NEW HORIZON COLLEGE OF ENGINEERING

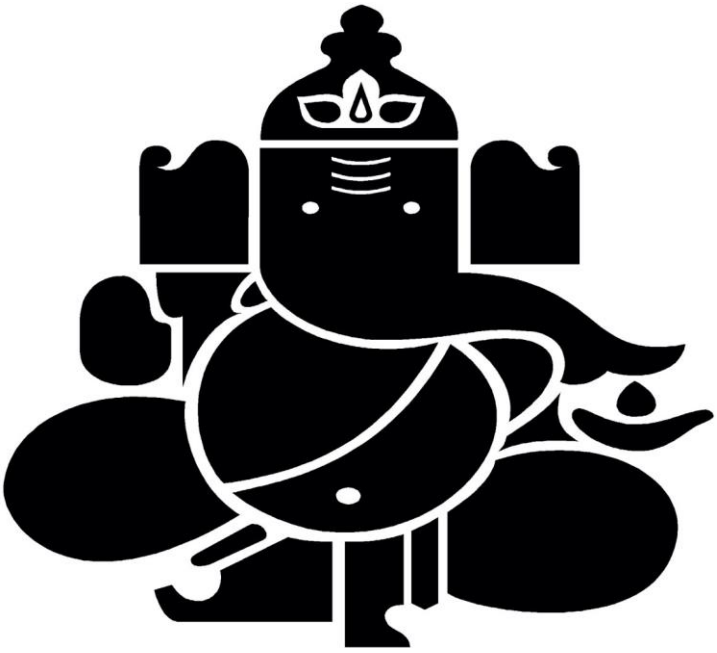
Autonomous College Permanently Affiliated to VTU, Approved by AICTE & UGC
Accredited by NAAC with 'A' Grade, Accredited by NBA

The Trust is a Recipient of Prestigious Rajyotsava State Award 2012 Conferred by the Government of Karnataka
Awarded Outstanding Technical Education Institute in Karnataka-2016
Ring Road, Bellandur Post, Near Marathalli, Bangalore -560 103, INDIA

2015 BATCH

BE - Mechanical Engineering

Third and Fourth Semesters
Scheme and Syllabus



Contents

VISION

To create competent mechanical engineers capable of working in diversified disciplines for transformative impact on societal progressive development in the field of mechanical engineering through creative research and lifelong learning.

MISSION

- To impart excellent education by proving state of art research facilities in the field of mechanical engineering.
- To develop alliances with industries and other organizations for excellence in teaching learning process, research and consultancy projects.
- To enhance the students in intellectual, entrepreneurial and ethical challenges through active participation by critical thinking.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: To prepare students with overall knowledge in Mechanical Engineering and also in the field of Mathematics, Science, Communication and Computing skills and enabling them to understand specific problem areas and find the optimum solutions for the same.

PEO 2: To prepare students to implement ideas of Mechanical Engineering for the challenging task in the interdisciplinary area like Electrical, Electronics, Computer Science, Civil, Bio-Technology and allied branches.

PEO 3: Widen talents of student in the field of manufacturing industries, in not only getting employment but also in establishing the industries.

PEO 4: Education of the student for the development of lifelong learning attitudes, ethics and value that will help their careers in engineering, academia, defense, state and central government employments.

MAPPING OF PEOs TO DEPARTMENT MISSION

Program Educational	M1	M2	M3	M4
PEO1	3	2	3	1
PEO 2	2	1	3	1
PEO 3	3	2	2	3
PEO 4	2	2	3	3

PROGRAM OUTCOMES (POs)

Graduate Attributes	PO #	Program Outcomes
Engineering knowledge	1	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex mechanical engineering problems
Problem analysis	2	Identify, formulate, review research literature, and analyze complex engineering problems in Mechanical Engineering reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Design / Development of Solutions	3	Design solutions for complex engineering problems and design system components or processes of Mechanical Engineering that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
Conduct Investigations of Complex Problems	4	Use research-based knowledge and research methods including design of experiments in Mechanical Engineering, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
Modern tool usage	5	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities in Mechanical Engineering with an understanding of the limitations
The Engineer and society	6	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 in Mechanical Engineering.
Environment and sustainability	7	Understand the impact of the professional engineering solutions of mechanical Engineering in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
Ethics	8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
Individual & team work	9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
Communication	10	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	11	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.

Lifelong learning	12	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

After successful completion of mechanical Engineering Program, the graduates will be able to:

PSO1	Specification, fabrication, testing, operation or documentation of basic mechanical systems/processes.
PSO2	Analysis, design, development and implementation of more advance mechanical systems Or processes.

New Horizon College of Engineering

Department of Mechanical Engineering

Scheme of CYCLE A

Sl no	Course code	Course	Credit distribution				Credits	Contact hours	Contact hours lab	marks		
			L	P	T	S				CIE	SEE	TOTAL
1	MAT31/ 41	Engineering maths-3	4	0	1	0	5	5	0	50	50	100
2	HSS322/ 422	Life skills for engineers	2	0	0	1	3	2	0	50	50	100
3	MEE331/ 431	Computer aided machine drawing	3	0	0	1	4	2	3	50	50	100
4	MEE341/ 441	Casting and forging technology+lab	3	2	0	0	5	4	3	75	75	150
5	MEE351/ 451	Mechanics of materials +lab	3	2	0	0	5	4	3	75	75	150
6	MEE361/ 461	Material sc and metallurgy+lab	3	2	0	0	5	4	3	75	75	150
Total							27	21	12	375	375	750

New Horizon College of Engineering

Department of Mechanical Engineering

Scheme of CYCLE B

Sl. No	Course Code	Course	Credit Distribution				Over all Credits	Contact Hours Weekly Theory	Contact Hours Weekly lab	Marks		
			L	P	T	S				CIE	SEE	Total
1	MAT31/41	Engineering Mathematics-3/4	4	0	1	0	5	5	0	50	50	100
2	HSS321/421	Economics for Engineers	2	0	0	1	3	2	0	50	50	100
3	MEE332/432	Basic Thermodynamics	3	0	0	1	4	4	0	50	50	100
4	MEE342/442	Machines for Manufacturing Technology+Lab	3	2	0	0	5	4	3	75	75	150
5	MEE352/452	Mechanical Measurement& Metrology+Lab	3	2	0	0	5	4	3	75	75	150
6	MEE362/462	Fluid Mechanics+Lab	3	2	0	0	5	4	3	75	75	150
		Total					27	23	9	375	375	750

CYCLE A

(SYLLABUS)

LIFE SKILLS FOR ENGINEERS

Course Code : HSS322/HSS422 **Credits : 3**
L:P:T:S : 2:0:0:1 **CIE Marks : 50**
Exam Hours : 03 **SEE Marks : 50**

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

HSS322/422.1	Take responsibility for their actions and be accountable to themselves
HSS322/422.2	Acquire Corporate etiquettes and develop their personality for their professional career
HSS322/422.3	Understand and learn to manage themselves better and to work with groups
HSS322/422.4	Set their personal and professional goals by themselves
HSS322/422.5	Articulate effectively their ideas, thoughts and concepts

Mapping of Course Outcomes to Program Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	PO12
HSS322/422.1	-	-	-	-	-	3	3	3	3	3	-	-
HSS322/422.2	-	-	-	-	-	3	3	3	3	3	-	-
HSS322/422.3	-	-	-	-	-	3	3	3	3	3	-	-
HSS322/422.4	-	-	-	-	-	3	3	3	3	3	-	-
HSS322/422.5	-	-	-	-	-	3	3	3	3	3	-	-

SYLLABUS

Module	Module Contents		
1.	Taking Ownership, Being Responsible and Accountable for their own actions, The meaning of ownership, responsibility and accountability, Practicing these philosophies in everyday life, how do these philosophies build credibility, Developing a 'Credible Character Impression about yourself', Self motivation, Developing healthy Self esteem, Leadership	**4**	**HSS322 /422.1**
2.	**Personality Development and Grooming** Expectations from the industry, building personal presence, corporate grooming, corporate etiquettes, developing personal work code, corporate code of conduct	**10**	**HSS322 /422.2**
3.	**Self Awareness and Self Management** Knowing your own self- understanding personality, perception, values and attitude. Interpersonal skills - Knowing others, working well with others, developing the right attitude for work, being proactive and positive.	**10**	**HSS322 /422.3**
4.	**GOAL Setting** Importance of Goals, Creating SMART goals , Tips for effective execution of goals	**4**	**HSS322 /422.4**
5.	**Articulation and Group Discussion** Ideas generation, expressing thoughts in a logical flow, presenting views in a group	**8**	**HSS322 /422.5**

Textbooks:

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. Seven Habits of Highly Effective Teens, Convey Sean, New York, Fireside Publishers,1998.

3. Emotional Intelligence, Daniel Coleman, Bantam Book, 2006.
4. How to win friends and influence people, Dale Carnegie

Assessment Pattern

CIE- Continuous Internal Evaluation

Bloom's Category	**Tests**	**Self Study**	**Assignments**	**Co-curricular**
Marks (out of 50)	**25**	**10**	**5**	**10**
Remember	10		5	
Understand	10	5		
Apply	5			
Analyze		5		
Evaluate				
Create				

SEE- Semester End Examination

Blooms' Category	**GROUP DISCUSSION**
Remember	15
Understand	15
Apply	10
Analyze	10
Evaluate	
Create	

COMPUTER AIDED MACHINE DRAWING

Course Code :MEE331/431 **Credits :04**
L:P:T:S :3:0:0:1 **CIE Marks :50**
Exam Hours : 03 **SEE Marks:50**

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

MEE331/431.1	Apply the principle of first angle projection system to the engineering components
MEE331/431.2	Analyse the dimensions of mating parts for developing assembly drawings
MEE331/431.3	Develop the 3D assembly drawing with the use of modern tools
MEE331/431.4	Communicate through 2D/3D assembly drawings for effective design and drawing documentation with GD&T support
MEE331/431.5	Investigate the complex, combinations of rotary and reciprocating component assemblies and develop 2D model of the same
MEE331/431.6	Apply the knowledge of temporary joints in the complex engineering assemblies and document the same using modern tool usage

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MEE331/431.1	3													
MEE331/431.2	3	3	2									1	3	
MEE331/431.3		3	2		2									2
MEE331/431.4	3	3								1				
MEE331/431.5	3	3	2		2								3	
MEE331/431.6	3	3			2								3	2

Module No	Module Contents	Hours	Cos
1	**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 **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 (Only sketching)	8	MEE331/431.1 MEE331/431.2
2	**Thread Formsand Fasteners**: Thread terminology, popular forms of screw threads, 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. **Riveted joints**: Forms and proportions of rivet heads, Single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snap head rivets) (Software drafting)	8	MEE331/431.1 MEE331/431.2 MEE331/431.6
3	**Limits, Fits and Tolerances**: General aspects, Nominal size and basic dimensions, Definitions, Basis of fit or limit system, Systems of specifying tolerances, Designation of holes, Shafts and fits, Need of Geometrical Tolerance, Geometrical characteristics of symbols, Indication of Geometrical Tolerance, Surface finish representation (Theory/Numerical question)	8	MEE331/431.1 MEE331/431.4 MEE331/431.6

4	**Cams&Followers**:TypesofcamsandfollowersfollowermotionsofSHM , Uniform acceleration & retardation, uniform velocity and cycloidal motion. Disc cams with reciprocating follower having knife edge androller (only inline). (Software Drafting)	8	MEE331 /431.1,3 ,4,5
5	**Assembly Drawings**: Screw jack (Only demo), Plummer block, Machine vice, Tail stock of a lathe, Tool head of a shaper, I.C. Engine connecting rod, Rams Bottom Safety Valve, Drill jig (Sketching + Software Drafting)	12	MEE331 /431.1,2 ,3,4,6

Text Books:

1. Machine Drawing- K.L. Narayana, P.Kannaiah & K.Venkata Reddy, New Age Publishers,4thEd,2017, **ISBN-13:** 978-8122440546

2. Machine Drawing- K.R. Gopala Krishna, Subhash publications. **ISBN-13**9789383214235

3. Machine Drawing- Dhawan, S.Chand Publications, 2nd Ed, ISBN9788121908245.

Reference Books:

1. Machine Drawing, ND Bhat, Charotar publication house, 49th Ed, **ISBN-13:** 978-9380358888

2.Theory of Machines, S S Rattan, Tata McGraw – Hill Publishing Company Limited, 4th Edition,2014, **ISBN:** 9789351343479

Assessment Pattern

CIE- Continuous Internal Evaluation for theory(50Marks)

Bloom's Category	**Tests**	**Assignments**	**Self-Study**	**Cocurricular**
Marks (out of 50)	**25**	**5**	**10**	**10**
Remember	2			
Understand	3			
Apply	8	5	5	
Analyze	8	5	5	
Evaluate	4	5		
Create				

Bloom's Category	**Tests(lab)**
Remember	2
Understand	2
Apply	1
Analyze	10
Evaluate	10
Create	

CASTING AND FORGING TECHNOLOGY

Course Code : MEE341/441 **Credits : 05**
L:P:T:S : 3:2:0:0 **CIE Marks : 50+25**
Exam Hours. : 03+03 **SEE Marks : 50+25**

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

MEE341/441.1	Apply the basics of manufacturing processes in uniquely identifying various casting & Forging Techniques
MEE341/441.2	Apply the modern engineering tools of sand moulding and moulding machines in effectively making the moulds
MEE341/441.3	Identify the specific requirements in selection of suitable cores, gates & risers implemented in a particular casting process
MEE341/441.4	Analyze the various types of melting furnaces based on their suitability in usage to specific application.
MEE341/441.5	Evaluate and interpret the various design parameters of each forging process.
MEE341/441.6	Apply the inspection methods in predicting the various casting defects

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MEE341/441.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
MEE341/441.2	3	-	-	-	2	-	-	-	-	-	-	-	-	3
MEE341/441.3	-	1	-	-	-	-	-	-	-	-	-	-	3	-
MEE341/441.4	3	1	-	-	-	-	-	-	-	-	-	-	-	3
MEE341/441.5	-	-	-	1	-	-	-	-	-	-	-	-	-	3
MEE341/441.6	3	-	-	-	2	-	-	-	-	-	-	-	-	-

Module No	Module Contents	Hrs	Cos
1	**Introduction:** Concept of Manufacturing process, its importance. Classification of Manufacturing processes. Introduction Casting process & steps involved. Components produced by casting process. Advantages & Limitations of casting process. **Patterns:** Definition, functions, Materials used for pattern, various pattern allowances and their importance. Classification of patterns, BIS color coding of Patterns. **Binder:** Definition, Types of binder used in moulding sand. **Additives:** Need, Types of additives used and their properties	09	**MEE 341/ 441. 1**
	List of Experiments 1. Use of foundry tools and other equipment 2. Preparation of moulds using two moulding boxes with and without pattern		

2	**Sand Moulding:** Types of base sand, requirement of bases and Moulding sand mixture ingredients for different sand mixtures. Method used for sand moulding, such as Greensand, dry sand and skin dried moulds. **Cores**: Definition, Need, Types. Method of making cores, Binders used, core sand moulding. **Concept of Gating & Risers**: Principle and types. **Fettling and cleaning of castings:** Basic steps, Casting defects, Causes,	09	**MEE 341/ 441. 2,3, 6**
	features and remedies. **Inspection Methods** – Methods used for Inspection of casting and welding. Visual, Magnetic particle, Fluorescent particle, Ultrasonic, Radiography, Eddy current, Holography methods of Inspection.		
	List of Experiments 1. Preparation of casting (Aluminium or cast iron –Demonstration only). 2. Compression, shear and tensile tests on universal sand testing machine		
3	**Moulding Machines**: Jolt type, Squeeze type, Jolt & Squeeze type and Sand slinger. **Special moulding Process:** Study of important moulding processes, No bake moulds, Flask less moulds, Sweep mould,CO2 mould, Shell mould, Investment mould. **Metal moulds:** Gravity die-casting, Pressure die casting, Centrifugal casting, Squeeze Casting, Slush casting, Thixo-casting and Continuous Casting Processes.	09	**MEE 341/ 441. 3**
	List of Experiments 1. Permeability test 2. Core hardness and Mould hardness test 3. Sieve analysis to find grain fineness number of base sand.		
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	08	**MEE 341/ 441. 4**
	List of Experiments 1. Clay content determination in base sand 2. Moisture content test		
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	**MEE 341/ 441. 5**
	List of Experiments 1. Calculation of length of the raw material required to do the model 2. Preparing forged models involving upsetting, drawing and bending operations		

TEXT BOOKS:

1. "Manufacturing Process-I", Dr.K.Radhakrishna, Sapna Book House, 5th RevisedEdition 2013. ISBN: 978-8128002076
2. "Manufacturing & Technology: Foundry Forming and Welding", P.N.Rao,Volume1.Tata McGraw Hill Education Private Limited, 2013, ISBN 13: 978-9383286614
3. "Principles of metal casting",R.W Heine, C.R. Loyer, McGraw Hills Pvt limited ,2017 ISBN:978-0070993488

REFERENCE BOOKS:

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

CIE- Continuous Internal Evaluation for theory (50Marks)

Bloom's Category	Tests	Assignments	Quizzes
Marks (out of 50)	**25**	**15**	**10**
Remember	2		
Understand	3		
Apply	8	5	5
Analyze	8	5	5
Evaluate	4	5	
Create			

CIE- Continuous Internal Evaluation for lab (25 Marks)

Bloom's Category	Tests	Assignments	Quizzes/Viva
Marks (out of 25)	**10**	**10**	**05**
Remember			01
Understand			01
Apply			01
Analyze	5	4	01
Evaluate	5	4	01
Create		2	

SEE-Semester End Examination (50 Marks - Theory)

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

SEE – Semester End Examination (25 Marks - lab)

Bloom's Category	Tests(lab)
Remember	2
Understand	2
Apply	1
Analyze	10
Evaluate	10
Create	

MECHANICS OF MATERIALS

Course Code : MEE351/451 **Credits : 05**
L:P:T:S : 3:2:0:0 **CIE Marks : 50+25**
Exams Hours : 03+03 **SEE Marks: 50+25**

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

MEE351/451.1	Engage as an individual to make an effective application of mechanics in real-time engineering problems
MEE351/451.2	Apply the fundamental concepts of MOM in finding the properties of Engineering materials
MEE351/451.3	Analyze the complex engineering components subjected to various types of load
MEE351/451.4	Design the structural members using theory of simple bending and deflection
MEE351/451.5	Investigate the safe stresses in pressure vessels
MEE351/451.6	Design the shafts using the theory of torsional strength and rigidity

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
MEE351/451.1						1						1	2	3
MEE351/451.2	1									1			2	3
MEE351/451.3		3												3
MEE351/451.4		3	3											3
MEE351/451.5				1									2	3
MEE351/451.6	1		3											3

Module No	Module Contents	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 Mild steel, 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	MEE351/451.1, MEE351/451.2
	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		
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**	**MEE351/ 451.3**
	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		
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**	**MEE351/451. 4**

	List of Experiments: 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	**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	**9**	**MEE351/ 451.4**
	List of Experiments: 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	**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 **Thick and Thin Cylinder**: Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume). Thick cylinders - Lame's equation, Problems on Lame's equation	**8**	**MEE351/ 451,5,** **MEE351/ 451.6**
	List of Experiments: 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 Marks (out of 50)	**Tests**	**Assignments**	**Quiz**
	25	**15**	**10**
Remember	4		
Understand	4		
Apply	6	3	5
Analyze	8	7	5
Evaluate	3	5	
Create			

CIE- Continuous Internal Evaluation for lab (25 Marks)

Bloom's Category Marks (out of 50)	**Tests**	**Assignments**	**Quizzes /Viva**
	10	**10**	**05**
Remembers			1
Understand			1
Apply		4	1
Analyze	5	4	1
Evaluate	5	2	1
Create			

SEE – Semester End Examination (50 Marks - Theory)

Bloom's Category	Tests(theory)
Remember	8
Understand	7
Apply	15
Analyze	15
Evaluate	5
Create	

SEE – Semester End Examination (25 Marks-lab)

Bloom's Category	Tests(lab)
Remember	2
Understand	2
Apply	1
Analyze	10
Evaluate	10
Create	

MATERIAL SCIENCE AND METALLURGY

Course Code : MEE361/461 **Credits : 05**
L:P:T:S : 3:2:0:0 **CIE Marks: 50+25**
Exams Hours : 03+03 **SEE Marks:50+25**

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

MEE361.1	Formulate the various crystal structures of materials and study the phase diagrams of engineering alloys
MEE361.2	Identify the various constituents of the iron carbon equilibrium diagram and analyse the various heat treatment processes for tools and dies, crankshafts, connecting rods, engineering items.
MEE361.3	Recognise the structure-property relationships of metals for different applications.
MEE361.4	Analyse the ceramic materials, properties and processing aspects and select for different applications.
MEE361.5	Design the powder metallurgy materials, properties and processing aspects.
MEE361.6	Evaluate the mechanical properties of materials and use for engineering applications.

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MEE361.1	2	2	2			2				2		2	3	3
MEE361.2	2	2	2			2				2		2	3	3
MEE361.3	2	2	2			2				2		2	3	3
MEE361.4	2	2	2			2				2		2	3	3
MEE361.5	2	2	2			2				2		2	3	3
MEE361.6	2	2	2			2				2		2	3	3

Module No	Module Contents	Hrs	Cos
1	**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. **Fracture**: Types, Griffith's criterion of brittle fracture, **Creep**: Description of Creep phenomenon with examples. three stages of creep, creep properties, stress relaxation. **Fatigue**: Types of fatigue loading with examples, Mechanism of fatigue, fatigue properties, fatigue testing and S-N diagram	9	**MEE361/ 461.1, MEE361/461. 2**

	List of Experiments: 1. Scratch analysis of non-ferrous materials using scratch hardness tester 2. Determination of coating thickness for ferrous Materials		
	Phase Diagram I: Solid solutions Hume Rothary rule substitutional, and interstitial solid solutions, intermediate phases, Gibbs phase rule. **Phase Diagram II** Construction of equilibrium diagrams involving complete and partial solubility, lever rule. Different types invariant reactions – Eutectic, Eutectoid, Peritectic, Peritectectoid reactions	**9**	**MEE361 /461.2**
2	**List of Experiments:** 1. Preparation of specimen for metallographic examination and identification of microstructures of ferrous materials 2. Preparation of specimen for metallographic examination an identification of microstructures of non-ferrous materials		
	Iron carbon equilibrium diagram Description of phases, solidification of steels and cast irons, invariant reactions. **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, mar tempering, austempering, hardenability, surface hardening methods like carburizing, cyaniding, nitriding	**9**	**MEE3 61/461.5**
3	**List of Experiments:** **List of Experiments:** 1. Microstructure studies on heat treated (annealing, normalizin hardening, tempering) ferrous materials 2. Microstructure studies on heat treated (annealing, normalizing, hardening, tempering) non-ferrous materials.		
4	Ferrous and non ferrous materials Properties, Composition and uses of • 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	**8**	**161MEE3 61/461.3, 61MEE3 61/461.5**

	List of Experiments: 1. Determination of defects in given material using magnetic crack detector 2. Determination of cracks in given material using dye penetrant Test 3. Determination of defects in given material using ultrasonic inspection test		
5	**Ceramics:** 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 ceramics **Powder Metallurgy:** Definition and concept, applications, powder metallurgy process, Production of metal powders, characteristics of metal powders, compacting, presintering and sintering.	**9**	**MEE3 61/461.4 MEE3 61/461.6**
	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, ISNB
   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, 9 edition, 2010, ISBN: 9780137128426

Assessment Pattern

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom's Category	Tests	Assignments	Quizzes
Marks (out of 50)	**25**	**15**	**10**
Remember	5		
Understand	3		
Apply	7	5	5
Analyze	7	5	5
Evaluate	3	5	
Create			

CIE- Continuous Internal Evaluation for lab (25 Marks)

Bloom's Category	Tests	Assignments	Quizzes/ Viva
Marks (out of 50)	**10**	**10**	**05**
Remember	2		
Understand	1	1	
Apply	3	4	3
Analyze	3	4	1
Evaluate	1	1	1
Create			

SEE – Semester End Examination (50 Marks - Theory)

Bloom's Category	Tests(theory)
Remember	8
Understand	7
Apply	15
Analyze	10
Evaluate	10
Create	

SEE – Semester End Examination (25 Marks - Lab)

Bloom's Category	Tests(lab)
Remember	5
Understand	3
Apply	7
Analyze	7
Evaluate	3
Create	

CYCLE B

(Syllabus)

ECONOMICS FOR ENGINEERS

Course Code : HSS321/421 **Credits: 03**
L:P:T:S : 2:0:0:1 **CIE 50**
Exam Hour : 03 **SEE 50**

Course Outcomes: On completion of the course, the student will be able to:

HSS321/421.1	Gain knowledge about importance of economics in decision making processes in day to day life.
HSS321/421.2	Analyze business environment at micro and macroeconomic level and its impact on industries in country's economy.
HSS321/421.3	Acquire knowledge about costing and estimation of projects for profit making.
HSS321/421.4	Apply principles of budgeting and finance for entrepreneurial success.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
HSS321/421.1	2	2		-		-		2	2	-	2	2
HSS321/421.2	2	2		-		-		2	2	-	2	2
HSS321/421.3	2	2		-		-		2	2	-	2	2
HSS321/421.4	2	2		-		-		2	2	-	2	2

Module	**Module Contents**	Hrs	COs
I	**Introduction to Economics**: Role of Engineer as an Economist, Types and problem of economies, Basics of economics (GDP, National income, inflation, business cycle, fiscal and monetary policies, balance of payment).	**4**	**HSS321/421.1 HSS321/421.3**
II	**Basic concepts of Microeconomics**: concept of Demand & Elasticity of Demand. Concept of Supply & Elasticity of Supply, Meaning of Production and factors of production, Production Possibility Curve, Law of variable proportions and returns to scale. Relevance of Depreciation towards industry, Depreciation computing methods.	**5**	**HSS321/421.2, HSS321/421.3**
III	**Concepts of cost of production**: different types of cost; accounting cost, sunk cost, marginal cost and opportunity cost. Break even analysis, Make or Buy decision. Cost estimation, Elements of cost as Direct Material Costs, Direct Labor Costs, Fixed Over-Heads, Factory cost, Administrative Over-Heads.	**4**	**HSS321/421.3, HSS321/421.4**
IV	**Capital budgeting**: Traditional and modern methods, Payback period method, IRR, ARR, NPV, PI. . Interest and Interest factors: Interest rate, Simple interest,	**4**	**HSS321/421.1, HSS321/421.3**

	Compound interest, Cash - flow diagrams, Personal loansand EMI Payment. Present worth, Future worth.		**HSS321/421.4**
V	**Book Keeping and Accounts**: Journal, Ledger, Trial balance, asset Types, profit & loss account, balance sheet.	**5**	**HSS321/421.1, HSS321/421.2, HSS321/421.3, HSS321/421.4**

TEXT BOOKS:

1. Riggs J.L, Engineering Economy, TMH, 2012 edition
2. Jain T.R., Economics for Engineers, VK Publications
3. IM PANDEY,Finacial Management, Vikas Pub. House
4. D N Dwivedi, Mangerial Economics , Vikas Pub. House

REFERENCE BOOKS:

1. Thuesen H.G, Engineering Economy. PHI
2. Prasanna Chandra, Financial Mangement,TMH
3. Singh Seema, Economics for Engineers, IK International
4. Chopra P. N, Principle of Economics, Kalyani Publishers
5. Dewett K K, Modern Economic Theory, S. Chand
6. H. L. Ahuja, Modern Economic Theory, S. Chand
7. Mishra S. K, Modern Micro Economics, Pragathi Publications
8. Gupta Shasi K, Management Accounting, Kalyani Publications

Assessment pattern

CIE –Continuous Internal Evaluation (50 Marks, Theory)

Bloom's category	**Test**	**Assignments**	**SSR**	**Co-curricular**
Marks (out of 50)	**25**	**5**	**10**	**10**
Remember	5			
Understand	5			
Apply	5	5	5	
Analyze	5		5	
Evaluate	5			
Create				

SEE –Semester Ending Examination (50 Marks)

Bloom's category	**SEE Theory(50)**
Remember	20
Understand	10
Apply	10
Analyze	10
Evaluate	
Create	

BASIC THERMODYNAMICS

Course Code	**: MEE332/432**	**Credits**	**: 04**
L: P: T: S	**: 3:0:0:1**	**CIE Marks**	**: 50**
Exam Hours	**: 03**	**SEE Marks**	**: 50**

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

MEE332/432.1	Understand the basic concepts of thermodynamics such as system, equilibrium, process, temperature scales, work and heat etc.
MEE332/432.2	Apply the laws of thermodynamics to various processes and real systems to solve engineering problems.
MEE332/432.3	Understand and analyze the concept of entropy for a given thermodynamic system.
MEE332/432.4	Analyze the Properties of Pure substances in real thermodynamics problems
MEE332/432.5	Usage of compressibility chart and the essential data by referring through the prescribed data hand books. .
MEE332/432.6	Apply the knowledge of thermodynamic relations with respect to real and ideal gas

Mapping of Course Outcomes to Program Outcomes:

	PO1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
MEE332/432.1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
MEE332/432.2	3	3	-	-	-	-	-	-	-	-	-	-	2	-
MEE332/432.3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
MEE332/432.4	3	3	2	-	-	-	-	-	-	-	-	1	-	2
MEE332/432.5	3	3	-	-	-	-	-	-	-	-	-	-	-	-
MEE332/432.6	3	3	2	-	-	-	-	-	-	-	-	-	-	2

Module	Module Contents	Hrs	Cos
1	**Fundamental Concepts & Definitions:** Thermodynamics: definition and scope, Microscopic and Macroscopic approaches. Applications of Thermodynamics: Power generation, Power absorption, Pollution control, **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; **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.	9	**MEE332/ 432.1, MEE332/ 432.**2
2	**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. **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	9	**MEE332/ 432.1,ME E332/432.2, MEE332/ 432.3**
3	**First Law of Thermodynamics for open systems:** Extension of the First law to control volume; steady state-steady flow energy 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. **Second Law of Thermodynamics:** Thermal reservoir. Direc heat engine; schematic representation and efficiency. Devices converting work to heat in a thermodynamic cycle; reversed hea	9	**MEE332/ 432.2, MEE332/43**2.4

	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 o 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		
4	**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. **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.	9	**MEE332/ 432.4**
5	**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. **Real Gases:** Introduction. Van-der Waal's Equation of state, Van-der Waal's constants in terms of critical properties, Law of corresponding states, compressibility factor; compressibility chart. Numerical on real gases.	9	**MEE332/ 432.5, MEE332/ 432.6**

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

Assessment pattern

CIE –Continuous Internal Evaluation (50 Marks, Theory)

Bloom's category Marks (out of 50)	**Test**	**Assignments**	**quiz**	**Co-curricular**
	25	**10**	**05**	**10**
Remember	4			
Understand	3			
Apply	8	5		
Analyze	7	5	5	5
Evaluate	3			5
Create				

SEE –Semester Ending Examination (50 Marks)

Bloom's category	**SEE Theory(50)**
Remember	8
Understand	7
Apply	15
Analyze	15
Evaluate	5
Create	

MACHINES FOR MANUFACTURING TECHNOLOGY

Course Code	**: MEE342/442**	**Credits**	**: 05**
L:P:T:S	**: 3:2:0:0**	**CIE Marks**	**: 50+25**
Exam Hours.	**: 03+03**	**SEE Marks**	**: 50+25**

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

MEE342/442.1	Apply the basic knowledge of metal cutting, its parameters, coolants and Lubricants in Manufacturing process.
MEE342/442.2	Analyze the concept of turning, shaping & planning Machining procedures.
MEE342/442.3	Solve various complex problems with respect to different methods of indexing in milling.
MEE342/442.4	Design Process parameters for drilling and grinding machines for the different operating condition.
MEE342/442.5	Select the modern tool to fulfill the needs of engineering applications using broaching and finishing processes.
MEE342/442.6	Understand the sustainability in advanced Manufacturing Technology like CNC Machines and other newer manufacturing technologies.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MEE342/452.1	3												3	
MEE342/452.2	3	3											3	3
MEE342/442.3		3	2											3
MEE342/442.4		3	2											3
MEE342/442.5	3	3			1									3
MEE342/442.6	3				1							1		3

Module No	Module Contents	Hrs	COs
1	**Theory of metal cutting:** single point cutting tool nomenclature, geometry. Mechanism of chip formation, types of chips. Merchants circle diagram, tool wear and tool failure, tool life. Effects of cutting parameters on tool life. Tool failure criteria, Taylors tool life equation (no derivations). **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. **Coolants and Lubricants**- Introduction, functions of metal working fluids, types of lubricants, cutting fluids, characteristics of cutting fluids, types	10	**161MEE 342/ 442. 1**

	List of experiments 1. Preparation of three models on lathe involving plain turning and taper turning. 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	**MEE 342/ 442. 2**
	List of experiments 1. Preparation of three models on lathe involving facing, knurling and eccentric turning. 2. Cutting of V groove/ dovetail/ rectangular groove using a shaper		
3	**Milling machines:** Classification, constructional features, milling cutters nomenclature, milling operations, up milling and down milling concepts. Various milling operations. **Indexing:** Simple, compound, differential and angular indexing calculations.	08	**161MEE 342/ 442. 3**
	List of experiments 1. Cutting of gear teeth using milling machine. 2. Problem on simple and compound indexing.		
4	**Drilling machines:** Classification, constructional features, drilling & related operations. Types of drill & drill bit nomenclature, drill materials. **Grinding machines:** Types of abrasives, Grain size, bonding process, grade and structure of grinding wheels, grinding wheel types. Classification, constructional features of grinding machines (Center less, cylindrical and surface grinding). Selection of grinding wheel. Grinding process parameters. Dressing and truing of grinding wheels.	08	**MEE 342/ 442. 4**
	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.		
5	**Broaching process :** Broaching process - Principle of broaching. Details of a broach. Types of broaching machines-constructional 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	**MEE 342/ 442. 5, MEE 342/ 442. 6**
	List of experiments 1. Grinding of a surface using surface grinding machine 2. Demonstration of CAN turning and milling centers.		

TEXT BOOKS:

1. Workshop Technology, HazaraChoudhry, Vol-II, Media Promoters & Publishers Pvt. Ltd.2010 ISBN 13 9788185099156
2. Production Technology, R.K.Jain, Khanna Publishers Delhi 6, 2010, ISBN13: 9788174090997
3. Production Technology, HMT, Tata MacGraw Hill, 2008. ISBN-13:978-0070964433.

REFERENCE BOOKS:

1. Manufacturing Science, Amitabha Ghosh and Mallik, affiliated East West Press, 2010. ISBN-13: 978-8176710633.
2. Fundamentals of Metal Machining and Machine Tools, G. Boothroyd, McGraw Hill, 2005, ISBN-13:9781574446593.
3. Manufacturing Technology, HMT. Tata Mc Graw Hill, 2008. ISBN-13:978-0070964433

CIE- Continuous Internal Evaluation for theory (50Marks)

Bloom's Category	**Tests**	**Assignments**	**Quizzes**	**Co-curricular**
Marks (out of 50)	**25**	**5**	**10**	**10**
Remember	5	5	5	
Understand	5		5	
Apply	5			
Analyze	5			
Evaluate	5			
Create				

CIE- Continuous Internal Evaluation for lab (25 Marks)

Bloom's Category	**Tests**	**Assignments**	**Quizzes/Viva**
Marks (outof 25)	**10**	**10**	**05**
Remember	2	2	1
Understand	2	2	1
Apply	2	2	
Analyze	2	2	1
Evaluate	2		1
Create		2	1

SEE – Semester End Examination (50 Marks - Theory)

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

SEE – Semester End Examination (25 Marks - Lab)

Bloom's Category	**Tests(lab)**
Remember	6
Understand	6
Apply	5
Analyze	5
Evaluate	3
Create	

MECHANICAL MEASUREMENTS AND METROLOGY

Course Code : MEE352/452 **Credits : 05**
L: P: T: S : 3: 2: 0: 0 **CIE Marks: 50+25**
Exam Hours : 03+03 **SEE Marks: 50+25**

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

MEE352/452.1	Apply the basic concepts of Metrology and measurement in inspection and calibration of instruments
MEE352/452.2	Analyze the displacements and taper angles in components using various measuring instruments for linear and angular measurement
MEE352/452.3	Determine the errors in measuring instruments with the knowledge on standards
MEE352/452.4	Apply appropriate measuring techniques with modern engineering tools for measurement of force, torque, Pressure, temperature and strain with the knowledge of fundamental physics
MEE352/452.5	Engage in independent study as a member of a team and make an effective oral presentation on the application of metrology and measurement
MEE352/452.6	Design the gauges and apply the concepts of limits , fits, geometric dimensioning and tolerances (GD&T)

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PO12
MEE352/452.1	2											3		
MEE352/452.2		2											2	
MEE352/452.3	2	2										3		
MEE352/452.4	2				1							3		
MEE352/452.5						3				3		3		3
MEE352/452.6	2	2	3										2	

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-87112) of Slip gauges,	09
	Wringing phenomena, Numerical problems on building of slip gauges. **Measurements and measurement systems:** generalized measurement system, basic definitions, Errors in measurement, classification of errors.	**MEE352/452.1 MEE352/452.2 MEE352/452.3**
	List of Experiments: 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	**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.	09	**MEE352/452.6**
	List of Experiments: 1. Measurement of displacement using LVDT 2. Comparison and measurement of temperature using thermocouple and RTD		
3	**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.	09	

	List of Experiments: 1. Measurement of gear parameters using gear tooth vernier 2. Measurement of alignment of surface plate using roller set 3.Calibration of pressure gauge.		**MEE352/452.1 , MEE352/452.2**
4	**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.	04	**MEE352/452.2**
	List of Experiments: 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.		

	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. **Measurement of Temperature and strain:** Resistance thermometers, thermocouple, law of thermo couple, Strain measurements, electrical strain gauge.	09	
5	**List of Experiments:** 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.		**MEE352/452.4,MEE352/452.5**

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)

	Tests	Assignment	Quizzes
Bloom's	**25**	**15**	**10**
Remember	2		
Understand	3		
Apply	8	5	5
Analyze	8	5	5
Evaluate	4	5	
Create			

CIE- Continuous Internal Evaluation for lab (25 Marks)

Bloom's	**Tests**	**Assignments**	**Quizzes/Viva**
Marks (out of	**10**	**10**	**05**
Remember			01
Understand			01
Apply		2	01
Analyze	5	4	01
Evaluate	5	4	01
Create			

SEE – Semester End Examination (50 Marks - Theory)

Bloom's Category	**Tests(theory)**
Remember	8
Understand	7
Apply	15
Analyze	15
Evaluate	5
Create	

SEE – Semester End Examination (25 Marks - Lab)

Bloom's Category	**Tests(theory)**
Remember	2
Understand	2
Apply	1
Analyze	10
Evaluate	10
Create	

FLUID MECHANICS

Course Code : MEE362/462 | **Credits : 05**
L: P: T: S : 3:2:0:0 | **CIE Marks: 50+25**
Exam Hours : 03+03 | **SEE Marks: 50+25**

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

MEE362.1/462.1	Apply the basic Knowledge of Fluid Mechanics to determine its properties.
MEE362.2/462.2	Implement the concepts of fluid statics, fluid kinematics and fluid dynamics in the applications of Aerodynamics, Hydraulics, Marine Engineering and Gas dynamics
MEE362.3/462.3	Estimate the losses in a flow system, flow through pipes, boundary layer flow and flow past immersed bodies by using modern tools.
MEE362.4/462.4	Develop the solutions of real time fluid flow problems
MEE362.5/462.5	Analyze the types of fluid flow using Reynolds apparatus
MEE362.6/462.6	Design a flow measuring device to analyze the discharge of fluid

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MEE362.1/462.1	**3**	**3**												
MEE362.2/462.2	**3**	**3**												
MEE362.3/462.3		**3**			**1**									**3**
MEE362.4/462.4	**3**		**1**	**1**										**3**
MEE362.5/462.5	3	**3**												**3**
MEE362.6/462.6		**3**	**1**											**3**

Module No	Module Contents	Hrs	Cos
1	**Fluid Properties :-** Types of fluids, Mass Density, Specific Weight, Specific Gravity, Newton's Law of Viscosity, Dynamic Viscosity, Surface Tension, Capillarity, Compressibility, Vapour pressure ,numerical **Fluid Statics:** Pascal's law, pressure variation in a static fluid in 2D.	09	**MEE362 /462.1 MEE362 /462.2**
	List of Experiments: ***1.*** Determination of viscosity of given oil using Saybolt /Redwood/Torsion Viscometer**.** ***2.*** Calibration of given Venturimeter and plotting the suitable calibration curve		
2	**Buoyancy:** Buoyancy, center of buoyancy, archimede's principle, principle of floatation, metacentre and metacentric height, stability of floating and submerged bodies, determination of Metacentric height by experimental method. **Fluid Kinematics**:: fluid flow description by Langrangian and Eulerian method, 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, Continuity equation in 2D and 3D (Cartesian Co-ordinates only), velocity and acceleration, velocity	09	**MEE362 /462.2, MEE362 /462.3, MEE362 /462.5**

	potential function and stream function (simple numerical).		
	List of Experiments: **1.** Calibration of given Orifice meter and plotting the suitable calibration curve. **2.**To Determine the Metacentric Height Of a Ship Model.		
3	**Fluid Dynamics :-** Introduction to Navier-Stroke's Equation, derivation of Euler equation of motion along a stream line, and Bernoulli's equation from Euler's equation and first principles, application of Bernoulli's equation to pitot tube, venturi meter, orifices, orifice meter (No Derivation). (numerical)	09	**MEE362/ 462.3, MEE362/ 462.4, MEE362/**
	List of Experiments: ***1.*** To verify Bernoulli's equation by demonstrating the relationship between pressure head and kinetic head ***2.*** Calibration of given V-notch, Rectangular, Trapezoidal Notch and plotting the suitable calibration curve		
4	**Flow Through Pipes :-** Energy losses through pipe, Major losses, Darcy-Weisbach equation, Chezy's Equation, Minor losses in pipes-sudden enlargement, sudden contraction, TEL, HGL, pipes in series and parallel, Siphons, Transmission of power. (numerical). **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)	09	**MEE362 /462.4, MEE362 /462.5**
	List of Experiments: **1.** Determination of coefficient of friction and Chezy's constant for Turbulent flow in pipes. **2.** Determination of minor losses coefficient in flow through pipes due to sudden contraction and sudden expansion.		
5	**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, Laminar Sub Layer, Separation of Boundary Layer.	09	**MEE362 /462.5, MEE362 /462.6**
	List of Experiments: ***1***.Wind tunnel testing to determine the static pressure on cambered aerofoil. 2.Determination of the Reynolds Number and hence the Type of Flow using the Reynolds apparatus		

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)	25	15	10
Remember	5		
Understand	5		
Apply	5	5	5
Analyze	5	5	5
Evaluate	5	5	
Create			

CIE- Continuous Internal Evaluation for lab (25 Marks)

Bloom's Category	Tests	Assignments	Quizzes/Viva
Marks (out of 50)	10	10	05
Remember			1
Understand			1
Apply		2	1
Analyze	5	4	1
Evaluate	5	4	1
Create			

SEE – Semester End Examination
(50 Marks - Theory)

Bloom's Category	**Tests(theory)**
Remember	8
Understand	7
Apply	15
Analyze	15
Evaluate	5
Create	

SEE – Semester End Examination

(25 Marks - Lab)

Bloom's Category	**Tests(theory)**
Remember	2
Understand	2
Apply	1
Analyze	10
Evaluate	10
Create	

COMMON SUBJECTS
(Syllabus)

ENGINEERING MATHEMATICS – III

Course Code :	**MAT31**	**Credits**	**: 05**
L:P:T:S	**: 4:0:1:0**	**CIE Marks**	**: 50**
Exam Hours	**: 3**	**SEE Marks**	**: 50**

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

MAT31.1	Solve the Fourier series expansion of functions analytically and numerically.
MAT31.2	Solve the Continuous model problems using Fourier transform.
MAT31.3	Solve the discrete model problems using Z-transforms and Fast Fourier transform.
MAT31.4	Fit a suitable curve by the method of least squares and determine the lines of regression for a set of statistical data.
MAT31.5	Use appropriate numerical methods to solve algebraic and transcendental equations and also to calculate a definite integral numerically.
MAT31.6	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	POI0	POII	PO12
MAT31.1	3	3	3	2	2	-	-	-	1	1	-	2
MAT31.2	3	3	3	2	2	-	-	-	1	1	-	2
MAT31.3	3	3	3	2	2	-	-	-	1	1	-	2
MAT31.4	3	3	3	2	2	-	-	-	1	1	-	2
MAT31.5	3	3	3	2	2	-	-	-	1	1	-	2
MAT31.6	3	3	3	2	2	-	-	-	1	1	-	2

Module No	Module Contents	Hours	COs
1	**Fourier series**: Periodic function, Dirichlet's conditions, Fourier serie of periodic functions of period 2π and arbitrary period $2l$, half rang series. Fourier series and half Range Fourier series of periodic squar wave, half wave rectifier, full wave rectifier, Saw-tooth wave with graphical representation, practical harmonic analysis.	9	MAT31.1
2	**Fourier Transforms:** Infinite Fourier transforms, Fourier Sine and Cosine transforms, Inverse Fourier transform. **Z - Transform:** Definition, Z-transforms of some standard functions, properties, damping rule, shifting rule (without proof), initial and final value theorems, inverse Z- transforms. **Applications:** Solving difference equations using Z-transform.	9	MAT31.2 , MAT31.3

3	**Statistical Methods:** Fitting of the curves of the form $y = a + b\,x$, $y = a + b\,x + c\,x^2$, $y = ae^{bx}$, $y = a\,x^b$, and $y = ab^x$ by the method of least square**,** Correlation and Regression , Regression coefficients, line 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 transforms 4-Point only.	9	MAT31.3, MAT31.4
4	**Numerical Methods-1:** Numerical solution of algebraic and transcendental equations; Rugula- falsi method and Newton Raphson's method. Solution of a system of equations using Gauss-seidel and Relaxation method. Interpolation & extrapolation – Newton's forward and backward formulae for equal intervals, Newton divided difference and Lagrange's formulae for unequal intervals.	9	MAT31.5
5	**Numerical Methods-2**: Numerical integration - Simpson's 1/3rd rule, Simpson's 3/8th rule, Weddle's rule (without proof)-Problems. Numerical solution of Boundary value problems-Solution of one dimensional wave equation and heat equation, Numerical solution o two dimensional Laplace's equation and Poisson's equation.	8	MAT31.5, MAT31.6

TEXT BOOKS:

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

REFERENCE BOOKS:

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

Assessment Pattern

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes	C0-curricular
Marks (out of 50)	25	5	10	10
Remember	5	-	5	
Understand	5	3	5	
Apply	5	2	-	
Analyze	5	-	-	
Evaluate	5	-	-	
Create	-	-	-	

SEE – Semester End Examination (50 Marks)

Bloom's Taxonomy	**Tests**
Marks (Out of 50)	
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

ENGINEERING MATHEMATICS – IV

Course Code : MAT41 **Credits: 05**
L: P: T: S : 4:0:1:0 **CIE Marks: 50**
Exam Hours : 03 **SEE Marks : 50**

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

MAT41.1	Solve initial value problems using appropriate numerical methods.
MAT41.2	Understand the concepts of Complex variables and transformation for solving Engineering Problems.
MAT41.3	Understand the concepts of complex integration, Poles and Residuals in the stability analysis of engineering problems.
MAT41.4	Gain ability to use probability distributions to analyze and solve real time problems.
MAT41.5	Apply the stochastic process and Markov Chain in prediction of future events.
MAT41.6	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
MAT41.1	3	2	3	2	2	-	-	-	1	1	-	1
MAT41.2	3	2	3	2	2	-	-	-	1	1	-	1
MAT41.3	3	2	3	2	2	-	-	-	1	1	-	1
MAT41.4	3	2	3	2	2	-	-	-	1	1	-	1
MAT41.5	3	2	3	2	2	-	-	-	1	1	-	1
MAT41.6	3	2	3	2	2	-	-	-	1	1	-	1

Module No.	Module Contents	Hours	COs
1	**Numerical Methods:** Numerical solution of ordinary differential equations of first order and of first degree: single step methods- Picard's Method, Taylor's series method, modified Euler's metho and Runge-Kutta method of fourth-order. Multi step methods- Milne's and Adams- Bashforth predictor and corrector methods. Numerical solution of simultaneous first order differential equations ; Picard's Method and Runge-Kutta Method of fourth order(no derivation of formulae)	9	MAT41.1
2	**Complex Variables**: Functions of complex Variables, Analytical		MAT41.2

	functions, Cauchy's Riemann Equations in Cartesian and Polar forms, Harmonic functions and Construction of analytic function Discussion of Transformations: $w = z^2$, $w = e^z$ and $w = z + (1 / z)$ and Bilinear Transformations.	9	
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-problems(Without proof).	9	MAT41.3
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	MAT41.4
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 for test of goodness of fit. **Stochastic Processes:** Stochastic processes, Probability Vectors, Stochastic matrix, Regular stochastic matrix, Markov chains, Higher transition probabilities, Stationary distribution of regular Markov chains and absorbing states	8	MAT41.5 MAT41.6

TEXT BOOKS:

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

REFERENCE BOOKS:

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

Assessment Pattern

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category Marks (Out of 50)	Tests (25 Marks)	Assignments (5 Marks)	Quizzes (10 Marks)	Co-curricular (10 Marks)
Remember	5	-	5	
Understand	5	3	5	
Apply	5	2	-	
Analyze	5	-	-	
Evaluate	5	-	-	
Create	-	-	-	

SEE- Semester End Examination (50 Marks)

Bloom's Category Marks (Out of 50)	Test (50 Marks)
Remember	10
Understand	10
Apply	20
Analyze	5
Evaluate	5
Create	-

BASIC ENGINEERING MATHEMATICS-I

Course Code : DMAT31
L:P:T:S : 0:0:0:0
Exam Hours : 02

Credits : 00
CIE Marks : 25
SEE Marks : 25

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

CO1	Learn the principles of engineering mathematics through calculus
CO2	Determine the power series expansion of a function
CO3	Find the definite integrals with standard limits
CO4	Develop the ability to construct mathematical models involving differential equations
CO5	Apply ideas from linear algebra in solving systems of linear equations
CO6	Determine Eigen values and Eigen vectors of a matrix

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

Course Syllabus			
Module No.	Contents of the Module	Hours	CO'S
1	Differential Calculus: Polar curves-Problems on angle between the radius vector and tangent, Angle between two curves-Problems, Pedal equation for polar curves-Problems. Taylor's and Macluren's theorems for function of one variable (statement only)-Problems.	5	CO1, CO2
2	Partial differentiation: Definition and Simple problems, Euler's theorem for Homogeneous function (NO Derivation & NO extended theorem)-Problems, Partial differentiation of composite functions (chain rule)-Problems, Jacobians - definition and problems.	5	CO1, CO2
3	Integral Calculus: Problems on reduction formulae for functions $\sin x$, $\cos^n x$, $\sin^n x \cos^n x$, Problems on evaluation of these integrals wit standard limits $(0 \text{ to } \pi/2)$. Differential Equations: Solution of first order and first degree differential equations-Variable separable, Linear Bernoulli's and Exact differential equations.	5	CO3, CO4

4	Linear Algebra-1: Problems on rank of a matrix by elementary transformations, consistency of a system of linear equations and solution (homogeneous and non-homogeneous)-Problems. Solution of system of linear equations by Gauss elimination method-Problems.	5	CO5
5	Linear Algebra-2: Linear transformation, Eigen values and Eigen vectors, diagonalisation of a square matrix, Quadratic forms, Reduction to canonical form by orthogonal transformation-Problem	5	CO6

Text Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 10^{tH} edition, 2014, Wiley-India Publishers.
2. Higher Engineering Mathematics, B.S.Grewal, 43nd edition, 2014, Khanna Publishers .

Reference Books:

1. 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.

Assessment Pattern:

CIE- Continuous Internal Evaluation (25 Marks).

Bloom's Category	Tests (20 Marks)	Assignments (5 Marks)
Remember	5	--
Understand	5	5
Apply	5	--
Analyze	2.5	--
Evaluate	2.5	--
Create	--	--

SEE- Semester End Examination (50 Marks)

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

BASIC ENGINEERING MATHEMATICS-II

Course Code: DMAT41
L:P:T:S : 0:0:0:0
Exam Hours : 02

Credits : 00
CIE Marks : 25
SEE Marks : 25

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

CO1	Gain knowledge of basic operations of vectors
CO2	Use curl and divergence of a vector function in three dimensions
CO3	Understand ordinary differential equations and their application.
CO4	Understand basic concepts of Laplace transform to solve engineering problems
CO5	Solve the Laplace transform of Periodic and step functions
CO6	Solve initial and boundary value problems using Laplace transform method.

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

Syllabus			
Module No.	Contents of the Module	Hours	CO's
1	Vectors: Definition of scalar and vector, Vector addition , Subtraction and multiplication-dot product, cross product, scalar triple product and vector triple product .Orthogonal ,co-planar and angle between vectors.	5	CO1
2	Vector Differentiation: Velocity and accelerations,Vector differential operator-Gradient of a scalar function, Divergence of a vector function, Cu of a vector function, problems and Vector Identities.	5	CO2
3	Linear differential equations with constant coefficients: Solutions of second and higher order differential equations - inverse differential operator method.	5	CO3
4	Laplace Transform: Definition and Laplace transforms of elementary	5	CO4,

	functions. Properties of Laplace transforms (without proof) ,Periodic functions, Heaviside function – problems		CO5
5	Inverse Laplace Transform: Properties of inverse Laplace Transform, problems, solution of linear differential equations using Laplace Transforms.	5	CO4, CO6

Text Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 10^{tH} edition,2014, Wiley-India Publishers.
2. Higher Engineering Mathematics, B.S.Grewal, 43nd edition, 2014, Khanna Publishers .

Reference Books:

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

Assessment Pattern:

CIE- Continuous Internal Evaluation (25 Marks).

Bloom's Category	Tests (20 Marks)	Assignments (5 Marks)
Remember	5	--
Understand	5	5
Apply	5	--
Analyze	2.5	--
Evaluate	2.5	--
Create	--	--

SEE- Semester End Examination (50 Marks)

Bloom's Category	Questions (50 Marks)
Remember	10
Understand	20
Apply	10
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

Mapping of Outcomes
COURSE OUTCOME

PROGRAM OUTCOME

PROGRAM EDUCATIONAL OBJECTIVES

DEPARTMENTAL MISSION

DEPARTMENTAL VISION

APPENDI
X B

The Graduate Attributes of
NBA

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

Problem analysis: Identify, formulate, research literature, and analyse 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 meet 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 that 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: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

APPENDI
X 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. **[eduglosarry.org]**