CONTENTS

1. Vision, Mission and Program Educational Objectives (PEO) **2**
2. Program Outcomes (PO) with Graduate Attributes **2**
3. Mapping of POs with PEOs **3**

SCHEME

4. Scheme of 3rd sem A cycle **4**
5. Scheme of 4th sem A cycle 5
6. Scheme of 3rd sem B cycle **6**
7. Scheme of 4th sem A cycle 7

SYLLABUS

8. Syllabus of Third Semester BE:

- Applied Mathematics-3 8
- Life skills for Engineers 10
- Environmental Science and Awareness 11
- Computer Aided Machine Drawing 12
- Casting & Forging Technology 14
- Mechanics of Materials 16
- Material Sc. & Metallurgy 18
- Casting & Forging Technology Lab 20
- Mechanics of Materials Lab 22
- Material Sc. & Metallurgy Lab 24
- Mini Project- 2nd year-Phase 1

Syllabus of Fourth Semester BE:

- Applied Mathematics-4 26
- Economics for Engineers 28
- Aadalitha kannada/Vyavaharika Kannada 30
- Basic Thermodynamics 32
- Machines for Manufacturing Technology 34
- Mechanical Measurements & Metrology 36
- Fluid Mechanics 38
- Machines for Manufacturing Technology Lab 40
- Mechanical Measurements & Metrology Lab 42
- Fluid Mechanics Lab 44
- Mini Project-2nd year-Phase 2
- Basic applied mathematics-1 46
- Basic applied mathematics-1 48

Appendix A Outcome Based Education **50**
Appendix B Graduate Parameters as defined by National Board of Accreditation **51**
Appendix C Bloom's Taxonomy **52**

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.

3rd semester scheme (cycle A)											
SL no	Course Code	Course	BOS	Credit Distribution			Overall Credits	Contact Hours	Marks		
				L	T	P			CIE	SEE	Total
1	19MEE31	Applied Mathematics-3	BS	2	1	0	3	4	50	50	100
2	19HSS322	Life skills for engineers	HSS	3	0	0	3	3	50	50	100
3	19HSS323	Environmental Science and Awareness	HSS	mandatory course			0	2	25	25	50
4	19MEE331	Computer aided machine drawing	MEE	2	0	2	4	6	50	50	100
5	19MEE341	Casting, Forging and Joining Technology	MEE	3	0	0	3	3	50	50	100
6	19MEE351	Mechanics of Materials	MEE	2	1	0	3	4	50	50	100
7	19MEE361	Material Science & Metallurgy	MEE	3	0	0	3	3	50	50	100
8	19MEL341	Casting, Forging and Joining Technology Lab	MEE	0	0	2	2	4	25	25	50
9	19MEL351	Mechanics of Materials Lab	MEE	0	0	1	1	2	25	25	50
10	19MEL361	Material Science & Metallurgy Lab	MEE	0	0	1	1	2	25	25	50
Total							23	33	400	400	800

4th semester scheme (cycle A)											
SL no	Course Code	Course	BOS	Credit Distribution			Overall Credits	Contact Hours	Marks		
				L	T	P			CIE	SEE	Total
1	19MEE41	Applied Mathematics-4	BS	2	1	0	3	4	50	50	100
2	19HSS421	Economics for Engineers	HSS	2	0	0	2	2	25	25	50
3	20HSS424/425	Aadalitha Kannada/ Vyavaharika Kannada	HSS	1	0	0	1	2	25	25	50
4	19MEE432	Basic Thermodynamics	MEE	2	1	0	3	4	50	50	100
5	19MEE442	Machines for Manufacturing Technology	MEE	3	0	0	3	3	50	50	100
6	19MEE452	Mechanical Measurements & Metrology	MEE	3	0	0	3	3	50	50	100
7	19MEE462	Fluid Mechanics	MEE	2	1	0	3	4	50	50	100
8	19MEL442	Machines for Manufacturing Technology Lab	MEE	0	0	1	1	2	25	25	50
9	19MEL452	Mechanical Measurements & Metrology Lab	MEE	0	0	1	1	2	25	25	50
10	19MEL462	Fluid Mechanics Lab	MEE	0	0	1	1	2	25	25	50
11	19MEE47	Mini Project-1	MEE	-			2	-	25	25	50
Total							23	27	400	400	800

3rd semester scheme (cycle B)											
SL no	Course Code	Course	BOS	Credit Distribution			Overall Credits	Contact Hours	Marks		
				L	T	P			CIE	SEE	Total
1	19MEE31	Applied Mathematics-3	BS	2	1	0	3	4	50	50	100
2	19HSS321	Economics for Engineers	HSS	2	0	0	2	2	25	25	50
3	20HSS324/325	Aadalitha Kannada/ Vyavaharika Kannada	HSS	1	0	0	1	2	25	25	50
4	19MEE332	Basic Thermodynamics	MEE	2	1	0	3	4	50	50	100
5	19MEE342	Machines for Manufacturing Technology	MEE	3	0	0	3	3	50	50	100
6	19MEE352	Mechanical Measurements & Metrology	MEE	3	0	0	3	3	50	50	100
7	19MEE362	Fluid Mechanics	MEE	2	1	0	3	4	50	50	100
8	19MEL342	Machines for Manufacturing Technology Lab	MEE	0	0	1	1	2	25	25	50
9	19MEL352	Mechanical Measurements & Metrology Lab	MEE	0	0	1	1	2	25	25	50
10	19MEL362	Fluid Mechanics Lab	MEE	0	0	1	1	2	25	25	50
Total							21	27	375	375	750

4th semester scheme (cycle B)											
SL no	Course Code	Course	BOS	Credit Distribution			Overall Credits	Contact Hours	Marks		
				L	T	P			CIE	SEE	Total
1	19MEE41	Applied Mathematics-4	BS	2	1	0	3	4	50	50	100
2	19HSS422	Life skills for engineers	HSS	3	0	0	3	3	50	50	100
3	19HSS423	Environmental Science and Awareness	HSS	mandatory course			0	2	25	25	50
4	19MEE431	Computer aided machine drawing	MEE	2	0	2	4	6	50	50	100
5	19MEE441	Casting, Forging and Joining Technology	MEE	3	0	0	3	3	50	50	100
6	19MEE451	Mechanics of Materials	MEE	2	1	0	3	4	50	50	100
7	19MEE461	Material Science & Metallurgy	MEE	3	0	0	3	3	50	50	100
8	19MEL441	Casting, Forging and Joining Technology Lab	MEE	0	0	2	2	4	25	25	50
9	19MEL451	Mechanics of Materials Lab	MEE	0	0	1	1	2	25	25	50
10	19MEL461	Material Science & Metallurgy Lab	MEE	0	0	1	1	2	25	25	50
11	19MEE47	Mini Project-1	MEE	-			2	-	25	25	50
Total							25	33	425	425	850

APPLIED MATHEMATICS – III

Course Code : 19MEE31 | **Credits : 03**
L:T:P : 2:1:0 | **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:

19MEE31.1	Use appropriate numerical methods to solve algebraic equations and transcendental equations
19MEE31.2	Evaluate a definite integral numerically and Use appropriate numerical methods to solve Boundary Value Problems in Partial differential equations
19MEE31.3	Fit a suitable curve by the method of least squares and determine the lines of regression for a set of statistical data and obtain the extremal of a functional.
19MEE31.4	Express the periodic functions as Fourier series expansion analytically and numerically
19MEE31.5	Solve the Continuous model problems using Fourier transforms
19MEE31.6	Differentiate the physical problems numerically

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19MEE31.1	3	3	3	2	2	-	-	-	1	1	-	2
19MEE31.2	3	3	3	2	2	-	-	-	1	1	-	2
19MEE31.3	3	3	3	2	2	-	-	-	1	1	-	2
19MEE31.4	3	3	3	2	2	-	-	-	1	1	-	2
19MEE31.5	3	3	3	2	2	-	-	-	1	1	-	2
19MEE31.6	3	3	3	2	2	-	-	-	1	1	-	2

Course Syllabus

Module No.	Contents of the Module	Hours	Co's
1.	**Numerical Methods-1:** Numerical solution of algebraic and transcendental equations: Regula-falsi method and Newton-Raphson method-Problems. Interpolation: Newton's forward and backward formulae for equal intervals, Newton divided difference and Lagrange's formulae for unequal intervals (without proofs)-Problems.	**9L + 2T**	**19MEE 31.1**
2.	**Numerical Methods-2**: Numerical integration: Simpson's 1/3rd rule, Simpson's 3/8th rule, Weddle's rule (without proofs)-Problems. Numerical solution of one-dimensional wave equation, heat equation and two-dimensional Laplace's equation. **Applications:** Application of numerical integration to velocity of a particle and volume of solids.	**9L + 2T**	**19MEE 31.2**
3.	**Statistical Methods and Calculus of Variation:** Fitting of the curves of the form $y = a + bx$, $y = a + bx + cx^2$, $y = ae^{bx}$, $y = ax^b$, and $y = ab^x$ by the method of least square-Problems. Correlation and Regression lines - Problems. Variation of a function and a functional, variational problems, Euler's equation and Isoperimetric problems. **Applications:** Minimal surface of revolution and Hanging cable.	**9L + 2T**	**19MEE 31.3**

4.	**Fourier series:** Periodic function, Dirichlet's conditions, Fourier series of periodic functions of period 2π and arbitrary period $2l$, half range series-Problems. **Applications:** 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-Problems.	**9L + 2T**	**19MEE 31.4**
5.	**Fourier Transforms:** Infinite Fourier transforms, Fourier Sine and Cosine transforms, Inverse Fourier sine and cosine transforms. **Numerical Differentiation:** Derivatives of first order and second order using Newton's forward differences and Newton's backward Differences.	**9L + 2T**	**19MEE 31.5 19MEE 31.6**

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, 10th Edition, 2014, ISBN: 978-81-265-5423-2.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2014, ISBN: 978-81-7409-195-5.

Reference Books:

1. Glyn James, Modern Engineering Mathematics, Prentice Hall, 4th Edition, 2015, ISBN: 978-0-273-73409-3
2. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, 4th Edition, 2016, ISBN: 978-0-07-063419-0.
3. H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., 28th Edition, 2012, ISBN: 81-219-0345-9.
4. N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., 9th Edition, 2014, ISBN: 978-81-318-0832-0.

Assessment Pattern:

1. CIE- Continuous Internal Evaluation (50 Marks).

Bloom's Category	Tests (25 Marks)	Assignments (15 Marks)	Quizzes (10 Marks)
Remember	5	5	-
Understand	5	5	-
Apply	5	5	10
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	-

LIFE SKILLS FOR ENGINEERS

Course Code : 19HSS322/422 | **Credits : 03**
L: P: T: : 3:0:0 | **CIE Marks : 50**
Exam Hours : 3 | **SEE Marks : 50**

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

19HSS322/422.1	Set personal and professional goals
19HSS322/422.2	Develop his critical thinking skills and practise creativity.
19HSS322/422.3	Demonstrate an understanding of personal and professional responsibility
19HSS322/422.4	Apply the concepts of personality development and grooming in real life
19HSS322/422.5	Understand self and work with groups
19HSS322/422.6	Articulate and convey his ideas and thoughts with clarity and focus

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19HSS322/422.1						2		3	3	3	2	3
19HSS322/422.2						2		3	3	3	2	3
19HSS322/422.3						2		3	3	3	2	3
19HSS322/422.4						2		3	3	3	2	3
19HSS322/422.5						2		3	3	3	2	3
19HSS322/422.6						2		3	3	3	2	3

Module No.	Module Contents	Hours	COs
1	Goal Setting: Importance of Goals: Creating SMART goals; Critical Thinking and Problem Solving, Six Thinking Hats, Multiple Intelligences and Mind Mapping	6	CO1, CO2
2	Taking Ownership, Being Responsible and Accountable. Meaning of Ownership, Responsibility and Accountability, Practicing these philosophies in course, career and life, Developing a 'Credible Character Impression about self', Self-Motivation, Developing healthy Self-esteem, Leadership	8	CO3
3	Personality Development and Grooming: Expectations from the industry, building personal presence, corporate grooming, corporate etiquettes, Personal branding and image management	6	CO4
4	Self-Awareness and Self-Management: Emotional Intelligence, 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.	8	CO5
5	Articulation and Group Discussion: Ideas generation, expressing thoughts in a logical flow, presenting views in a group	8	CO6

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

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Tests	Assignments	Self-Study	Peer Evaluation
Marks (out of 50)	**10**	**15**	**15**	**10**
Remember	-	-	-	-
Understand	-	-	-	-
Apply	5	5	-	5
Analyze	-	-	5	-
Evaluate	-	-	-	
Create	5	10	10	5

SEE- Semester End Examination (50 Marks)

NOTE: Being a Life skills course we felt it would be suitable to do the final assessment through a structured group discussion which will provide an opportunity to test students in all levels of Bloom's Taxonomy.

Bloom's Category	Group Discussion
Remember	**5**
Understand	**10**
Apply	**10**
Analyse	**10**
Evaluate	**5**
Create	**10**

ENVIRONMENTAL SCIENCE AND AWARENESS

Course Code	**: 19HSS323/423**	**Credits**	**: 01**
L : T : P	**: 1:0:0**	**CIE Marks**	**: 25**
Exam Hours	**: 02 Hrs**	**SEE Marks**	**: 25**

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

19HSS323/423.1	Understand the concepts of environment, ecosystem, biodiversity and its interdependence on human life.
19HSS 323/423.2	Develop an insight on types of natural resources and the concept of sustainable development.
19HSS 323/423.3	Understand the different control measures of pollution and importance of waste management.
19HSS 323/423.4	Think and apply technology as a solution for environment related concerns, keeping in view the different environmental acts and amendments.

Mapping of Course Outcomes to Program Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19HSS 323/423.1	1	1	1	1	1	3	3	3	1	1	1	1
19HSS 323/423.2	2	1	1	1	1	3	3	3	1	1	1	3
19HSS 323/423.3	3	3	3	3	3	3	3	3	3	1	2	3
19HSS 323/423.4	3	3	3	3	3	3	3	3	3	1	3	3

Module No.	Content of Module	Hrs	COs
1	**Introduction to Environment, Ecosystem and biodiversity:** Environment - Components of Environment, Scope and importance of Environmental studies, Ecosystem: Types & Structure of Ecosystem, Energy flow in the ecosystem, Food chains – food webs & ecological pyramids. Biodiversity – Definition, Hot-spots of biodiversity, Threats to biodiversity, Conservation of biodiversity.	05	19HSS 323/423.1
2	**Natural Resources:** Renewable and non-renewable resources – Natural resources and associated problems. Role of an individual in conservation of natural resources. Water conservation, rain water harvesting. Balanced use of resources for sustainable lifestyle – strategies.	04	19HSS 323/423.2
3	**Environmental Pollution:** Definition, Causes, effects and control measures of Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise pollution, Thermal Pollution and Nuclear hazards. Role of an individual in prevention of pollution - Waste management – urban and industrial wastes.	04	19HSS 323/423.3

4	**Social Issues and Environment:** Environmental ethics – issues and possible solutions. Environment protection act – Air (prevention and Control of pollution) act & Water (prevention and Control of pollution) act. Role of government: Swatch Bharat Abhiyan, National Mission for Clean Ganga (NMCG), River rejuvenation, Role of Non-governmental Organizations (NGOs), Global warming and climate change.	04	19HSS 323/423.3 19HSS 323/423.4
5	**Human Population and Environment:** Population growth & explosion, Family welfare programme. Environment and human health, Human rights, Value education. Role of Technology in protecting environment and human health.	05	19HSS 323/423.4

Text Books:

1. "Environmental Studies: Basic Concepts" by Ahluwalia, V. K. . The Energy and Resources Institute (TERI) Publication, 2nd edition, 2016. ISBN: 817993571X, 9788179935712.
2. "Textbook of Environmental Studies for Undergraduate Courses of all branches of Higher Education" by Bharucha, Erach for UGC, New Delhi, 2004. ISBN: 8173715408, 9788173715402.

Reference Books:

1. Handbook of Environmental Engineering by Rao Surampalli, Tian C. Zhang, Satinder Kaur Brar, Krishnamoorthy Hegde, Rama Pulicharla, Mausam Verma; McGraw Hill Professional, 2018. ISBN: 125986023X, 9781259860232
2. Environmental Science and Engineering by P. Venugopala, Prentice Hall of India Pvt. Ltd, New Delhi, 2012 Edition. ISBN: 978-81-203-2893-8.
3. Environmental Science- Working with the earth by G Taylor Miller Jr, Brooks Cole Thompson Publications, 10 thEdition. ISBN: 10: 0534424082.
4. Elements of Environmental Science and Engineering by P. Meenakshi, Prentice Hall of India Pvt. Ltd, 2005 Edition. ISBN: 8120327748, 9788120327740.

CIE- Continuous Internal Evaluation (25 Marks)

Bloom's Category	Tests	Assignments	Quiz
Marks (out of 50)	15	05	05
Remember	5	2	2
Understand	5	2	2
Apply	5	1	1
Analyze	0	0	0
Evaluate	0	0	0
Create	0	0	0

SEE – Semester End Examination (25 Marks)

Bloom's Category	Tests
Remember	10
Understand	10
Apply	5
Analyze	0
Evaluate	0
Create	0

COMPUTER AIDED MACHINE DRAWING

Course Code	**: 19MEE331/431**	**Credits**	**: 04**
L:T:P	**: 2:0:2**	**CIE Marks**	**: 50**
Exams Hours	**: 03**	**SEE Marks**	**: 50**

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

19MEE331/431.1	Understand the different sections of solids and also true shapes of sections.
19MEE331/431.2	Translate the pictorial views into orthographic projections of simple machine parts.
19MEE331/431.3	Relate the limits, tolerance on component dimensions along with GD&T and represent the kind of surface quality.
19MEE331/431.4	Construct models for threaded fasteners, riveted joints and along with drafting using software.
19MEE331/431.5	Comprehend different types of Cams & Followers, Analyze the sketching of CAM-Follower profiles under different motions.
19MEE331/431.6	Explore different types of assembly constraints and create assembly of machine components.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19MEE331/431.1	3	3	3	2	3	1	-	-	2	2	2	2
19MEE331/431.2	3	3	3	2	3	1	-	-	2	2	2	2
19MEE331/431.3	3	3	3	3	3	1	-	-	2	2	2	2
19MEE331/431.4	3	3	3	2	3	1	-	-	2	2	2	2
19MEE331/431.5	2	3	3	2	3	1	-	-	2	2	2	2
19MEE331/431.6	3	2	2	-	3	1	-	-	2	2	-	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. (BIS conventions are to be followed for the drawings) Hidden line conventions, Precedence of lines (Only Sketching)	8	**19MEE331/431.1, 19MEE331/431.2**
2	Thread Forms & 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	**19MEE331/431.6**

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	**19MEE331/431.3**
4	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 and roller (only inline).	8	**19MEE331/431.5**
5	Assembly Drawings: Screw jack, Plummer block, Machine vice, Tailstock of lathe, Tool head of a shaper, I.C. Engine connecting rod, Rams Bottom Safety Valve, Drilling jig (Sketching + Software Drafting)	12	**19MEE331/431.4**

NOTE: In the Semester End Examination, the examiner will set ONE question from each module 1 to 4 and TWO questions from Module 5. The students will be required to attempt first FOUR questions compulsory and any ONE question from module-5.

Text Books:

1. Machine Drawing- K.R. Gopala Krishna, Subhash publications. **ISBN-13** 9789383214235
2. Machine Drawing- Dhawan, S.Chand Publications, 2nd Ed**, ISBN** 9788121908245.

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

Assessment Pattern

CIE- Continuous Internal Evaluation for theory (50 Marks)

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

SEE – Semester End Examination (50 Marks - Theory)

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

CASTING, FORGING & JOINING TECHNOLOGY

Course Code	**: 19MEE341/441**	**Credits**	**: 03**
L:T:P	**: 3:0:0**	**CIE Marks**	**: 50**
Exam Hours.	**: 03**	**SEE Marks**	**: 50**

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

19MEE341/441.1	Understand various manufacturing processes relevant to casting, forging and joining techniques.
19MEE341/441.2	Determine the affect of gates, riser and runners in foundry operations for suitable applications.
19MEE341/441.3	select the suitable moulding and casting processes
19MEE341/441.4	Recommend the suitable type of melting furnaces
19MEE341/441.5	Empathize various concepts of forging and joining techniques for required materials.
19MEE341/441.6	Identify various defects in casting, forging and joining process through NDT methods.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	POI0	POII	PO12
19MEE341/441.1	3	2	3	1	2	2	1	1	2	2	2	1
19MEE341/441.2	2	2	3	2	1	1	2	1	2	2	2	1
19MEE341/441.3	2	2	3	2	1	1	2	1	2	2	2	1
19MEE341/441.4	3	3	1	1	1	2	1	1	3	2	2	1
19MEE341/441.5	3	2	3	1	2	2	1	1	2	2	2	1
19MEE341/441.6	2	2	3	2	1	1	2	1	2	2	2	1

Module No	Module Contents	Hrs	Cos
1	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. 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	7	**19MEE 341/ 441.1**
2	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, 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.	7	**19MEE 341/ 441.2,4,6**
3	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. Moulding Machines: Jolt type, Squeeze type, Jolt & Squeeze type and Sand slinger, classifications of Melting Furnaces.	6	**19MEE 341/ 441.3**

4	Welding process: Principle of welding, classification, application advantages and disadvantages, welding terminology, edge preparation. Arc welding: Arc welding process, Metal arc welding(MAW) or Flux shielded metal arc welding(FSMAW), Tungsten inert gas welding(TIG), Metal inert gas welding(MIG), Submerged arc welding(SAW), Atomic hydrogen welding(AHW). Soldering and Brazing: Surface cleaning and soldering flux, Types of soldering, advantages and disadvantages, types of brazing, advantages and disadvantages.	7	**19MEE 341/ 441.4,5,6**
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.	6	**19MEE 341/ 441.5**

TEXT BOOKS:

1. Manufacturing Process-I, Dr.K.Radhakrishna, Sapna Book House, 5th Revised Edition 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, 4thEd. 2006, ISBN-13:978-0205118175.
2. Manufacturing Technology, SeropeKalpakjian, 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 (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			

SEE-Semester End Examination (50 Marks - Theory)

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

MECHANICS OF MATERIALS

Course Code	**: 19MEE351/451**	**Credits**	**: 03**
L:T:P	**: 2:1:0**	**CIE Marks**	**: 50**
Exams Hours	**: 03**	**SEE Marks**	**: 50**

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

19MEE351/451.1	Apply the formal theory of solid mechanics to calculate forces, deflections, moments, stresses, and strains in a wide variety of structural members subjected to different loading conditions such as tension, compression, torsion and bending.
19MEE351/451.2	Understand the concepts of stress at a point, strain at a point, and the stress-strain relationships for linear, elastic, homogeneous, isotropic materials.
19MEE351/451.3	Build theoretical background for structural analysis and design courses.
19MEE351/451.4	Recognize physical phenomenon in the context of mechanics of materials. And also, competence in problem identification, formulation and solution.
19MEE351/451.5	To establish an understanding of the fundamental concepts of mechanics of deformable solids; including static equilibrium, geometry of deformation, and material constitutive behavior
19MEE351/451.6	Apply structural mechanics of deformable bodies to solve engineering problems

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19MEE351/451.1	3	3	3	3	-	2	2	-	3	2	3	-
19MEE351/451.2	3	3	3	3	-	2	2	-	3	2	3	-
19MEE351/451.3	3	3	3	3	3	3	2	-	3	2	3	-
19MEE351/451.4	3	3	3	3	3	3	2	-	3	2	3	-
19MEE351/451.5	3	3	3	3	3	3	2	-	3	2	3	-
19MEE351/451.6	3	3	3	3	3	3	2	-	3	2	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 section varying in steps, bars with continuously varying cross sections (circular and rectangular), Elongation due to self weight, Principle of super position, Thermal Stresses(No Numericals),elastic constants(only definition).	7	**19MEE351/ 451.1**
2	**Bending Moment and Shear Force Diagrams:** 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.	6	**19MEE351/ 451.3**
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	7	**19MEE351/4 51.4**
4	**Deflection of Beams:** Introduction, Differential equation for deflection. Equations for deflection, slope and bending moment. Double integration	7	**19MEE351/ 451.4 19MEE351/**

	method for cantilever and simply supported beams for point load, UDL, UVL and Couple, Macaulay's method. **Elastic Stability of Columns:** Introduction, Columns and struts, slenderness ratio, Classification of columns, buckling load or critical load, Sign conventions, Euler's theory of buckling, Effective length for various boundary conditions, Limitations of Euler's theory, Rankine formula, numericals.		**451.5**
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.	6	**19MEE351/ 451,5, 19MEE351/ 451.6**

TEXT BOOKS:

1. Ferdinand Beer & Russell Johston., 'Mechanics of Materials', McGraw Hill India, 7th Edition, 2016, ISBN-(13 digits): 9789339217624.
2. Ramamrutham S., 'Strength of Materials', Dhanpat Rai Publishing Co Pvt Ltd, 6th Edition, 2017, ISBN-(13 digits): 978-9352164387; ISBN-(10 digits): 9352164385.

REFERENCE BOOKS:

1. R C Hibbeler., 'Mechanics of Materials', Pearson Education, 9th Edition, 2018, ISBN-(13 digits): 978-9332584037; ISBN-(10 digits): 9332584036.
2. James M. Gere, Barry J. Goodno., 'Mechanics of Materials', Cengage Learning, 8th Edition, 2014, ISBN-(13 digits): 9788131524749.
3. S S Rattan., 'Strength of Materials', McGraw Hill India, 2nd Edition, 2011, ISBN-(13 digits): 978-0071072564; ISBN-(10 digits): 007107256X.

Assessment Pattern

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom's Category Marks (out of 50)	Tests	Assignments	Quiz
	25	**15**	**10**
Remember	2		
Understand	3		
Apply	6	3	5
Analyze	8	7	5
Evaluate	3	5	
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

MATERIAL SCIENCE AND METALLURGY

Course Code : 19MEE361/461 | **Credits : 03**
L:T:P : 3:0:0 | **CIE Marks : 50**
Exams Hours : 03 | **SEE Marks : 50**

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

19MEE361/461.1	Distinguish and identify the different materials, defects, their processing techniques and heat treatments methods
19MEE361/461.2	Analyze material structure-property relationship; carry out modifications of engineering materials to perform in a specific applications
19MEE361/461.3	Apply the suitable processing technology in manufacturing of ceramics
19MEE361/461.4	Recommend the suitable type of Heat treatment which helps in various applications such as tools and dies, crankshafts, connecting rods, fabrications, springs etc
19MEE361/461.5	Select different ferrous and nonferrous metals, alloys, non metal for specific applications
19MEE361/461.6	Apply the concept of powder metallurgy based on its characteristics

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19MEE361/461.1	3	3	2	-	2	2	1	-	2	2	2	2
19MEE361/461.2	3	3	2	-	2	2	1	-	2	2	2	2
19MEE361/461.3	3	3	2	-	2	2	1	-	2	2	2	2
19MEE361/461.4	3	3	3	-	2	2	1	-	2	2	2	2
19MEE361/461.5	3	3	2	-	2	2	1	-		2	2	2
19MEE361/461.6	3	3	2	-	2	2	1	-	2	2	2	2

Module	Contents of the Module	Hrs	COs
1	**Crystal Structure**: BCC, FCC and HCP Structures, coordination number and atomic packing factors, Derivation of APF for BCC, FCC & HCP structures, crystal imperfections -point line and surface imperfections. Simple problems. **Atomic Diffusion**: Phenomenon, Ficks laws of diffusion, factors affecting diffusion. Simple problems.	**7**	**19MEE361 / 461.1, 19MEE361 /461.2**
2	**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	**7**	**19MEE361 /461.2**
3	**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, martempering, austempering, hardenability, surface hardening methods like carburizing, cyaniding, nitriding, Flame hardening, induction hardening.	**7**	**19MEE361 / 461.5**

4	**Engineering materials**: Properties, Composition and Applications of Grey cast iron, White cast Iron, malleable iron, SG iron and steels, Copper & Aluminium alloys. Titanium and Magnesium alloys.	**6**	**19MEE361 /461.3, 19MEE361 /461.5**
5	**Ceramics:** Introduction to ceramics, nature of ceramics, types of ceramics, 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, pre sintering and sintering.	**6**	**19MEE361 / 461.6**

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, ISNB13: 978111806160

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	3		
Understand	3		
Apply	7	5	5
Analyze	7	5	5
Evaluate	3	5	
Create	2		

SEE – Semester End Examination (50 Marks - Theory)

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

CASTING, FORGING & JOINING TECHNOLOGY LAB

Course Code : 19MEL341/441 **Credits : 02**
L:T:P : 0:0:2 **CIE Marks : 25**
Exam Hours. : 03 **SEE Marks : 25**

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

19MEL341/441.1	Comprehend the significance of essential properties of sand towards mold preparation.
19MEL341/441.2	Utilize the patterns of different geometrical shapes for mold making and volumetric calculation in forging processes.
19MEL341/441.3	Analyze the properties of sand by determining the permeability test and hardness test.
19MEL341/441.4	Develop the skill towards metal joining techniques.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	POI0	POII	PO12
19MEL341/441.1	3	1	3	1	2	2	2	1	3	2	1	2
19MEL341/441.2	3	1	3	1	2	2	2	1	3	2	1	2
19MEL341/441.3	3	2	1	1	2	2	1	1	3	2	1	2
19MEL341/441.4	3	1	3	3	2	2	2	1	3	2	1	2

Sl NO	CONTENT	HRS	CO,PO
1	Foundry Models Model 1- Preparation of moulds using two moulding boxes with pattern	2	19MEL341.1/441.1
2	Model 2- Preparation of moulds using two moulding boxes without pattern	2	19MEL341.2/441.2
3	Model 3- Preparation of moulds using two moulding boxes without pattern	2	19MEL341.2/441.2
5	Sand Testing Compression, shear and tensile tests using Universal sand testing machine	1	19MEL341.3/441.3
6	Permeability test and Core hardness	2	19MEL341.3/441.3
7	Sieve analysis test and Mould hardness test	2	19MEL341.3/441.3
8	Clay content test and Moisture content test	1	19MEL341.3/441.3
9	Joining Models Model 1- Soldering, Model 2- Brazing, Model 3- Electric Arc & gas welding	2	19MEL341.4/441.4
10	Forging Models Model 1- Converting round rod to square rod	2	19MEL341.4/441.4
11	Model 2 - Converting square rod to Nail, Model 3- L -bending	2	19MEL341.4/441.4
12	Demonstration of melting and pouring for casting.	2	19MEL341.4/441.4

TEXT BOOKS:

1. Manufacturing Process-I, Dr.K.Radhakrishna, Sapna Book House, 5th Revised Edition 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, 4thEd. 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 lab (25 Marks)

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

SEE-Semester End Examination
(25 Marks - lab)

Bloom's Category	**Test**
Remember	5
Understand	5
Apply	5
Analyze	5
Evaluate	5
Create	

MECHANICS OF MATERIALS LAB

Course Code : 19MEL351/451 **Credits : 01**
L:T:P : 0:0:1 **CIEMarks:25**
Exams Hours : 03 **SEE Marks:25**

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

19MEL351/451.1	Apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials.
19MEL351/451.2	Understand the function on multi-disciplinary teams in the area of materials testing stresses and strains in the members subjected to axial, bending and torsional loads.
19MEL351/451.3	Use the techniques, skills and modern engineering tools necessary for engineering towards effectively communicate the mechanical properties of materials.
19MEL351/451.4	Understanding of professional and ethical responsibility in the areas of material testing.

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19MEL351/451.1	2	3	2	3	-	2	2	-	3	2	2	2
19MEL351/451.2	3	2	3	3	-	2	2	-	3	2	2	2
19MEL351/451.3	2	2	3	3	3	3	2	-	3	2	3	2
19MEL351/451.4	3	3	2	2	3	3	2	-	3	2	2	2

Expt No.	Name of the Experiment	Hrs	CO's
1	Determining the hardness number of aluminum specimen using Brinell hardness test	**2**	**19MEL351/ 451.1**
2	Evaluating the hardness number of hardened steel specimen using Vickers's hardness test	**2**	**19MEL351/ 451.1**
3	To determine the hardness number of mild steel/cast iron specimen using Rockwell hardness test.	**2**	**19MEL351/ 451.2**
4	To determine the ultimate shear strength of the given specimen in single and double shear using UTM	**3**	**19MEL351/ 451.2**
5	To determine the moment of inertia, modulus of elasticity and maximum bending stress of wood specimen by conducting bending test.	**2**	**19MEL351/ 451.3**
6	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.	**3**	**19MEL351/ 451.3**
7	To determine the impact energy and strength of notched specimen using Izod test	**2**	**19MEL351/ 451.3**
8	To determine the impact energy and strength of notched specimen using Charpy test	**2**	**19MEL351/ 451.4**
9	To determine the modulus of rigidity, Torsional strength and modulus of toughness of mild steel specimen using torsion test	**2**	**19MEL351/ 451.4**

10	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.	**2**	**19MEL351/ 451.4**

TEXT BOOKS:

1. Ferdinand Beer & Russell Johston., 'Mechanics of Materials', McGraw Hill India, 7th Edition, 2016, ISBN-(13 digits): 9789339217624.
2. Ramamrutham S., 'Strength of Materials', Dhanpat Rai Publishing Co Pvt Ltd, 6th Edition, 2017, ISBN-(13 digits): 978-9352164387; ISBN-(10 digits): 9352164385.

REFERENCE BOOKS:

1. R C Hibbeler., 'Mechanics of Materials', Pearson Education, 9th Edition, 2018, ISBN-(13 digits): 978-9332584037; ISBN-(10 digits): 9332584036.
2. James M. Gere, Barry J. Goodno., 'Mechanics of Materials', Cengage Learning, 8th Edition, 2014, ISBN-(13 digits): 9788131524749.
3. S S Rattan., 'Strength of Materials', McGraw Hill India, 2nd Edition, 2011, ISBN-(13 digits): 978-0071072564; ISBN-(10 digits): 007107256X.

Assessment Pattern

CIE- Continuous Internal Evaluation for lab (25 Marks)

Bloom's Category	**Experiments/Tests**	**Record**	**Viva**
Marks (Out of 25)	10	10	5
Remember			1
Understand			1
Apply			1
Analyze	5	4	1
Evaluate	5	4	1
Create		2	

SEE – Semester End Examination for lab (25 Marks)

Bloom's Category	**Test**
Remember	2
Understand	2
Apply	1
Analyze	10
Evaluate	10
Create	

MATERIAL SCIENCE AND METALLURGY LAB

Course Code : **19MEL361/461** **Credits** : **01**
L:T:P : **0:0:1** **CIE Marks** : **25**
Exams Hours : **03** **SEE Marks** : **25**

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

19MEL361/461.1	Prepare ferrous and nonferrous specimens for microstructure analysis and Identify the grain boundaries and crystal structure of materials
19MEL361/461.2	Observe and examine the microstructure details of Ferrous and nonferrous materials before and after heat treatment
19MEL361/461.3	Identify the surface defects through NDT techniques for ferrous and nonferrous materials
19MEL361/461.4	Determine the Coating thickness of ferrous and non-ferrous materials and Scratch hardness number of ferrous and non-ferrous materials

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19MEL361/461.1	3	3	2	-	2	2	-	1	2	2	2	2
19MEL361/461.2	3	3	2	-	2	2	-	1	2	2	2	2
19MEL361/461.3	3	3	2	-	2	2	-	1	2	2	2	2
19MEL361/461.4	3	3	3	-	2	2	-	1	2	2	2	2

Syllabus			
Experiment No	Contents of Laboratory	Hrs	COs
1	Preparation of specimen for metallographic examination and identification of microstructures of ferrous materials.	2	19MEL361/461.1
2	Preparation of specimen for metallographic examination and identification of microstructures of non-ferrous materials.	2	19MEL361/461.1
3	Preparation of heat treated specimen for metallographic examination and identification of microstructures of ferrous materials.	2	19MEL361/461.2
4	Preparation of heat treated specimen for metallographic examination and identification of microstructures of non-ferrous materials.	2	19MEL361/461.2
5	Determination of defects in given material using magnetic crack detector.	2	19MEL361/461.3
6	Determination of cracks in given material using dye penetrant test.	2	19MEL361/461.3
7	Determination of coating thickness for ferrous Materials.	2	19MEL361/461.3
8	Determination of coating thickness for non- ferrous materials.	2	19MEL361/461.4
9	Scratch testing of Ferrous materials using scratch hardness tester.	3	19MEL361/461.4
10	Scratch testing of Non-ferrous materials using scratch hardness tester.	3	19MEL361/461.4

CIE- Continuous Internal Evaluation for lab (25 Marks)

Bloom's Category	Experiments/Tests	Record	Viva
Marks (out of 25)	10	10	05
Remember	1		
Understand	1		
Apply	3	4	3
Analyze	3	4	1
Evaluate	1	1	1
Create	1	1	

SEE – Semester End Examination (25 Marks - Lab)

Bloom's Category	Test
Remember	3
Understand	3
Apply	7
Analyse	7
Evaluate	3
Create	2

APPLIED MATHEMATICS – IV

Course Code : 19MEE41 **Credits : 03**
L:T:P : 2:1:0 **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:

19MEE41.1	Solve initial value problems using appropriate numerical methods
19MEE41.2	Understand the concepts of Complex variables to solve Engineering Problems
19MEE41.3	Understand the concepts of Transformations, Complex integration, Poles and Residuals in the stability analysis of engineering problems
19MEE41.4	Gain ability to use probability distributions to analyze and solve real time problems
19MEE41.5	Apply the concept of sampling distribution to solve engineering problems
19MEE41.6	Use the concepts to analyze the data to make decision about the hypothesis and understand the concepts of logic

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19MEE41.1	3	2	3	2	2	-	-	-	1	1	-	1
19MEE41.2	3	2	3	2	2	-	-	-	1	1	-	1
19MEE41.3	3	2	3	2	2	-	-	-	1	1	-	1
19MEE41.4	3	2	3	2	2	-	-	-	1	1	-	1
19MEE41.5	3	2	3	2	2	-	-	-	1	1	-	1
19MEE41.6	3	2	3	2	2				1	1		1

Course Syllabus

Module No.	Contents of the Module	Hours	CO's
1	**Numerical Methods:** Numerical solution of ordinary differential equations o first order and of first degree: Modified Euler's method and Runge-Kutta method of fourth-order-Problems. Milne's predictor and corrector methods-Problems. Numerical Solutions of second order ordinary differential equations by Runge-Kutta method of fourth-order-Problems.	**9L + 2T**	**19MEE 41.1**
2	**Complex Variables**: Functions of complex variables, Analytical functions, Cauchy-Riemann Equations in Cartesian and Polar forms, Harmonic functions and Construction of analytic functions-Problems using Milne-Thompson's method. **Applications:** Flow problems-Velocity potential, Stream functions and complex potential functions.	**9L + 2T**	**19MEE 41.2**
3	**Conformal Transformations and Complex Integrations:** $w = z^2$, $w = e^z$ and $w = z + (1/z)$. Cauchy's Theorem (with proof). Singularities, Poles and Residues, Residue theorem (without proof)-Problems.	**9L + 2T**	**19MEE 41.3**
4	**Probability distributions:** Random variables (discrete and continuous), probability density functions. Discrete Probability distributions: Binomial and Poisson distributions-Problems. Continuous Probability distributions: Exponential and Normal distributions-Problems.	**9L + 2T**	**19MEE 41.4**

5	**Sampling Theory:** Sampling, Sampling distributions, standard error, Test of hypothesis for small samples by Student's t-distribution, F-distribution and Chi-square distribution for test of goodness of fit. **Mathematical Logic:** Connectives and Truth tables, Logical Equivalence, The laws of logic and logical implication.	**9L + 2T**	**19MEE 41.5 19MEE 41.6**

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, 10th Edition, 2014, ISBN: 978-81-265-5423-2.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2014, ISBN: 978-81-7409-195-5.

Reference Books:

1. Glyn James, Modern Engineering Mathematics, Prentice Hall, 4th Edition, 2015, ISBN: 978-0-273-73409-3
2. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, 4th Edition, 2016, ISBN: 978-0-07-063419-0.
3. H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., 28th Edition, 2012, ISBN: 81-219-0345-9.
4. N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., 9th Edition, 2014, ISBN: 978-81-318-0832-0.

Assessment Pattern:

3. CIE- Continuous Internal Evaluation (50 Marks).

Bloom's Category	Tests (25 Marks)	Assignments (15 Marks)	Quizzes (10 Marks)
Remember	5	5	-
Understand	5	5	-
Apply	5	5	10
Analyze	5	-	-
Evaluate	5	-	-
Create	-	-	-

4. SEE- Semester End Examination (50 Marks).

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

ECONOMICS FOR ENGINEERS

Course Code : 19HSS321/421 **Credits :02**
L:T:P : 2:0:0 **CIE MARKS:25**
Exam Hour : 03 **SEE MARKS:25**

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

19HSS321/421.1	Gain knowledge about importance of economics in decision making processes in day to day life.
19HSS321/421.2	Analyze business environment at micro and macroeconomic level and its impact on industries in country's economy.
19HSS321/421.3	Acquire knowledge about costing and estimation of projects for profit making.
19HSS321/421.4	Apply principles of budgeting and finance for entrepreneurial success.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19HSS321/421.1	2	2	1	-	1	-	2	2	2	1	2	2
19HSS321/421.2	2	2	1	-	1	-	2	2	2	1	2	2
19HSS321/421.3	2	2	1	-	1	-	2	2	2	1	2	2
19HSS321/421.4	2	2	1	-	1	-	2	2	2	1	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**	**19HSS321 /421.1 19HSS321 /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**	**19HSS321 /421.2, 19HSS321 /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**	**19HSS321 /421.3, 19HSS321 /421.4**
IV	**Capital budgeting**: Traditional and modern methods, Payback period method, IRR, ARR, NPV, PI. . Interest and Interest factors: Interest rate, Simple interest, **Compound interest, Cash - flow diagrams, Personal Loans and EMI Payment. Present worth, Future worth.**	**4**	**19HSS321 /421.1, 19HSS321 /421.3 19HSS321 /421.4**
V	**Book Keeping and Accounts**: Journal, Ledger, Trial balance, asset Types, profit & loss account, balance sheet.	**5**	**19HSS321 /421.1, 19HSS321 /421.2, 19HSS321 /421.3, 19HSS321 /421.4**

TEXT BOOKS:

1. Riggs J.L, Engineering Economy, TMH, 2012 edition
2. Jain T.R., Economics for Engineers, VK Publications,2008 Edition
3. IM PANDEY,Finacial Management, Vikas Pub. House, 2018 Edition
4. D N Dwivedi, MangerialEconomics ,Vikas Pub. House, 2018 Edition
5. Dr.A.R Sainath,Sasikala Devi,Engineering Economics and Financial Accounting,Charulatha Publications,2015 edition

REFERENCE BOOKS:

1. Thuesen H.G, Engineering Economy. PHI,1984
2. Prasanna Chandra, Financial Mangement,TMH,2007
3. Singh Seema, Economics for Engineers, IK International,2014
4. Chopra P. N, Principle of Economics, Kalyani Publishers,2012
5. Dewett K K, Modern Economic Theory, S. Chand,2006

Assessment pattern

CIE –Continuous Internal Evaluation (50 Marks, Theory)

Bloom's Category	**Test**	**Assignment**	**SSR**
Marks (out of 50)	**10**	**7.5**	**7.5**
Remember	2.5		
Understand	2.5		
Apply	2.5		
Analyze	2.5	2.5	2.5
Evaluate		2.5	2.5
Create		2.5	2.5

SEE –Semester Ending Examination (50 Marks)

Bloom's Category	**SEE Theory (25)**
Remember	10
Understand	5
Apply	5
Analyze	5
Evaluate	
Create	

ಆಡಳಿತ / ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

(ಕನ್ನಡಿಗರಿಗಾಗಿ for Kannadigas common to all branches)

Course code : 20HSS324/424	Credits : 01
L:T:P : 1:0:0	CIE Marks : 25
Exam Hours : 2	SEE Marks : 25

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಅಧ್ಯಯನದ ಕಲಿಕಾಂಶಗಳು:

C01 ವಿದ್ಯಾರ್ಥಿಗಳು ಕನ್ನಡ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಹಾಗೂ ಭಾಷಾ ರಚನೆ ನಿಯಮಗಳನ್ನು ಅರ್ಥೈಸಿಕೊಳ್ಳುತ್ತಾರೆ.

C02 ಕನ್ನಡ ಭಾಷಾ ಬರಹದಲ್ಲಿನ ದೋಷಗಳು, ನಿವಾರಣೆ ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳನ್ನು ಅರಿತುಕೊಳ್ಳುವರು.

C03 ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆಸರ್ಕಾರಿ ಪತ್ರ ವ್ಯವಹಾರದ ಬಗ್ಗೆ ತಿಳುವಳಿಕೆ ಪಡೆಯುವರು .

C04 ಭಾಷಾಂತರ ಮತ್ತು ಪ್ರಬಂಧ ರಚನೆ ಬಗ್ಗೆ ಅಸಕ್ತಿವಹಿಸಿಕೊಳ್ಳುವರು.

CO-PO Mapping :

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
CO1	-	-	-	-	-	-	-	-	-	3	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-

ಪರಿವಿಡಿ (ಪಠ್ಯ ಪುಸ್ತಕದಲ್ಲಿರುವ ವಿಷಯಗಳ ಪಟ್ಟಿ)

ಭಾಗ–1 ಲೇಖನಗಳು : ಕನ್ನಡ ನಾಡು ನುಡಿ ಮತ್ತು ಸಂಸ್ಕೃತಿಗೆ ಸಂಬಂಧಿಸಿದ ಲೇಖನಗಳು
ಭಾಗ–2 ಕಾವ್ಯ ಭಾಗ (ಆಧುನಿಕ ಪೂರ್ವ)
ಭಾಗ–3 ಕಾವ್ಯ ಭಾಗ (ಆಧುನಿಕ)
ಭಾಗ–4 ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿ ಪರಿಚಯ ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ
ಭಾಗ–5 ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯ ಪುಸ್ತಕದ ಲೇಖಕರು

ಡಾ.ಎಲ್.ತಿಮ್ಮೇಶ, ಪ್ರೋ.ವಿ. ಕೇಶವಮೂರ್ತಿ, ಪ್ರಕಟಣೆ: ಪ್ರಸಾರಾಂಗ,ವಿ.ತಾ.ವಿ ಬೆಳಗಾವಿ

ಪರೀಕ್ಷೆಯ ವಿಧಾನ:

ನಿರಂತರ ಅಂತರೀಕ ಮೌಲ್ಯ ಮಾಪನ (Continuous Internal Evaluation) : 25

ಸೆಮಿಸ್ಟರ್ ಎಂಡ್ ಪರೀಕ್ಷೆ (Semester End Examination) : 25

Bloom's Category	CIE (25)	SEE(25)
Remember	12	12
Understand	13	13

ವ್ಯಾವಹಾರಿಕ/ ಬಳಕೆ ಕನ್ನಡ

Vyavaharika / Balake Kannada

(Kannada for usage - common to all branches)

Course code : 20HSS325/425	Credits : 01
L:T:P : 1:0:0	CIE Marks : 25
Exam Hours : 2	SEE Marks : 25

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

CO1 Understand Kannada Language.
CO2 Communicate in Kannada Language
CO3 Read simple Kannada words
CO4 Pronounce Kannada words

CO – PO Mapping:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
CO1	-	-	-	-	-	-	-	-	-	3	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-

Syllabus

Chapter -1 Abbreviations
Chapter -2 Key to Transcription
Chapter -3 Easy learning of a Kannada Language: A few tips
Chapter -4 Necessity of learning a local Langauge
Chapter -5 Tips to learn the language with easy methods.
Chapter -6 Hints for correct and polite conservation
Chapter -7 About Kannada Language (Kannada Bhashe)
Chapter -8 Eight Kannada authors who have won ‘Jnanpith Award’
Chapter -9 Information about Karnataka State

Text Book:

Balake Kannada by Dr. L. Thimmesh, Prof. V. Keshavamurthy, published by: VTU, Belagavi

Continuous internal evaluation & semester end examination (25 Marks each)

Bloom’s Category	CIE (25)	SEE(25)
Remember	12	12
Understand	13	13

BASIC THERMODYNAMICS

Course Code: 19MEE332/432 **Credits: 03**
L:T:P : 2: 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:

19MEE332/432.1	Analyze and evaluate various thermodynamic cycles used for energy production - work and heat, within the natural limits of conversion.
19MEE332/432.2	Demonstrate an ability to use thermodynamic relations and the physical property tables and charts for the analysis of gas and vapor power mixtures, phase transformations, chemical reactions, and combustions processes.
19MEE332/432.3	Apply thermodynamic principles to the design, analysis, and optimization of the basic energy conversion systems: power generation, refrigeration, air-conditioning, and combustion.
19MEE332/432.4	Determine engineering design quantities and estimate their effects on the basic performance characteristics of the energy conversion systems.
19MEE332/432.5	Design the basic energy conversion systems, select working fluids, and estimate the effects of pressure, temperature, and flow rate on the system efficiency
19MEE332/432.6	Evaluate the feasibility of a thermodynamic cycle using the second law of thermodynamics for typical engineering problems.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19MEE332/432.1	3	3	3	3	-	-	-	-	2	2	-	3
19MEE332/432.2	3	3	3	3	-	-	3	-	2	2	-	3
19MEE332/432.3	3	3	3	3	-	2	3	-	2	2	-	3
19MEE332/432.4	3	3	3	3	-	2	3	-	2	2	-	3
19MEE332/432.5	3	3	3	3	-	3	3	-	2	2	-	3
19MEE332/432.6	3	3	3	3	-	3	2	-	2	2	-	3

Module	Contents of Module	Hrs	Co.'s
1.	**Fundamental Concepts & Definitions:** Thermodynamics: definition and scope, Microscopic and Macroscopic approaches. Applications of Thermodynamics: **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	**19MEE332/ 432.1 19MEE332/ 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, Problems on work transfer and heat transfer. **First Law of Thermodynamics:** 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 quasi-static process. Extension of the First law to	9	**19MEE332/ 432.1 19MEE332/ 432.2 19MEE332/ 432.3**

	control volume; steady state-steady flow energy equation, Assumptions for SFEE and some important applications. Numerical on open and closed systems		
3.	**Second Law of Thermodynamics:** Thermal reservoirs. Direct heat engine; schematic representation and efficiency. Reversed heat engine, schematic representation, coefficients of performance. Kelvin - Planck and Clausius statement: of the Second law of Thermodynamics; PMM I and PMM II, Equivalence of the two statements; Reversible and irreversible processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Numerical	9	**19MEE332, 432.2 19MEE332, 432.4**
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, Numerical **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	**19MEE332, 432.4**
5.	**Ideal gas mixtures**: 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	**19MEE332, 432.5 19MEE332 432.6**

Data Book:

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, 2006, 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, Tata McGraw 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)

Bloom's Taxonomy	Tests	Assignments	Quizzes
	25	15	10
Remember	5		
Understand	5	5	5
Apply	5	5	5
Analyze	5	5	
Evaluate	5		
Create			

SEE- Semester End Examination (50 Marks)

Bloom's Taxonomy	Tests
Remember	10
Understand	20
Apply	10
Analyze	5
Evaluate	5
Create	

MACHINES FOR MANUFACTURING TECHNOLOGY

Course Code : 19MEE342/ 442 | **Credits : 03**
L:T:P : 3:0:0 | **CIE Marks : 50**
Exam Hours : 03 | **SEE Marks : 50**

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

19MEE342/442.1	Estimate the machining time during metal cutting by selecting appropriate parameters such as speed, feed and depth of cut
19MEE342/442.2	Analyze the tool life and tool failure during machining process
19MEE342/442.3	Select the appropriate machine tools and machining operations to manufacture the components
19MEE342/442.4	Determine the dimensional tolerances obtained in different finishing and super finishing operations
19MEE342/442.5	Index the number of divisions on the work using various indexing techniques during gear cutting operations
19MEE342/442.6	Design the forming dies depending on the shape of the component

Mapping of course outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19MEE342/442.1	3	3	3	2	-	2	1	-	-	1	2	2
19MEE342/442.2	3	3	3	3	-	2	1	-	-	1	2	2
19MEE342/442.3	3	3	3	2	-	2	1	-	-	1	2	2
19MEE342/442.4	3	3	2	2	-	2	1	-	-	1	2	2
19MEE342/442.5	3	3	3	3	-	2	1	-	-	1	2	2
19MEE342/442.6	3	3	3	3	2	2	1	-	-	1	2	2

Module No	Module Contents	Hrs	CO's
1	Theory of metal cutting: Single point cutting tool nomenclature ,types of metal cutting, 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 equations, measurement of forces in metal cutting, numerical on tool life, Metal removal rate, shear angle, shear energy. Cutting tool materials: Desired properties and type 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 of metal working fluids, type of lubricant, cutting fluids, characteristics of cutting fluids.	7	**19MEE342/442.1**
2	Turning (lathe): classifications, Work holding devices, constructional features of turret and capstan lathe, tool layout. Milling machines : classification,, constructional features, milling cutters nomenclature, milling operations, up milling and down milling concept. Various milling operations, Indexing: simple, compound, differential and angular indexing calculations	6	**19MEE342/442.2**
3	Drilling machine : classification, constructional features, drilling & related operations. Types of drill & drill bit nomenclature, drill	6	**19MEE342/442.3**

	materials, reaming, boring, tapping Broaching process : Broaching process – principle of broaching. Details of a broach. Types of broaching machine – constructional details. Applications advantages and limitations		
4	Grinding machine: types of abrasives, grain size, bonding process, grade and structure of grinding wheels types. Classification, constructional features of a grinding machine (centerless, cylindrical and surface grinding). Selection of grinding wheel. Grinding process parameters, Dressing and truing of grinding wheels Finishing and other process lapping and honing operations – principles, arrangement of set up and application, tolerances in finishing Super finishing process: polishing, buffing operation and application, tolerances in super finishing	7	**19MEE342/442.3** **19MEE342/442.4**
5	CNC machines: introduction to CNC machines, principles of operations. Axes of NC machines, coordinate systems. Metal Forming: Blanking, Piercing, punching, drawing, draw ratio, drawing force, trimming and shearing, bending, bending dies, bending force, numerical on bending, embossing and coining Types of dies, compound and combination dies, numerical on die design	7	**19MEE342/442.4**

TEXT BOOKS:

1. Hazara Choudhry, 'Work shop Technology', Vol – II, Media promoters and publishers Pvt. Ltd. 2010 ISBN:9788185099156

2. , R.K.Jain, 'Production Technology', Khanna Publishers-Delhi , 2010 ,ISBN:9788174090997

REFERENCE BOOKS:

1. G.Boothroyd , 'Fundamentals of Metal machining and machine tools', McGraw Hill, 2005, ISBN:978-574446593
2. HMT, 'Production Technology', HMT, Tata McGraw Hill, 2008. ISBN:978-0070964433
3. Hienrich Gerling, Karl H Heller, 'All about machine tools', 2nd Edition, New Age publishers, 2016,ISBN: 8122418260 / 9788122418262
4. P. N. Rao, ' Manufacturing Technology', Vol I & II, 4th edition, Tata McGraw Hill publication, New Delhi, 2018, ISBN: 9789353160524

Assessment Pattern

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes
	25	15	10
Remember	5		
Understand	5	5	5
Apply	5	5	5
Analyze	5	5	
Evaluate	5		
Create			

SEE- Semester End Examination (50 Marks)

Bloom's Taxonomy	Tests
Remember	10
Understand	20
Apply	10
Analyze	5
Evaluate	5
Create	

MECHANICAL MEASUREMENTS AND METROLOGY

Course Code : 19MEE352/452 | **Credits :03**
L:T:P : 3:0:0 | **CIE Marks :50**
Exam Hours : 03 | **SEE Marks :50**

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

19MEE352/452.1	Determine the geometry and dimensions of components in engineering application by applying the tools and techniques of metrology and measurements
19MEE352/452.2	Compute the number of slip gauges required in building the required dimensions
19MEE352/452.3	Analyze the errors and their causes in measuring instruments for linear and angular measurements
19MEE352/452.4	Estimate the surface finish on work pieces and measure form parameters in screw and gear.
19MEE352/452.5	Select appropriate measuring instruments for measurement of force, torque, pressure, temperature and strain
19MEE352/452.6	Apply the concepts of geometric dimensioning and tolerances (GD&T), Limits, fits, gauges etc on components and design the gauges using the same.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19MEE352/452.1	3	2	1	1	1	1	-	-	-	1	1	2
19MEE352/452.2	3	2	1	1	1	1	-	-	-	1	1	2
19MEE352/452.3	3	2	1	2	1	1	-	-	-	1	1	2
19MEE352/452.4	3	2	2	1	1	1	-	-	-	1	1	2
19MEE352/452.5	3	2	1	1	1	1	-	-	-	1	1	2
19MEE352/452.6	3	3	3	3	1	1	1	-	-	1	1	2

Module No	Module Contents	Hrs	CO's
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-87, M-112) of Slip gauges, Wringing phenomena, Numerical problems on building of slip gauges. **Measurements and measurement systems:** Generalized measurement system, basic definitions, Errors in measurement, classification of errors.	**7**	19MEE352/452.1 19MEE352/452.2 19MEE352/452.3
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.	**7**	19MEE352/452.6
3	**Comparators:** Introduction to comparators, characteristics, classification of comparators, Johnson's Mikrokator, Sigma comparator, Dial gauge, Ziess ultra-optimeter LVDT, Solex pneumatic gauge.	**6**	19MEE352/452.1 19MEE352/

	Angular measurements: Bevel protractor, sine principle and use of sine bars, sine centre, angle gauges, numerical on building of angles using angle gauges.		452.2
4	**Surface metrology:** Terminology of surface roughness, Methods of measuring surface finish, Analysis of surface traces. **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.	**6**	19MEE352/ 452.4
5	**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.	**7**	19MEE352/ 452.5

TEXT BOOKS:

1. R.K. Jain , 'Engineering Metrology', Khanna Publishers, 2017, ISBN-13: 978-8174091536.

2. Beckwith Marangoni and Lienhard , 'Mechanical Measurements', Pearson Education, 7th Edition, 2015, ISBN 13: 978-8131717189.

3. Dr. T Chandrashekar , 'Metrology and Measurement', Subhas publication, 2017, ISBN: 9789383214198

REFERENCE BOOKS:

1. I.C. Gupta , 'Engineering Metrology', Dhanpat Rai Publications, Delhi, 8th Edition, 2018, ISBN 13: 9788189928452

2. R.K. Jain , 'Mechanical and Industrial Measurements', Khanna Publishers, 2008, ISBN: 9788174091918

3. , Anand K. Bewoor& Vinay A. Kulkarni , 'Metrology & Measurement', Tata McGraw Hill Pvt. Ltd., New Delhi, 2009, ISBN: 9781259081323

4. N V Raghavendra and Krishnamurthy , 'Engineering Metrology and Measurement', Oxford University Press, 2013, ISBN: 9780198085492

Assessment Pattern

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Taxonomy	Tests	Assignments	Quizzes
	25	15	10
Remember	5	5	
Understand	5	5	5
Apply	10	5	5
Analyze	5		
Evaluate			
Create			

SEE- Semester End Examination (50 Marks)

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

FLUID MECHANICS

Course Code: 19MEE362/462 **Credits: 03**
L: T: P 2:1:0 **CIE Marks: 50**
Exam Hours: 03 **SEE Marks: 50**

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

19MEE362/462.1	Identify and obtain the values of fluid properties and relationship between them and understand the principles of continuity, momentum, and energy as applied to fluid motions.
19MEE362/462.2	Compute the lift, drag, and moments acting on simple aerodynamic profiles and shapes in inviscid, steady fluid flows
19MEE362/462.3	Apply Continuity and Bernoulli equation in solving problems on flow through conducts.
19MEE362/462.4	Understand the friction losses and minor losses while flowing through a pipe and also used for the designing of pipeline net work.
19MEE362/462.5	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.
19MEE362/462.6	To formulate and analyze problems related to calculation of forces in fluid structure interaction. Analyze the types of fluid flows and different flow description.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19MEE362/462.1	3	3	3	3	2	2	2	-	-	-	-	2
19MEE362/462.2	3	2	2	3	2	2	2	-	-	-	-	2
19MEE362/462.3	3	3	3	3	2	2	2	-	-	-	-	2
19MEE362/462.4	3	3	3	3	2	2	2	-	-	-	-	2
19MEE362/462.5	3	3	2	3	2	2	2	-	-	-	-	2
19MEE362/462.6	3	3	2	3	2	2	2	-	-	-	-	2

Module No	Module Content	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, Hydrostatic law , pressure variation in a static fluid in 2D.	**06**	**19MEE362/462.1** **19MEE362/462.2**
2	**Buoyancy:** Buoyancy, centre of buoyancy, Archimedes' principle, principle of floatation, metacentre and metacentric height, stability of floating and submerged bodies, determination of Metacentric height by experimental method. (Numerical on Meta center and center of Buoyancy) **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 potential function and stream function (Numerical).	**07**	**19MEE362/462.2** **19MEE362/462.3** **19MEE362/462.5**
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 (Numerical). Application of	**06**	**19MEE362/462.3** **19MEE362/462.4** **19MEE362/462.5**

	Bernoulli's equation to pitot tube, venturimeter, orifice meter (No Derivation of discharge equation). Dimension Analysis concepts.		
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)	**08**	**19MEE362/462.4** **19MEE362/462.5**
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. (Numerical) **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.	**06**	**19MEE362/462.5** **19MEE362/462.6**

TEXT BOOKS:

1. Dr R K Bansal., 'A textbook of Fluid Mechanics', Laxmi Publications Pvt. Ltd., 1st Edition, 2016, ISBN-(13 digits): 978-8131802946; ISBN-(10 digits): 9788131802946.
2. Er. R K Rajput., 'Fluid Mechanics & Hydraulic Machine', S Chand & Company, 6th Edition, 2015, ISBN-(13 digits): 978-9385401374.

REFERENCE BOOKS:

1. Yunus A. Cengel and John M. Cimbala., 'Fluid Mechanics', McGraw Hill, 3rd Edition, 2017, ISBN-(13 digits): 978-9385401374.
2. Dr D S Kumar., 'Fluid Mechanics', S K Kataria & Sons, 6th Edition, 2012, ISBN-(13 digits): 978-9380027654; ISBN-(10 digits): 9380027656.

CIE- Continuous Internal Evaluation for theory (50 Marks)

Bloom's Category	Tests	Assignments	Quiz
Marks (Out of 50)	25	15	10
Remember	2		
Understand	2		
Apply	7	5	
Analyse	7	5	5
Evaluate	7	5	5
Create			

SEE – Semester End Examination (50 Marks Theory)

Bloom's Category	Tests (Theory)
Remember	4
Understand	4
Apply	14
Analyse	14
Evaluate	14
Create	

MACHINES FOR MANUFACTURING TECHNOLOGY LAB

Course Code : 19MEL342/ 442 | **Credits : 01**
L:T:P : 0:0:1 | **CIE Marks : 25**
Exam Hours : 03 | **SEE Marks : 25**

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

19MEL342/442.1	Prepare various models of turning, Knurling, facing and step turning operations using lathe, Develop Models to Cut grooves using Shaper Machine
19MEL342/442.2	Analyze the methods of taper turning, thread cutting and preparing models using the same.
19MEL342/442.3	Index the number of slots on the work piece by different indexing methods and practicing them for gear cutting
19MEL342/442.4	Drill the holes and grind the work pieces into the required contour using drilling and grinding machines

Mapping of course outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19MEL342/442.1	3	3	3	2	-	2	2	1	3	2	1	2
19MEL342/442.2	3	2	3	2	-	2	2	1	3	2	1	2
19MEL342/442.3	3	3	3	2	-	2	2	1	3	2	1	2
19MEL342/442.4	3	3	3	2	-	2	2	1	3	2	1	2

Module No.	Module Contents	Hrs.	Cos
1.	Preparation of three models on lathe involving facing, plain turning and step turning.	**6**	**19MEL342/442.1**
2.	Preparation of the three models on lathe involving taper turning and thread cutting.	**3**	**19MEL342/442.2**
3.	Preparation of three models on lathe involving facing, knurling and eccentric turning.	**3**	**19MEL342/442.1**
4.	Cutting of v groove/ dovetail/ rectangular groove using a milling.	**3**	**19MEL342/442.2**
5.	Problems on simple and compound indexing.	**3**	**19MEL342/442.3**
6.	Cutting of gear teeth using milling machine.	**3**	**19MEL342/442.3**
7.	Preparation of three models on drilling involving reaming, boring and internal thread cutting.	**3**	**19MEL342/442.4**
8.	Drilling of a cylindrical hole using a drilling machine.	**3**	**19MEL342/442.4**
9.	Grinding of a surface using a surface grinding machine.	**3**	**19MEL342-/442.4**
10.	Demonstration of CAN turning and milling centres.	**3**	**19MEL342/442.2**

Text books:

1. Work shop technology, Hazara Choudhry, Vol – II, Media promoters and publishers Pvt. Ltd. 2010 ISBN 13:9788185099156
2. Production technology, R.K.Jain, Khanna Publishers Delhi 6,2010,ISB13:9788174090997

3. Production technology, HMT, Tata MacGraw Hill, 2008. ISBN-13:978-0017964433

Reference books :

1. Manufacturing Science, Amithabha Ghosh and Malik, affiliated east west press, 2010. ISBN-13:978-8176710633
2. Fundamentals of metal machining and machine tools, G.Boothroyd, McGraw Hill, 2005, ISBN-13:978-574446593
3. Manufacturing Technology, HMT, Tata MacGraw Hill, 2008. ISBN-13:978-0070964433

CIE – Continuous internal Evaluation for Lab (25 marks)

Bloom's Category	Experiments/Tests	Record	Viva
Marks (out of 50)	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 (25 Marks - Lab)

Bloom's Category	Test
Remember	6
Understand	6
Apply	5
Analyze	5
Evaluate	3
Create	

MECHANICAL MEASUREMENTS AND METROLOGY LAB

Course Code : 19MEL352/452 | **Credits :01**
L:T:P : 0:0:1 | **CIE Marks :25**
Exam Hours : 03 | **SEE Marks :25**

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

19MEL352/452.1	Calibrate the measuring instruments such as micrometer, pressure gauge, LVDT, load cell, thermocouple etc
19MEL352/452.2	Determine the taper angle, surface roughness and alignment of machined components
19MEL352/452.3	Measure the screw thread and gear tooth parameters of the specimens
19MEL352/452.4	Compute the cutting forces and torque in drilling and turning using dynamometers

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19MEL352/452.1	3	1	1	-	1	1	-	-	2	1	1	1
19MEL352/452.2	3	1	1	-	1	1	-	-	2	1	1	1
19MEL352/452.3	3	1	1	-	1	1	-	-	2	1	1	1
19MEL352/452.4	3	1	1	2	1	1	-	-	2	1	1	1

Experiment No.	Module Contents	Hrs	CO's
1	Calibration of load cell using standard weights	**3**	19MEL352/452.1
2	Calibration of micrometer using slip gauge	**3**	19MEL352/452.1
3	Calibration of LVDT using micrometer	**3**	19MEL352/452.1
4	Calibration of pressure gauge	**3**	19MEL352/452.1
5	Measurement of Taper angle using sine bar and slip gauge	**3**	19MEL352/452.2
6	Measurement of surface roughness of component using mechanical comparator	**3**	19MEL352/452.2
7	Measurement of screw thread parameters using Tool makers' microscope	**3**	19MEL352/452.3
8	Measurement of screw thread parameters using floating carriage micrometer by 2-wiremethod	**3**	19MEL352/452.3
9	Measurement of gear parameters using gear tooth vernier	**3**	19MEL352/452.3
10	Measurement of alignment of surface plate using roller set	**3**	19MEL352/452.2
11	Comparison and measurement of temperature using thermocouple and RTD	**3**	19MEL352/452.4
12	Measurement of cutting forces and torque using lathe/ drill tool Dynamometer	**3**	19MEL352/452.4
13	Determination of young s modulus using strain gauge.	**3**	19MEL352/452.2

TEXT BOOKS:

1. **Engineering Metrology**, R.K. Jain, Khanna Publishers, 2017, ISBN-13: 978-8174091536.
2. **Mechanical Measurements**, Beckwith Marangoni and Lienhard, Pearson Education, 7th Ed., 2015, ISBN 13: 978-8131717189.

3. **Metrology and Measurement**, Dr. T Chandrashekar, Subhas publication, 2017, ISBN: 9789383214198

REFERENCE BOOKS:

1. **Engineering Metrology**, I.C. Gupta, Dhanpat Rai Publications, Delhi. 8th Edition, 2018, 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 (25 Marks)

Bloom's Taxonomy	Experiments/Tests	Record	Viva
	10	10	5
Remember			
Understand			
Apply	5	5	3
Analyze	5	5	2
Evaluate			
Create			

SEE- Semester End Examination (25 Marks)

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

FLUID MECHANICS LAB

Course Code :19MEL362/462 **Credits: 01**
L: T: P : 0:0:1 **CIE Marks: 25**
Exam Hours : 03 **SEE Marks: 25**

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

19MEL362/462.1	Apply practical knowledge in verification of principles of fluid flow, modern computational techniques in fluid dynamics
19MEL362/462.2	Impart knowledge in measuring pressure, discharge and velocity of fluid flow
19MEL362/462.3	Conduct experiments (in teams) in pipe flows and open-channel flows and interpreting data from model studies to prototype cases, as well as documenting them in engineering reports
19MEL362/462.4	Analyze a variety of practical fluid-flow devices and utilize fluid mechanics principles in design, viscosity of various lubrication oils and diesel, validate the results with standards.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19MEL362/462.1	3	3	-	3	3	2	2	2	3	3	2	2
19MEL362/462.2	3	-	2	3	3	2	2	2	3	3	2	2
19MEL362/462.3	3	3	3	3	3	2	2	2	3	3	2	2
19MEL362/462.4	3	3	3	3	2	2	2	2	3	3	2	2

Expt. No.	Name of the Experiment	Hrs	COs
1.	Determination of viscosity of given lubricating oil using Saybolt / Redwood / Torsion Viscometer**.**	**02**	**19MEL362/462.1 19MEL362/462.2**
2.	Calibration of given Venturi meter and plotting the suitable calibration curve	**03**	**19MEL362/462.1 19MEL362/462.2**
3.	Calibration of given Orifice meter (Open and Closed) and plotting the suitable calibration curve.	**02**	**19MEL362/462.2 19MEL362/462.3**
4.	To determine the Metacentric Height of a Ship Model.	**02**	**19MEL362/462.2 19MEL362/462.3**
5.	Demonstrate Vertical Axis Wind Turbine setup.	**02**	**19MEL362/462.3 19MEL362/462.4**
6.	Calibration of given V-notch, Rectangular, Trapezoidal Notch and plotting the suitable calibration curve	**02**	**19MEL362/462.3 19MEL362/462.4**
7.	Determination of coefficient of friction and Chezy's constant for Turbulent flow in pipes.	**03**	**19MEL362/462.4**
8.	Determination of minor losses coefficient in flow through pipes due to sudden contraction and sudden expansion.	**02**	**19MEL362/462.4**
9.	Wind tunnel testing to determine the static pressure on cambered aerofoil.	**02**	**19MEL362/462.3**
10.	Determination of the Reynolds Number and hence the Type of Flow using the Reynolds apparatus	**02**	**19MEL362/462.4**

TEXT BOOKS:

1. Dr R K Bansal., 'A textbook of Fluid Mechanics', Laxmi Publications Pvt. Ltd., 1st Edition, 2016, ISBN-(13 digits): 978-8131802946; ISBN-(10 digits): 9788131802946.
2. Er. R K Rajput., 'Fluid Mechanics & Hydraulic Machine', S Chand & Company, 6th Edition, 2015, ISBN-(13 digits): 978-9385401374.

REFERENCE BOOKS:

1. Yunus A. Cengel and John M. Cimbala., 'Fluid Mechanics', McGraw Hill, 3rd Edition, 2017, ISBN-(13 digits):

978-9385401374.

2. Dr D S Kumar., 'Fluid Mechanics', S K Kataria & Sons, 6th Edition, 2012, ISBN-(13 digits): 978-9380027654; ISBN-(10 digits): 9380027656.

Assessment Pattern

CIE- Continuous Internal Evaluation for theory (25 Marks Lab)

Bloom's Category	Experiments/Tests	Record	Viva
Marks (Out of 25)	10	10	5
Remember			1
Understand			1
Apply			1
Analyze	5	4	1
Evaluate	5	4	1
Create		2	

SEE – Semester End Examination (25 Marks Lab)

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

BASIC APPLIED MATHEMATICS-I

Course Code : 19DMAT31 **Credits : 00**
L:T:P : 0:0:0 **CIE Marks : 25**
Exam Hours : 02 **SEE Marks : 25**

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

19DMAT31.1	Learn the principles of engineering mathematics through calculus
19DMAT31.2	Determine the power series expansion of a function
19DMAT31.3	Find the definite integrals with standard limits
19DMAT31.4	Develop the ability to solve different types of differential equations
19DMAT31.5	Apply ideas from linear algebra in solving systems of linear equations
19DMAT31.6	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
19DMAT31.1	3	2	3	2	2	-	-	-	1	1	-	1
19DMAT31.2	3	2	3	2	2	-	-	-	1	1	-	1
19DMAT31.3	3	2	3	2	2	-	-	-	1	1	-	1
19DMAT31.4	3	2	3	2	2	-	-	-	1	1	-	1
19DMAT31.5	3	2	3	2	2	-	-	-	1	1	-	1
19DMAT31.6	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 equatio for polar curves-Problems. Macluren's theorems for function of one variable (statement only)-Problems.	**5L**	**19DMA 31.1 19DMA 31.2**
2.	**Partial differentiation:** Definition and Simple problems, Euler's theorem for Homogeneous function (NO Derivation and NO extended theorem)-Problems, Partial differentiation of composite functions (chain rule)-Problems, Jacobians of order two - definition and problems.	**5L**	**19DMA 31.1**
3.	**Integral Calculus and Differential Equations:** Problems on reduction formulae for functions $\sin^n x$, $\cos^n x$, Problems on evaluation of these integrals with standard limits (0 to $\pi/2$). Solution of first order and first degree differential equations-Variable separable Linear and Exact differential equations.	**5L**	**19DMA 31.3 19DMA 31.4**
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.	**5L**	**19DMA 31.5**
5.	**Linear Algebra-2:** Linear transformation, Eigen values and Eigen vectors, diagonalisation of a square matrix-Problems.	**5L**	**19DMA 31.6**

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, 10th Edition, 2014, ISBN: 978-81-265-5423-2.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2014, ISBN: 978-81-7409-195-5.

Reference Books:

1. Glyn James, Modern Engineering Mathematics, Prentice Hall, 4th Edition, 2015, ISBN: 978-0-273-73409-3
2. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, 4th Edition, 2016, ISBN: 978-0-07-063419-0.
3. H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., 28th Edition, 2012, ISBN: 81-219-0345-9.
4. N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., 9th Edition, 2014, ISBN: 978-81-318-0832-0.

Assessment Pattern:

1. CIE- Continuous Internal Evaluation (25 Marks)

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

2. SEE- Semester End Examination (25 Marks)

Bloom's Category	Questions (25 Marks)
Remember	5
Understand	10
Apply	5
Analyze	2.5
Evaluate	2.5
Create	-

BASIC APPLIED MATHEMATICS-II

Course Code : 19DMAT41 **Credits : 00**
L:T:P : 0:0:0 **CIE Marks : 25**
Exam Hours : 02 **SEE Marks : 25**

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

19DMAT41.1	Gain knowledge of basic operations of vectors
19DMAT41.2	Use curl and divergence of a vector function in three dimensions
19DMAT41.3	Develop the ability to solve higher order Linear differential equations
19DMAT41.4	Understand basic concepts of Laplace transform to engineering problems
19DMAT41.5	Solve the Laplace transform of Periodic and Step functions
19DMAT41.6	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
19DMAT41.1	3	2	3	2	2	-	-	-	1	3	-	1
19DMAT41.2	3	2	3	2	2	-	-	-	1	3	-	1
19DMAT41.3	3	2	3	2	2	-	-	-	1	3	-	1
19DMAT41.4	3	2	3	2	2	-	-	-	1	3	-	1
19DMAT41.5	3	2	3	2	2	-	-	-	1	3	-	1
19DMAT41.6	3	2	3	2	2	-	-	-	1	3		1

Course 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. Orthogonal, Co-planar and Angle between vectors-Problems.	**5L**	**19DMAT 41.1**
2.	**Vector Differentiation:** Velocity and Accelerations, Vector differential operator-Gradient of a scalar function, Divergence of a vector function, Curl of a vector function-Problems. Solenoidal and irrotational vector fields-Problems.	**5L**	**19DMAT 41.2**
3.	**Linear differential equations with constant coefficients:** Solution of initial and boundary value problems, Inverse differential operator technique for the functions-e^{ax}, $Sin\ (ax+b)$ and $\mathrm{Cos}\ (\mathrm{ax}+\mathrm{b})$.	**5L**	**19DMAT 41.3**
4.	**Laplace Transform:** Definition and Laplace transforms of elementary functions-Problems. Properties of Laplace transforms (without proof) ,Periodic functions(without proof), Heaviside function(without proof) - Problems.	**5L**	**19DMAT 41.14 19DMAT 41.5**
5.	**Inverse Laplace Transform:** Inverse Laplace Transform by partial fractions, completing the square method-Problems. Solution of linear differential equations using Laplace Transforms-Problems.	**5L**	**19DMAT 41.6**

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, 10th Edition, 2014, ISBN: 978-81-265-5423-2.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2014, ISBN: 978-81-7409-195-5.

Reference Books:

1. Glyn James, Modern Engineering Mathematics, Prentice Hall, 4th Edition, 2015, ISBN: 978-0-273-73409-3
2. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, 4th Edition, 2016, ISBN: 978-0-07-063419-0.
3. H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., 28th Edition, 2012, ISBN: 81-219-0345-9.
4. N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., 9th Edition, 2014, ISBN: 978-81-318-0832-0.

Assessment Pattern:

1. CIE- Continuous Internal Evaluation (25 Marks)

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

2. SEE- Semester End Examination (25 Marks)

Bloom's Category	Questions (25 Marks)
Remember	5
Understand	10
Apply	5
Analyze	2.5
Evaluate	2.5
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 AppendixC

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 thelimitations.

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 sustainabledevelopment.

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

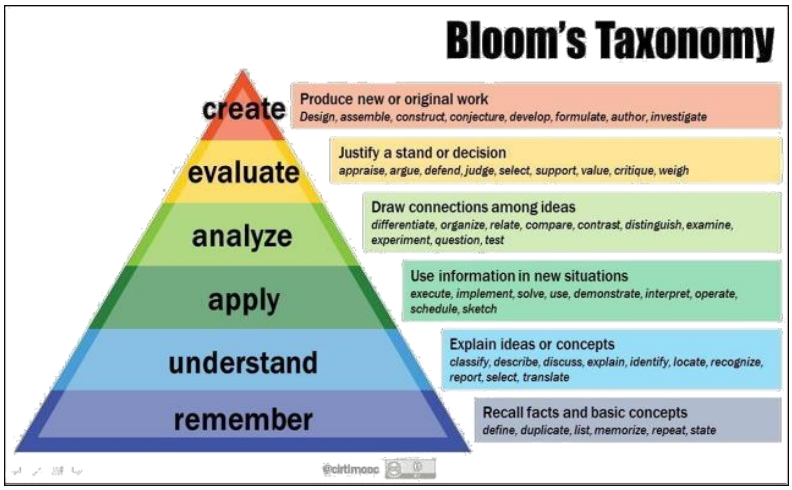
Individual and team work: Function effectively as an individual, and as a member or leaderin
diverse teams, and in multidisciplinary settings.

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 clearinstructions.

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 multidisciplinaryenvironments.

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]**