.
CO3	Identify the various moulding processes for casting
CO4	Gain the knowledge on the various types of melting furnaces.
CO5	Study the various concepts of forging
CO6	Aware of the basic inspection methods.

Mapping of Course Outcomes to Program Outcomes:

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

Module No	Module Contents	Hrs	COs
1	<p>Introduction: Concept of Manufacturing process, its importance. Classification of Manufacturing processes. Introduction to Casting process & steps involved. Components produced by casting process. Advantages & Limitations of casting process.</p> <p>Patterns: Definition, functions, Materials used for pattern, various pattern allowances and their importance. Classification of patterns, BIS color coding of Patterns.</p> <p>Binder: Definition, Types of binder used in mouldings sand.</p> <p>Additives: Need, Types of additives used and their properties</p>	09	CO1
	<p>List of Experiments</p> <p>1. Use of foundry tools and other equipment</p>	08	

	2. Preparation of moulds using two moulding boxes with and without pattern		
2	<p>Sand Moulding: Types of base sand, requirement of base sand. Moulding sand mixture ingredients for different sand mixtures. Method used for sand moulding, such as Greensand, dry sand and skin dried moulds.</p> <p>Cores: Definition, Need, Types. Method of making cores, Binders used, core sand moulding.</p> <p>Concept of Gating & Risers: Principle and types.</p> <p>Fettling and cleaning of castings: Basic steps, Casting defects, Causes, features and remedies.</p> <p>Inspection Methods – Methods used for Inspection of casting and welding. Visual, Magnetic particle, Fluorescent particle, Ultrasonic, Radiography, Eddy current, Holography methods of Inspection.</p>	09	CO2,CO3,C06
	<p>List of Experiments</p> <p>1. Preparation of casting (Aluminium or cast iron – Demonstration only).</p> <p>2. Compression, shear and tensile tests on universal sand testing machine</p>	08	
3	<p>Moulding Machines: Jolt type, Squeeze type, Jolt & Squeeze type and Sand slinger.</p> <p>Special moulding Process: Study of important moulding processes, No bake moulds, Flask less moulds, Sweep mould, CO2 mould, Shell mould, Investment mould.</p> <p>Metal moulds: Gravity die-casting, Pressure die casting, Centrifugal casting, Squeeze Casting, Slush casting, Thixo-casting and Continuous Casting Processes.</p>	09	CO3

	List of Experiments <ol style="list-style-type: none"> 1. Permeability test 2. Core hardness and Mould hardness test 3. Sieve analysis to find grain fineness number of base sand. 	08	
4	Melting Furnaces: Classification of furnaces. Constructional features & working principle of coke fired, oil fired and Gas fired pit furnace, Resistance furnace, Coreless Induction furnace, Electric Arc Furnace, Cupola furnace	09	CO4
	List of Experiments <ol style="list-style-type: none"> 1. Clay content determination in base sand 2. Moisture content test 	08	
5	Forging: Introduction, Classification of forging processes. Forging machines & equipment. Forging pressure and load in open die forging and closed die forging, concepts of friction hill and factors affecting it. Die-design parameters. Material flow lines in forging. Forging defects, Residual stresses in forging. Advantages and disadvantages of forging. Simple problems.	09	CO5
	List of Experiments <ol style="list-style-type: none"> 1. Calculation of length of the raw material required to do the model 2. Preparing forged models involving upsetting, drawing and bending operations 	8	

TEXT BOOKS:

1. "Manufacturing Process-I", Dr.K.Radhakrishna, Sapna Book House, 5th Revised Edition 2009.

2. "Manufacturing & Technology: Foundry Forming and Welding", P.N.Rao, Volume 1. Tata McGraw Hill Education Private Limited, 2013, ISBN 13: 978-9383286614

REFERENCE BOOKS:

1. "Process and Materials of Manufacturing", Roy A Lindberg, Pearson Edu, 4th Ed. 2006, ISBN-13: 978-0205118175.
2. "Manufacturing Technology", Serope Kalpakjian, Steuen. R. Sechmid, Pearson Education Asia, 7th Ed. 2013, ISBN -13: 978-9810694067.
3. "Manufacturing Process-III", Dr.K.Radhakrishna, Sapna Book House, 5th Revised Edition 2013, ISBN: 9788128010439

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes
Marks (out of 50)	30	10	10
Remember	5		5
Understand	5	05	5
Apply	5	5	
Analyze	5		
Evaluate	5		
Create	5		

CIE- Continuous Internal Evaluation for lab (25 Marks)

Bloom's Category	Tests	Assignments	Quizzes/Viva
Marks (out of 25)	10	10	05
Remember	2	2	01

Understand	2	2	01
Apply	2	2	
Analyze	2	2	01
Evaluate	2		01
Create		2	01

SEE – Semester End Examination (50 Marks - Theory)

Bloom's Category	Tests(theory)
Remember	10
Understand	10
Apply	10
Analyze	05
Evaluate	05
Create	10

SEE – Semester End Examination (25 Marks - Lab)

Bloom's Category	Tests(theory)
Remember	5
Understand	5
Apply	4
Analyze	5

Evaluate	03
Create	03

MECHANICS OF MATERIALS

Course Code : 16AUT351/451

L:P:T:S : 3:2:0:0

Exams Hours : 03+03

Credits : 05

CIE Marks: 50+25

SEE Marks: 50+25

COURSE OUTCOMES: At the end of the course, the students will be able to:

CO1	Empathize with the behavior of components when subjected to various type of loading.
CO2	Extend the ability to identify a problem and apply the fundamental concepts of MOM.
CO3	Draw Shear Force Diagrams and Bending Moment Diagrams for different types of loads and support conditions.
CO4	Estimate and analyze bending and shear stresses and deflections induced in beams.
CO5	Determine stresses in thin cylinders
CO6	Resolve the Torsional stresses, stiffness of shafts

Mapping of Course outcomes to Program outcomes:

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

Module No	Contents of Module	Hrs	Cos
1	Simple Stress and Strain: Assumptions in MOM, stress, strain, mechanical properties of materials, Linear elasticity, Hooke's Law and Poisson's ratio, Stress-Strain curve for Mildsteel, cast iron and Aluminum. Extension / Shortening of a bar, bars with cross sections varying in steps, bars with continuously varying cross sections (circular and rectangular), Elongation due to self weight, Principle of super position, elastic constants(only definition).	9	CO1, CO2
	List of Experiments: 1. To determine the hardness number of mild steel/cast iron specimen using Rockwell hardness test 2. To determine the hardness number of hardened steel specimen using Vickers's hardness test	8	
2	Bending Moment and Shear Force in Beams: Introduction, Types of beams, loads and reactions, shear forces and bending moments, rate of loading, sign conventions, relationship between shear force and bending moments. Shear force and bending moment diagrams for different beams subjected to concentrated loads, uniformly distributed load, (UDL) uniformly varying load (UVL) and couple for different types of beams.	9	C03
	List of Experiments: 1. To determine the hardness number of aluminum specimen using Brinell hardness test 2. To determine the ultimate shear strength of the given specimen in single and double shear using UTM	8	
3	Bending and Shear Stresses in Beams: Introduction, Theory of simple bending, assumptions in simple bending. Bending stress equation, relationship between bending stress and radius of curvature, relationship between bending moment and radius of curvature. Moment carrying capacity of a section. Shearing stresses in beams, shear stress across rectangular, circular, symmetrical I and T sections	9	CO4

	<p>List of Experiments:</p> <ol style="list-style-type: none"> 1. To determine the moment of inertia, modulus of elasticity and maximum bending stress of wood specimen by conducting bending test. 2. To determine the compressive strength, modulus of elasticity, % reduction in length and % increase in area of mild steel specimen by conducting compression test on universal testing machine. 		
4	<p>Deflection of Beams: Introduction, Differential equation for deflection. Equations for deflection, slope and bending moment. Double integration method for cantilever and simply supported beams for point load, UDL, UVL and Couple, Macaulay's method</p>	9	C04
	<p>List of Experiments:</p> <ol style="list-style-type: none"> 1. To determine the impact energy and strength of notched specimen using Izod test 2. To determine the impact energy and strength of notched specimen using Charpy test 		
5	<p>Torsion of Circular Shafts: Introduction, Pure torsion, assumptions, derivation of torsional equations, polar modulus, Torsional rigidity / stiffness of shafts. Power transmitted by solid and hollow circular shafts</p> <p>Thick and Thin Cylinder: Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume). Thick cylinders - Lamé's equation, Problems on Lamé's equation</p>	9	C05, C06
	<p>List of Experiments:</p> <ol style="list-style-type: none"> 1. To determine the modulus of rigidity, Torsional strength and modulus of toughness of mild steel specimen using torsion test 2. To determine the elastic strength, ultimate tensile strength, modulus of toughness and young's modulus of mild steel specimen by conducting tensile test on universal testing machine. 		

TEXT BOOKS:

1. "Strength of Materials", S.S. Rattan, McGraw Hill Education. 2nd Edition, 2011, ISBN-13:9780071072564.
2. "Strength of Materials", S.S.Bhavikatti, Vikas Publishing House Pvt. Ltd.-NOIDA, 3rd Ed.,2008, ISBN – 13: 9788125927914

REFERENCE BOOKS:

1. "Mechanics of Materials", by R.C.Hibbeler, Pearson Education, 11-Jan-2016, ISBN:9780134321233
2. "Mechanics of materials", James.M.Gere, Cengage Learning, 2012, ISBN-13 - 9781111577735.
3. "Mechanics of materials", in SI Units, Ferdinand Beer & Russell, Johston, 5th Ed.,McGraw-Hill Higher Education, 2009, ISBN: 0071284222, 9780071284226.

Assessment Pattern

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes
Marks (out of 50)	30	10	10
Remember	5		5
Understand	5	5	5
Apply	5		
Analyze	5		
Evaluate	5		
Create	5	5	

CIE- Continuous Internal Evaluation for lab (25 Marks)

Bloom's Category	Tests	Assignments	Quizzes/Viva
Marks (out of 50)	10	10	05
Remember	2	2	01
Understand	2	2	01
Apply	2	2	
Analyze	2	2	01
Evaluate	2		01
Create		2	01

SEE – Semester End Examination (50 Marks - Theory)

Bloom's Category	Tests(theory)
Remember	10
Understand	10
Apply	10
Analyze	05
Evaluate	05
Create	10

SEE – Semester End Examination (25 Marks - Lab)

Bloom's Category	Tests(theory)
Remember	5
Understand	5
Apply	4
Analyze	5
Evaluate	03
Create	03

MATERIAL SCIENCE AND METALLURGY

Course Code : 16AUT361/461

L:P:T:S : 3:2:0:0

Exams Hours : 03+03

Credits: 05

CIE Marks: 50+25

SEE Marks: 50+25

COURSE OUTCOMES: At the end of the course, the students will be able to:

CO1	Depute the different materials, their processing, and heat treatments in suitable application in mechanical engineering fields.
CO2	realize structure-property relationship, allow modification or engineering of materials to perform well in a specific application
CO3	Know-how of the structure-property relationships of metals can be beneficial in the study of ceramics and polymers
CO4	Recommend the suitable type of Heat treatment which helps in steel applications in tools and dies, crankshafts, connecting rods, fabrications, spring etc
CO5	Knowledge of Extraction process of different ferrous and nonferrous metals,

	nonmetallic materials like polymers, ceramics helps in preparation of polymer, ceramic application of composites
CO6	Evaluate the mechanical properties and deformation mechanism

Mapping of Course outcomes to Program outcomes:

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

Syllabus			
Module	Contents of the Module	Hours	COs
1	<p>Crystal Structure: BCC, FCC and HCP Structures, coordination number and atomic packing factors, crystal imperfections -point line and surface imperfections. Atomic Diffusion: Phenomenon, Ficks laws of diffusion, factors affecting diffusion.</p> <p>Fracture: Types, Griffith's criterion of brittle fracture,</p> <p>Creep: Description of Creep phenomenon with examples. three stages of creep, creep properties, stress relaxation.</p> <p>Fatigue: Types of fatigue loading with examples, Mechanism of fatigue, fatigue properties, fatigue testing and S-N diagram</p>	9	CO1, CO2
	<p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Scratch analysis of non-ferrous materials using scratch hardness tester 2. Determination of coating thickness for ferrous materials 		
2	<p>Phase Diagram I: Solid solutions Hume Rothary rule substitutional, and interstitial solid solutions, intermediate phases, Gibbs phase</p>		CO2

	<p>rule.</p> <p>Phase Diagram II Construction of equilibrium diagrams involving complete and partial solubility, lever rule. Different types invariant reactions – Eutectic, Eutectoid, Peritectic, Peritectoid reactions</p>	9	
	<p>List of Experiments:</p> <p>1. Preparation of specimen for metallographic examination and identification of microstructures of ferrous materials</p> <p>2. Preparation of specimen for metallographic examination and identification of microstructures of non-ferrous materials</p>		
3	<p>Iron carbon equilibrium diagram Description of phases, solidification of steels and cast irons, invariant reactions.</p> <p>Heat treating of metals TTT curves, continuous cooling curves, description of the following heat treatment processes with industrial applications: annealing and its types. normalizing, hardening, tempering, martempering, austempering, hardenability, surface hardening methods like carburizing, cyaniding, nitriding</p>	9	CO5
	<p>List of Experiments:</p> <p>1. Microstructure studies on heat treated (annealing, normalizing, hardening, tempering) ferrous materials</p> <p>2. Microstructure studies on heat treated (annealing, normalizing, hardening, tempering) non-ferrous materials.</p>		
4	<p>Ferrous and non ferrous materials Properties, Composition and uses of</p> <ul style="list-style-type: none"> • Grey cast iron, malleable iron, SG iron and steel • Copper alloys-brasses and bronzes. • Aluminum alloys-Al-Cu,Al-Si,Al-Zn alloys. • Titanium alloys <p>List of Experiments:</p> <p>1. Determination of defects in given material using magnetic crack detector</p> <p>2. Determination of cracks in given material using dye penetrant test</p> <p>3. Determination of defects in given material using ultrasonic inspection test</p>	9	CO3, CO5
5	<p>Ceramics:</p> <p>Introduction to ceramics, nature of ceramics, types of ceramics, comparison of ceramics and non ceramics phases, properties of ceramics materials, ceramic forming techniques, applications of</p>	9	CO6

	ceramics Powder Metallurgy: Definition and concept, applications, powder metallurgy process, Production of metal powders, characteristics of metal powders, compacting, presintering and sintering.		
	List of Experiments: 1. Determination of coating thickness for non-ferrous materials 2. Comparative study on microstructures for the given specimen before and after heat treatment and identification of defects in the same using appropriate tests		

TEXT BOOKS:

1. "Introduction to Physical Metallurgy" Sidney H Avner, Mcgraw Hill Education, 1997, ISBN 13: 9780074630068.
2. Fundamentals of Material Science and Engineering" David G Rethwisch William D Callister Jr. Rethwisch Callister , John Wiley & Sons Publishers, 4th Edition, 2012, ISBN 13: 9781118061602

REFERENCES:

1. "Materials Science and Engineering", V. RAGHAVAN, PHI Learning, 2004, ISBN: 9788120324558
2. "Engineering Materials", Kenneth G. Budinski, Michael K. Budinski, Prentice Hall, 9th edition, 2010, ISBN: 9780137128426.

Assessment Pattern

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes
Marks (out of 50)	30	10	10
Remember	5		5
Understand	5	05	5
Apply	5	5	

Analyze	5		
Evaluate	5		
Create	5		

CIE- Continuous Internal Evaluation for lab (25 Marks)

Bloom's Category	Tests	Assignments	Quizzes/ Viva
Marks (out of 50)	10	10	05
Remember	2	2	01
Understand	2	2	01
Apply	2	2	
Analyze	2	2	01
Evaluate	2		01
Create		2	01

SEE – Semester End Examination (50 Marks - Theory)

Bloom's Category	Tests(theory)
Remember	10
Understand	10
Apply	10

Analyze	05
Evaluate	05
Create	10

SEE – Semester End Examination (25 Marks - Lab)

Bloom's Category	Tests(theory)
Remember	5
Understand	5
Apply	4
Analyze	5
Evaluate	03
Create	03

CYCLE B
(Syllabus)

INTRODUCTION TO ECONOMICS

Course Code : 16HS322/422
 L:P:T:S : 2:0:0:1
 Exam Hours : 03

Credits : 03
 CIE Marks : 50
 SEE Marks : 50

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

CO1	Understand the basics of economics and different types of economics.
CO2	Understand the macro-economic environment of the business and its impact on enterprise.
CO3	Evaluate the national income by using various methods.
CO4	Examine the money and banking system of India.
CO5	Have a in depth knowledge about budget and the economy.
CO6	Analyse the balance of payments and foreign exchange markets.

S N	Contents of Module	Hrs	Cos
1	Introduction: Open, closed and mixed economy, central problems of an economy, Organization of economic activities: the centrally planned economy and The market economy, positive economics and Normative economics. Microeconomics: Consumer Behaviour: rationality, revealed preferences and utility, indifference curves, utility maximization, demand functions, substitution and income effects, demand elasticity- substitutes and complements.	5	CO1,
2	Introduction to Macroeconomics: Definition, Introduction to National income, circular flow of income, methods of calculating national income: value added, expenditure and income method, macroeconomic identities, goods and prices, Role of LPG and FDI, Inflation.	5	CO2, CO3
3	Money and Banking: Role of money, Transaction motive & Speculation motive, the supply of money, instruments of monetary policy and the Reserve bank of India.	4	CO4
4	Budget and the Economy: Components of the government budget: The revenue account, the capital account, measures of government deficit, Fiscal policy: changes in government expenditure, changes in taxes and debt.	4	CO5
5	Open economy Macroeconomics: The balance of payments, the foreign exchange market, determination of the exchange rate, flexible exchange rates, fixed exchange rates and managed floating, trade deficits, savings and investment.	4	CO6

Textbooks :

1. K K Dewett, Modern economic theory, S.Chand publishing
2. Begg, D., S. Fischer and R. Dornbusch, Economics. (McGraw Hill), 2014
3. Lipsey, R.G. and K.A. Chrystal, Economics. (Oxford University Press), 2015
4. Chopra P. N., Principle of Economics, Kalyani Publishers.
5. Agrawal AN, Indian Economy, Wiley Eastern Ltd, New Delhi, 2012

Reference books:

1. Introductory to Macroeconomics, Textbook for class 12th, NCERT.

Assessment Pattern**CIE- Continuous Internal Evaluation (50 Marks)**

Bloom's Category	Tests	Assignments	Quizzes
Marks (out of 50)	30	10	10
Remember	-	-	5
Understand	-	-	-
Apply	10	-	-
Analyze	10	-	-
Evaluate	10	-	5
Create	-	10	-

SEE- Semester End Examination (50 Marks)

Bloom's Category	Tests
Remember	-
Understand	-
Apply	10
Analyze	10
Evaluate	30
Create	-

BASIC THERMODYNAMICS

Course Code : 16AUT332/432

L: P: T: S : 3:0:0:1

Exam Hours : 03

Credits : 04

CIE Marks : 50

SEE Marks :50

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

CO1	Empathize with the basic concepts of thermodynamics like systems, equilibrium, process etc. and its applications
CO2	Realize the laws of thermodynamics and apply to solve engineering, problems.
CO3	Identify the different types of work and heat transfer mechanisms.
CO4	Differentiate reversible and irreversible process using second law and entropy concepts
CO5	classify the quantities used to describe the composition of a gas mixture, such as mass fraction, mole fraction, and volume fraction
CO6	Understand the behavior of real gases at various conditions

Mapping of Course Outcomes to Program Outcomes:

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

Module No	Module Contents	Hrs	Cos
1	<p>Fundamental Concepts & Definitions: Thermodynamics: definition and scope, Microscopic and Macroscopic approaches. Applications of Thermodynamics: Power generation, Power absorption, Pollution control,</p> <p>Thermodynamic Concepts: System and its types, Surroundings, boundary and its types, Thermodynamic properties: definition and units, Intensive and extensive properties. Thermodynamic state, state Diagram, path and process, quasi-static process: definition and illustration, cyclic and non-cyclic processes;</p> <p>Thermodynamic equilibrium: definition and conditions, Zeroth law of thermodynamics: Statement, and significance. Temperature: concept, two point scales and one point scale, International fixed points. Temperature measurements: Constant volume gas thermometer, Electrical resistance thermometer, thermocouple. Numerical on temperature scales.</p>	09	CO1,CO2
2	<p>Work and Heat: Mechanics definition of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work explanation, expressions for displacement work in various processes through p-V diagrams. Shaft work, Spring work, Heat: definition, sign convention, Modes and laws of heat transfer. problems on work transfer and heat transfer.</p> <p>First Law of Thermodynamics for closed systems: Joules experiment, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, Internal energy, To prove energy is a property of the system, modes of energy, Specific heat at constant volume, enthalpy, specific heat at constant pressure. Heat transfer for various quasistatic process. Numerical on closed systems</p>	09	CO1,CO2,CO3
3	<p>First Law of Thermodynamics for open systems: Extension of the First law to control volume; steady state-steady flow energy</p>	09	CO2,CO

	<p>equation, Assumptions for SFEE, important applications - Nozzle, Compressors, turbines, boilers, throttling device, Heat exchangers. Analysis of unsteady processes such as filling and evacuation of vessels with and without heat transfer. Problems.</p> <p>Second Law of Thermodynamics: Thermal reservoir. Direct heat engine; schematic representation and efficiency. Devices converting work to heat in a thermodynamic cycle; reversed heat engine, schematic representation, coefficients of performance. Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clausius statement of Second law of Thermodynamics, Equivalence of the two statements; Reversible and irreversible processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Carnot Theorem-1, 2 and 3 .Numerical</p>		4
4	<p>Entropy: Clausius theorem, Clausius inequality; Statement, proof, application to a reversible cycle. Entropy; definition, a property, change of entropy for irreversible process, principle of increase in entropy of the universe, entropy as a quantitative test for irreversibility, calculation of entropy using Tds relations, Available and unavailable energy, Numericals.</p> <p>Pure Substances: P-T and P-V diagrams, triple point and critical points. Sub cooled liquid, saturated liquid, mixture of saturated liquid and vapour, saturated vapour and superheated vapour states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality), T-S and H-S diagrams, Numerical.</p>	09	CO4
5	<p>Ideal gas mixtures: Kinetic theory of gases assumptions, Avogadro's law, Gas laws-Boyle's and Charles law. Ideal gas equation of state. Different forms of Ideal gas equation. Gas constant: Universal and particular .Ideal gas mixture; Dalton's laws of partial pressures, Amagat's law of additive volumes, evaluation of mass fractions, mole fractions, Expressions for C_p, C_v and Gas constant of the mixture. Numerical on mixtures.</p> <p>Real Gases: Introduction. Van-der Waal's Equation of state,</p>	09	CO5,CO6

	Van-der Waal's constants in terms of critical properties, Law of corresponding states, compressibility factor; compressibility chart. Numerical on real gases.		
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SELF STUDY:

Student has to conduct Energy analysis for Air conditioners, IC Engines and Refrigerators.

Data Handbook:

1. **Thermodynamics data hand book**, B.T. Nijaguna.B.S & Samaga, Sudha publication, 2006

TEXT BOOKS:

1. Basic and Applied Thermodynamics, P.K.Nag, Tata McGraw Hill Publication, 2nd edition, 2014, ISBN:9780070151314.
2. Basic Thermodynamics, B.K Venkanna, Swati B. Wadavadagi, PHI Learning Private Limited, 2010, ISBN 13 – 9788120341128.

REFERENCE BOOKS:

1. Fundamentals of Engineering Thermodynamics, Moran J Shapiro., John wiley Pub.2006,ISBN – 9780470032091.
2. Thermodynamics, An Engineering Approach, YunusA.Cenegal and Michael A.Boles, TataMcGraw Hill publications, 2007, ISBN - 9780073305370
3. Fundamentals of Thermodynamics, Claus Borgnakke, Richard Edwin Sonntag, 8th Edition,WILEY, ISBN - 9781306947732

CIE- Continuous Internal Evaluation 50 Marks (Theory)

Bloom's Category	Tests	Assignments	Quizzes	Self Study
Marks (out of 50)	30	05	05	10
Remember	05	02	03	
Understand	05			
Apply	05	03	02	05

Analyze	05			
Evaluate	05			
Create	05			05

SEE – Semester End Examination (50Marks)

Bloom's Category	Tests (Theory)
Remember	10
Understand	15
Apply	10
Analyze	5
Evaluate	5
Create	5

MACHINES FOR MANUFACTURING TECHNOLOGY

Course Code : 16AUT342/442
L: P: T: S : 3:2:0:0
Exam Hours : 03+03

Credits : 05
CIE Marks : 50+25
SEE Marks : 50+25

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

CO1	Gain the basic knowledge of Metal cutting, its parameters, Coolants and Lubricants.
CO2	Acquire the concepts of Turning, shaping and planning machines.
CO3	Gain the knowledge of the concepts of Milling machine
CO4	Attain the concepts of Drilling and grinding machines
CO5	Realize the concepts of Broaching, Sawing, various finishing process

CO6	Understand the concepts of CNC machines
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Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	1	3	2	2	9	2	2	1
CO2	3	2	3	2	1	3	2	1	3	2	2	1
CO3	3	3	3	2	1	3	2	1	3	2	2	1
CO4	3	3	3	2	1	3	2	1	3	2	2	1
CO5	3	3	3	2	1	3	2	1	3	2	2	2
CO6	3	3	3	2	1	3	2	1	3	2	2	2

Module No	Module Contents	Hrs	COs
1	<p>Theory of Metal Cutting: Single point cutting tool nomenclature, geometry. Mechanism of Chip Formation, Types of Chips. Merchant's circle diagram, Tool Wear and Tool failure, tool life. Effects of cutting parameters on tool life. Tool Failure Criteria, Taylor's Tool Life equation(no derivations).</p> <p>Cutting Tool Materials: Desired properties and types of cutting tool materials – HSS, carbides coated carbides, ceramics. Heat generation in metal cutting, factors affecting heat generation. Heat distribution in tool and work piece and chip. Measurement of tool tip temperature.</p> <p>Coolants and Lubricants- Introduction, functions of metal working fluids, types of lubricants, cutting fluids, characteristics of cutting fluids, types of cutting fluids. Desired properties and selection of lubricants.</p>	09	CO1
	<p>List of Experiments:</p> <p>1. Preparation of three models on lathe involving plain turning and taper turning.</p>	08	

	2. Preparation of three models on lathe involving taper turning step turning and thread cutting.		
2	Turning (Lathe), Shaping and Planning Machines: Classification, constructional features of Turret and Capstan Lathe. Tool Layout, shaping Machine, Planning Machine, Driving mechanisms of lathe, shaping and planning machines, Different operations on lathe, shaping machine and planning machine. Simple problems.	09	C02
	List of Experiments <ol style="list-style-type: none"> 1. Preparation of three models on lathe involving Facing Knurling and Eccentric Turning. 2. Cutting of V groove/dovetail/Rectangular groove using a shaper. 	08	
3	Milling machines: Classification, constructional features, milling cutters nomenclature, up milling and down milling concepts. Various milling operations.	09	C03
	Indexing: Simple, compound, differential and angular indexing calculations. Simple problems on simple and compound indexing.		
	List of Experiments: <ol style="list-style-type: none"> 1. Cutting of gear teeth using milling machine. 2. Problems on simple and compound indexing 	08	
4	Drilling machines: Classification, constructional features, drilling & related operations. Types of drill & drill bit nomenclature, drill materials.	09	C04
	Grinding machines: Types of abrasives, Grain size, bonding process, grade and structure of grinding wheels, grinding wheel types. Classification, constructional features of grinding machines (Centerless, cylindrical and surface grinding). Selection of grinding wheel. Grinding process parameters. Dressing and truing of grinding wheels.		

	List of Experiments 1. Preparation of three models on drilling involving reaming, boring and internal thread cutting. 2. Drilling of a cylindrical hole using drilling machine	08	
5	Broaching process - Principle of broaching. Details of a broach. Types of broaching machines-constructural details. Applications. Advantages and Limitations. Sawing Machines - Introduction, classification, sawing machine blades, applications of sawing machines. Finishing and other Processes Lapping and Honing operations – Principles, arrangement of set up and application. Super finishing process, polishing, buffing operation and application. CNC Machines -Introduction to CNC machines- Principles of operation. Axes of NC machine-Coordinate systems.	09	C05,C06
	List of Experiments 1. Grinding of a surface using surface grinding machine 2. Demonstration of CAN turning and milling centers	08	

Text Books

1. “Workshop Technology”, Hazara Choudhry, Vol-II, Media Promoters & Publishers Pvt.Ltd. 2010, ISBN 13 - 9788185099156
2. Production Technology, R.K.Jain, Khanna Publishers Delhi 6, 2010, ISBN 13:9788174090997
3. Production Technology, HMT, Tata Mc Graw Hill, 2008. ISBN-13: 978-0070964433.

Reference Books

1. Manufacturing Science, Amitabha Ghosh and Mallik, Affiliated East-West Press Pvt. Ltd, 2010, ISBN-13: 978-8176710633.
2. Fundamentals of Metal Machining and Machine Tools, Geoffrey Boothroyd, McGraw Hill, 2005, ISBN-13: 9781574446593.
3. Manufacturing Technology, R K Rajput, LAXMI PUBLICATIONS-NEW DELHI, 2010, ISBN-13: 9788131802441.

Assessment Pattern

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes
Marks (out of 50)	30	10	10
Remember	5		5
Understand	5	05	5
Apply	5		
Analyze	5		
Evaluate	5		
Create	5	5	

CIE- Continuous Internal Evaluation for lab (25 Marks)

Bloom's Category	Tests	Assignments	Quizzes/Viva
Marks (out of 50)	10	10	05
Remember	2	2	01
Understand	2	2	01
Apply	2	2	
Analyze	2	2	01
Evaluate	2		01

Create		2	01
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SEE – Semester End Examination (50 Marks - Theory)

Bloom's Category	Tests(theory)
Remember	10
Understand	10
Apply	10
Analyze	05
Evaluate	05
Create	10

SEE – Semester End Examination (25 Marks - Lab)

Bloom's Category	Tests(theory)
Remember	5
Understand	5
Apply	4
Analyze	5
Evaluate	03
Create	03

MECHANICAL MEASUREMENTS AND METROLOGY

Course Code : 16AUT352/452

L: P: T: S : 3: 2: 0: 0

Exam Hours : 03+03

Credits : 05

CIE Marks: 50+25

SEE Marks: 50+25

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

CO1	Realize the basic concepts of Metrology.
CO2	Recall the various measuring instruments for linear and angular measurement.
CO3	Describe basic concepts of mechanical measurement and errors in Measurements.
CO4	Use appropriate measuring instruments for measurement of force, torque and pressure
CO5	Select appropriate measuring instruments for measurement of temperature and strain
CO6	Empathize the concepts of geometric dimensioning and tolerances (GD&T), Limits, fits, gauges etc.

Mapping of Course Outcomes to Program Outcomes:

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

Module No	Module Contents	Hrs	COs
1	Standards of measurement: Definition and Objectives of metrology, Material standards-International Prototype meter, Imperial standard yard, Airy points, Wave length standard, subdivision of standards, line and end standard, calibration of end bars , Indian Standards (M-45,M-87 M-112) of Slip gauges,	09	

	<p>Wringing phenomena, Numerical problems on building of slip gauges.</p> <p>Measurements and measurement systems: generalized measurement system, basic definitions, Errors in measurement, classification of errors.</p>		CO1,CO2 ,CO3
	<p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Calibration of micrometer using slip gauge 2. Measurement of Taper angle using sine bar and slip gauge 3. Calibration of load cell using standard weights 		
2	<p>Limits, Fits, Tolerance and Gauge: Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS 919-1963), geometrical tolerance, hole basis system, shaft basis system, classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges- plain plug gauge, ring gauge, and gauge materials.</p>	09	CO6
	<p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Measurement of displacement using LVDT 2. Comparison and measurement of temperature using thermocouple and RTD 		
3	<p>Comparators: Introduction to comparators, characteristics, classification of comparators, mechanical comparators- Johnson's Mikrokator, Sigma comparator, Dial gauge, optical comparator- Ziess ultra-optimeter LVDT, pneumatic comparator-Solex pneumatic gauge, Angular measurements: Bevel protractor, sine principle and use of sine bars, sine centre, angle gauges, numerical on building of angles using angle gauges.</p>	09	

	<p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Measurement of gear parameters using gear tooth vernier 2. Measurement of alignment of surface plate using roller set 3. Calibration of pressure gauge. 		<p>CO1, CO2</p>
4	<p>Form Measurement: Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, best size wire. Tool maker's microscope, gear tooth terminology, gear tooth vernier caliper.</p>	09	<p>CO2</p>
	<p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Measurement of screw thread parameters using Tool makers' microscope. 2. Measurement of surface roughness of component using mechanical comparator 3. Measurement of screw thread parameters using floating carriage micrometer by 2-wire method. 		
5	<p>Measurement of force, torque, pressure: Principle of analytical balance, platform balance, proving ring. Torque measurement- Prony brake, hydraulic dynamometer. Pressure measurements- McLeod gauge, Pirani gauge.</p> <p>Measurement of Temperature and strain: Resistance thermometers, thermocouple, law of thermo couple, Strain measurements, electrical strain gauge.</p>	09	<p>CO4, CO5</p>
	<p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Measurement of cutting forces and torque using drill tool Dynamometer 2. Measurement of cutting force and power using Lathe tool Dynamometer 3. Determination of young s modulus using strain gauge. 		

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TEXT BOOKS:

1. Engineering Metrology, R.K. Jain, Khanna Publishers, 2009, ISBN-13: 978-8174091536.
2. Mechanical Measurements, Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2007, ISBN 13: 978-8131717189.
3. Metrology and Measurement, Dr. T Chandrashekar, Subhas publication, 2013, ISBN: 9789383214198

REFERENCE BOOKS:

1. Engineering Metrology, I.C. Gupta, Dhanpat Rai Publications, Delhi. 7th Edition, 2012, ISBN 13: 9788189928452
2. Mechanical and Industrial Measurements, R.K. Jain, Khanna Publishers, 2008, ISBN: 9788174091918
3. Metrology & Measurement, Anand K. Bewoor & Vinay A. Kulkarni, Tata McGraw Hill Pvt. Ltd., New Delhi, 2009, ISBN: 9781259081323
4. Engineering Metrology and Measurement, N V Raghavendra and Krishnamurthy, Oxford University Press, 2013, ISBN: 9780198085492

Assessment Pattern

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes
Marks (out of 50)	30	10	10
Remember	5		5
Understand	5	5	5
Apply	5		
Analyze	5		
Evaluate	5		

Create	5	5	
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CIE- Continuous Internal Evaluation for lab (25 Marks)

Bloom's Category	Tests	Assignments	Quizzes/Viva
Marks (out of 50)	10	10	05
Remember	2	2	01
Understand	2	2	01
Apply	2	2	
Analyze	2	2	01
Evaluate	2		01
Create		2	01

SEE – Semester End Examination (50 Marks - Theory)

Bloom's Category	Tests(theory)
Remember	10
Understand	10
Apply	10

Analyze	05
Evaluate	05
Create	10

SEE – Semester End Examination (25 Marks - Lab)

Bloom's Category	Tests(theory)
Remember	5
Understand	5
Apply	4
Analyze	5
Evaluate	03
Create	03

FLUID MECHANICS

Course Code : 16AUT362/462

L: P: T: S : 3:2:0:0

Exam Hours : 03+03

Credits : 05

CIE Marks: 50+25

SEE Marks: 50+25

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

CO1	Determine the properties of fluid and pressure and their measurement structures.
CO2	Understand the types of fluid flow and different flow description.
CO3	Apply continuity equation and energy equation in solving problems on flow through conduits

CO4	Compute the frictional loss in laminar and turbulent flows and Analyze flow between reservoirs
CO5	Correctly apply the course content to new situations so as to evaluate potential industrial applications of fluid theory through both physical induction and mathematical analysis.
CO6	Ability to decide when appropriate to use ideal flow concepts and the Bernoulli equation.

Mapping of Course Outcomes to Program Outcomes:

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

Module No	Module Contents	Hrs	COs
1	Basic Concepts and Fundamentals :- Types of fluids, Mass Density, Specific Weight, Specific Gravity (only definitions), Newton's Law of Viscosity, Dynamic Viscosity (numerical), Stoke's Theorem, surface Tension, Capillarity, Compressibility, Vapour pressure. Types of Flow- steady, unsteady, uniform, non-uniform, laminar, turbulent, one, two and three dimensional, compressible, incompressible, rotational, irrotational, stream lines, path lines, streak lines. Fluid as continuum, Lagrangian and Eulerian description, Velocity and stress field, Fluid statics (only fundamentals upto pascal law).	09	CO1, CO2,CO4
	List of Experiments:		

	<p>1. Determination of minor losses coefficient in flow through pipes due to sudden contraction</p> <p>2. To design and prepare a notch and test it in the open channel</p>		
2	<p>Fluid Kinematics: Continuity equation in 2D and 3D (Cartesian Co-ordinates only), velocity and acceleration, velocity potential function and stream function (simple numerical). Governing Equations of Fluid Motion: Reynolds transport theorem, Integral and differential forms of governing equations :mass, momentum and energy conservation equations , Navier-Stokes equations (no derivation) Euler's equation, Bernoulli's Equation.</p>	09	CO2, CO3
	<p>List of Experiments:</p> <p>1. Calibration of given Orifice meter and plotting the suitable calibration curve</p> <p>2. Calibration of given V-notch and plotting the suitable calibration curve</p>		
3	<p>Application of Bernoulli's equation: Pitot tube, Venturimeter orifices, orifice meter (No Derivation). (simple numerical) Flow.</p> <p>Through Pipes :- Energy losses through pipe, Major losses, Darcy-Weisbach equation, Chezy Equation, Minor losses in pipes-sudden enlargement, sudden contraction(no derivations), TEL, HGL, Moody diagram, pipes in series and parallel, Siphons, Transmission of power(only introduction, no numericals). Numericals on TEL,HGL and minor losses.</p>	09	CO6
	<p>List of Experiments:</p> <p>1. Determination of coefficient of friction and chezy constant for Turbulent flow in pipes</p> <p>2. Calibration of given Venturimeter and plotting the suitable calibration curve</p>		

4	<p>Laminar And Turbulent Flow :- Definition, Relation between pressure and shear stresses, Laminar flow through circular pipe, Fixed parallel plates, Turbulent flow and velocity distribution. (Numerical). Potential Flows: Basic plane potential flows: Uniform stream; Source and Sink; Vortex flow, Doublet, Superposition of basic plane potential flows, (no derivation).</p>	09	CO4,CO5
	<p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Determination of the Reynolds Number and hence the Type of Flow using the Reynolds apparatus 2. Performance test on an Air Blower 		
5	<p>Flow around Immersed Bodies: -Force exerted by flowing fluid on stationary body, expression for Lift and Drag, Classification of Drag, Flow around circular cylinder and Aerofoil, Development of lift on Aerofoil. Boundary Layer Theory :- Development of Boundary Layer on a thin plate and its characteristics, boundary layer thickness, boundary condition for velocity profile, Laminar and Turbulent Boundary Layers.</p>	09	CO5,CO6
	<p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Wind tunnel testing to determine the static pressure on cambered aerofoil. 2. To prepare a streamlined model and subject it to Flow visualization 		

TEXT BOOKS:

1. Fluid Mechanics and Hydraulic Machines, Dr. R.K. Bansal, Laxmi Publication (P) Ltd. New Delhi, 2011, ISBN - 13: 9788131808153
2. Fluid Mechanics & Hydraulic Machines, R.K. Rajput, S. Chand & Company Ltd, 2008, ISBN - 9788121916684.

REFERENCE BOOKS:

1. Fluid Mechanics and Fluid Power Engineering, Dr. D.S. Kumar, S.K. Kataria& sons, 2013, ISBN - 9789350143926
2. Fluid Mechanics, Frank M. White, McGraw Hill Publication, 7th Edition, 2011, ISBN - 9780071311212
3. Fluid Mechanics, Cengel&Cimbla, Tata McGraw Hill, 3rd Edition, 2014, ISBN – 9789339204655

Assessment Pattern**CIE- Continuous Internal Evaluation for theory (50 Marks)**

Bloom's Category	Tests	Assignments	Quizzes
Marks (out of 50)	30	10	10
Remember	5		5
Understand	5	05	5
Apply	5		
Analyze	5		
Evaluate	5		
Create	5	5	

CIE- Continuous Internal Evaluation for lab (25 Marks)

Bloom's Category	Tests	Assignments	Quizzes/Viva
Marks (out of 25)	10	10	05
Remember	2	2	01
Understand	2	2	01
Apply	2	2	

Analyze	2	2	01
Evaluate	2		01
Create		2	01

SEE – Semester End Examination (50 Marks - Theory)

Bloom's Category	Tests(theory)
Remember	10
Understand	10
Apply	10
Analyze	05
Evaluate	05
Create	10

SEE – Semester End Examination (25 Marks - Lab)

Bloom's Category	Tests(theory)
Remember	5
Understand	5
Apply	4
Analyze	5
Evaluate	03
Create	03

COMMON SUBJECTS (Syllabus)

ENGINEERING MATHEMATICS – III

Course Code : 16MAT31

L: P: T: S : 4:0:1:0

Exam Hours : 03

Credits: 05

CIE Marks: 50

SEE Marks: 50

Course Outcomes: At the end of the Course, the Student will be able to do the following:

CO1	Solve the Fourier series expansion of a functions analytically and numerically
CO2	Solve the Continuous model problems using Fourier transforms
CO3	Solve the discrete model problems using Z-transforms and Fast Fourier transform
CO4	Fit a suitable curve by the method of least squares and determine the lines of regression for a set of statistical data
CO5	Use appropriate numerical methods to solve algebraic and transcendental equations and also Evaluate a definite integral numerically
CO6	Use appropriate numerical methods to solve Boundary Value Problems in Partial differential equations

Mapping of Course Outcomes to Program Outcomes:

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

Syllabus			
Module	Contents of the Module	Hours	COs
1	Fourier series: Periodic function, Dirichlet's conditions, Fourier series of periodic functions of period 2π and arbitrary period, half range series. Fourier series and half Range Fourier series of periodic square wave, half wave rectifier, full wave rectifier, Saw-tooth wave with graphical representation, practical harmonic analysis.	9	CO1
2	Fourier Transforms: Infinite Fourier transforms, Fourier Sine and Cosine transforms, Inverse Fourier transform. Z - Transform: Definition, standard Z-transforms, properties,	9	CO2, CO3

	damping rule, shifting rule(without proof), initial and final value theorems, inverse Z- transforms. Applications: Solving difference equations using Z-transform.		
3	Statistical Methods: Fitting of the curves of the form $y = a + bx$, $y = a + bx + cx^2$, $y = ae^{bx}$, $y = ax^b$ by the method of least square and Correlation and Regression and Regression coefficients, lines of regression – problems. Discrete Fourier Transform and Fast Fourier Transform: Definition of N-Point DFT, problems for 4-Points and inverse DFT for four points only. FFT algorithm to compute the Fourier transform 4-Point only.	9	CO3, CO4
4	Numerical methods-1: Numerical solution of algebraic and transcendental equations; Regula- falsi method and Newton Raphson's method. Solution of a system of equation using Gaussideland Relaxation method. Interpolation & extrapolation – Newton's forward and backward formulae for equal intervals , Newton divided difference formula and Lagrange's formula for unequal intervals.	9	CO5
5	Numerical methods-2: Numerical integration - Simpson's 1/3 rd rule Simpson's 3/8 th rule, Weddle's rule (without proof). Partial differential equations-Numerical solution of one dimensional wave equation and heat equation, Numerical solution of two dimensional Laplace's equation and Poisson's equation.	9	CO5, CO6

Text Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 10th edition, 2014, Wiley-India publishers.
2. Higher Engineering Mathematics, B.S.Grewal, 43rd edition, 2014, Khanna Publishers .

Reference Books:

1. Advanced Modern Engineering Mathematics, Glyn James, 4th edition, 2015, Pearson Education.
2. Advanced Engineering Mathematics, Dennis G. Zill, Michael R. Cullen, 4th edition, 2015, Jones and Barlett Publishers Inc.
3. Engineering Mathematics, B. V. Ramana, 4th edition, 2005, Tata McGraw Hill Publications.
4. Engineering Mathematics, Anthony Craft, 4th edition, 2013, Pearson Education.

Assessment Pattern

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (30 Marks)	Assignments (10 Marks)	Quizzes (10 Marks)
Remember	10	3	5
Understand	5	5	5
Apply	5	2	
Analyze	5		
Evaluate	5		
Create			

SEE- Semester End Examination (50 Marks)

Bloom's Category	Questions (50 Marks)
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	

ENGINEERING MATHEMATICS – IV

Course Code : 16MAT41
L:P:T:S : 4:0:1:0
Exam Hours : 03

Credits : 05
CIE Marks : 50
SEE Marks : 50

Course Outcomes: At the end of the Course, the Student will be able to do the following:

CO1	Solve initial value problems using appropriate numerical methods
CO2	Understand the concepts of Complex variables and transformation for solving Engineering Problems
CO3	Understand the concepts of complex integration, Poles and Residuals in the stability analysis of engineering problems
CO4	Gain ability to use probability distributions to analyze and solve real time problems
CO5	Apply the stochastic process and Markov Chain in prediction of future events
CO6	Analyze, interpret, and evaluate scientific hypotheses and theories using rigorous probability and statistical methods

Mapping of Course Outcomes to Program Outcomes:

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

Syllabus			
Module	Contents of the Module	Hours	COs
1	Numerical Methods: Numerical solution of ordinary differential equations of first order and of first degree; Picard's Method, Taylor series method, modified Euler's method and Runge-Kutta method of fourth-order. Milne's and Adams- Bashforth predictor and corrector methods (No derivations of formulae). Numerical solution of simultaneous first order differential equations ; Picard's Method and Runge-Kutta Method of fourth-order	9	CO1
2	Complex Variables: Functions of complex Variables, Analytical functions, Cauchy's Riemann Equations in Cartesian and Polar form, Harmonic functions and Construction of analytic functions. Discussion of Transformations: $w = z^2$, $w = e^z$ and $w = z + (1/z)$ and Bilinear Transformations.	9	CO2
3	Complex Integrations: Complex line integrals – Cauchy's theorem and Cauchy's Integral formula. Power Series, Laurent's series. Singularities, Poles and Residuals, Residual Theorem (without proof)	9	CO3
4	Probability distributions: Random variables (discrete and continuous), probability density function, cumulative density function. Discrete Probability distributions: Binomial and Poisson distributions. Continuous Probability distributions; Exponential and normal distributions. Joint Probability distributions: , Mathematical expectation, correlation, covariance (discrete random variables only).	9	CO4
5	Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. Stochastic Processes: Stochastic processes, Probability Vectors, Stochastic matrices, Regular stochastic matrices, Markov chains, Higher transition probabilities, Stationary distribution of regular	9	CO5, CO6

	Markov chains and absorbing states		
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Text Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 10th edition, 2014, Wiley-India publishers.
2. Higher Engineering Mathematics, B.S.Grewal, 43rd edition, 2014, Khanna Publishers .

Reference Books:

1. Advanced Modern Engineering Mathematics, Glyn James, 4th edition, 2015, Pearson Education.

Assessment Pattern

1. CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests (30 Marks)	Assignments (10 Marks)	Quizzes (10 Marks)
Remember	10	3	5
Understand	5	5	5
Apply	5	2	
Analyze	5		
Evaluate	5		
Create			

2. SEE- Semester End Examination (50 Marks)

Bloom's Category	Questions (50 Marks)
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	

APPENDIX A

Outcome Based Education

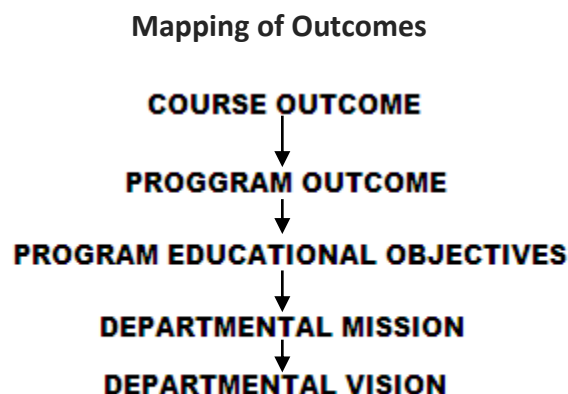
Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead classes, opportunities, and assessments should all help students achieve the specified outcomes.

There are three educational Outcomes as defined by the National Board of Accreditation:

Program Educational Objectives: The Educational objectives of an engineering degree program are the statements that describe the expected achievements of graduate in their career and also in particular what the graduates are expected to perform and achieve during the first few years after graduation. [nbaindia.org]

Program Outcomes: What the student would demonstrate upon graduation. Graduate attributes are separately listed in Appendix C

Course Outcome: The specific outcome/s of each course/subject that is a part of the program curriculum. Each subject/course is expected to have a set of Course Outcomes



APPENDIX B

The Graduate Attributes of NBA

Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that AUTt the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

Conduct investigations of complex problems: The problems that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline. * that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions.hat require consideration of appropriate constraints/requirements not explicitly given in the problem statement. (like: cost, power requirement, durability, product life, etc.). which need to be defined (modeled) within appropriate mathematical framework. that often require use of modern computational concepts and tools.#

Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Environment and sustainability: Understand the impact of the professional engineering

solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

APPENDIX C

BLOOM'S TAXONOMY

Bloom's taxonomy is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of [assessments](#) (tests and other evaluations of student learning), [curriculum](#) (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies. [eduglossary.org]

