B.N.M. Institute of Technology

An Autonomous Institution under VTU, Approved by AICTE

Department of Mathematics

Syllabus

Semester: III			
Course: Fourier Series, Transforms and Statistical Techniques **Course Code: 24MAE131 (Common to ECE, EEE & ME)**			
L:T:P:J	**2:2:0:0**	**CIA**	**: 50**
Credits:	**03**	**SEA**	**: 50**
Hours:	**40**	**SEA Duration**	**: 03 Hours**

Course Learning Objectives: The students will be able to develop the theoretical and practical knowledge of Statistical methods, Laplace transform, Fourier series, Fourier transforms and Z-transforms in a comprehensive manner in various fields of engineering.

Module-1: Curve fitting & Statistical methods	No. of hours	Blooms cognitive Levels
Examples from Engineering field that require curve fitting and statistical methods. **Curve Fitting:** Curve fitting by the method of least squares-fitting the curves of the form: $y = ax+b$, $y = ax^2 + bx + c$ and $y = ax^b$. **Statistical methods:** Introduction to Moments, Skewness, Kurtosis and problems. Karl Pearson's coefficient of correlation and lines of regression. *Experiential Learning component: Problems on curve fitting and statistical methods*	**L: 04** **T: 04**	**L1** **L2** **L3**
Module-2: Laplace Transform		
Examples from Engineering field that require Laplace transforms. Transformation for time domain to frequency domain. Definition and Laplace transforms of elementary functions (statements only). Laplace transform of $e^{at} f(t)$, $t^n f(t)$, $\frac{f(t)}{t}$, $\int_0^t f(t)dt$ and $f^n(t)$ (without proof). Laplace transforms of Periodic functions, unit-step function and unit impulse function. *Experiential Learning component: Finding the Laplace transforms of a function.*	**L: 04** **T: 04**	**L1** **L2** **L3**
Module-3: Inverse Laplace Transform		
Examples from Engineering field that require inverse Laplace transforms. Definition and problems. Inverse Laplace transform using convolution theorem (without proof). Solution of linear differential equations and simultaneous differential equations. Applications to engineering problems. *Experiential Learning component: Problems on LCR Circuit.*	**L: 04** **T: 04**	**L1** **L2** **L3**
Module-4: Fourier Series		
Examples from Engineering field that require Fourier series. Periodic functions, Introduction to Fourier Series, Dirichlet's condition. Fourier series of periodic functions with period 2π and arbitrary period. Half range Fourier sine and cosine series. Practical harmonic analysis over the interval *(0, 2l).* *Experiential Learning component: Finding the Fourier series.*	**L : 04** **T : 04**	**L1** **L2** **L3**
Module-5: Fourier Transforms & Z -Transforms		
Examples from Engineering field that require Fourier Transforms & Z -Transforms. **Fourier Transforms:** Fourier transform and properties-problems, Fourier sine and cosine transforms. Inverse Fourier transforms. **Z-Transforms:** Introduction to Z-transform, Z-transform of standard functions and properties (without proof). Initial value and final value theorems, problems. *Experiential Learning component: Finding the Fourier transforms & Z –Transforms of a function.*	**L : 04** **T : 04**	**L1** **L2** **L3**

Course Outcomes: After completing the course, the students will be able to

CO 1: Apply the knowledge of correlation and regression analysis to fit a suitable mathematical model for the statistical data.

CO 2: Apply Laplace transform technique to find the transformation from time domain to frequency domain.

CO 3: Use inverse Laplace transform in solving differential equations arising in network analysis, control system and other fields of engineering

CO 4: Demonstrate Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing and field theory.

CO 5: Apply the knowledge of Fourier transform and Z-transform to illustrate discrete / continuous function arising in wave and heat propagation, signals and systems.

CO - PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2			2							
CO 2	3	2			2							
CO 3	3	2			2							
CO 4	3	2			2							
CO 5	3	2			2							

Reference Books:

1. E. Kreyszig: “Advanced Engineering Mathematics”, John Wiley & Sons, 10"Ed.(Reprint), 2016.
2. B. S. Grewal: “Higher Engineering Mathematics”, Khanna Publishers, 44th Ed., 2017.
3. H. K. Dass, “ Advanced Engineering Mathematics” S. Chand publication.
4. C. Ray Wylie, Louis C. Barrett : “Advanced Engineering Mathematics", 6" Edition, 2. McGraw-Hill Book Co., New York, 1995.
5. James Stewart : “Calculus —Early Transcendentals”, Cengage Learning India Private Ltd., 2017.
6. B.V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
7. Srimanta Pal & Subodh C Bhunia: “Engineering Mathematics”, Oxford University Press, 3 Reprint, 2016.

Web links and Video Lectures:

1. https://youtu.be/BsVtMnp3vks
2. https://youtu.be/Nz4WB8-gNBg
3. https://youtu.be/6MXMDrs6ZmA
4. https://youtu.be/r18Gi8lSkfM
5. https://youtu.be/cy_KI_FiS7I
6. https://youtu.be/sMYtHaSIXbU

B.N.M. Institute of Technology

An Autonomous Institution under VTU

Department of Mechanical Engineering

Course Name	**Material Science & Metallurgy**	**Credits**	**03**
Course code	**24MEC132**	**CIA Marks**	**50**
Number of Lecture Hours/Week	**3L:T:P:J**	**SEA Marks**	**50**
Total Number of Lecture Hours	**40**	**Exam Hours**	**3 hours**

Course Objective:

This course will enable the students to:

- Familiarize the students with fundamentals of materials science such as crystallography principles of alloy formation,
- Plastic deformation, mechanical properties, various types of heat treatment processes, isothermal transformation and continuous cooling transformation diagrams.
- Introduce Ceramic, Composite and Polymeric Materials.

Module-I: Crystal Structure & Diffusion		
Pre-requisite: Periodic table, Atomic numbers, and basic crystal structure **Teaching component**: Introduction to Materials: Classifications of materials: Metallic materials, Polymeric materials and ceramic materials. Crystal Imperfections: crystal structures, APF, naming planes and directions, defects in crystals, Point imperfections, Line imperfections, Surface imperfections, Volume Imperfections Numericals. Diffusion: Introduction, Diffusion Mechanisms, steady state diffusion, non-study state diffusion, factors that influence diffusion. Fick's laws of diffusion.	**8 Hrs.**	**Apply**
Module-2: Mechanical Behavior of Materials		
Pre-requisite: Basics of materials elastic behavior, stress, strain, elongation **Teaching component**: Mechanical Behavior: Stress-strain diagram for ductile and brittle materials, True stress and true strain, linear and nonlinear elastic behavior and properties, Creep: Description of the phenomenon with		

examples, three stages of creep, stress relaxation, Fatigue- Types of fatigue loading with examples, S-N curve, R-R Moore reverse Bending test Dislocations and Plastic Deformations: Basic concepts, characteristics of dislocations, slip systems, slip in single crystals, plastic deformation of polycrystalline materials, Deformation by twinning, Mechanisms of strengthening in metals, Strain hardening.	**8Hrs**	**Apply**
Module-3: Solidification and Phase Diagrams		
Pre-requisite: types of alloys, atomic weight percentage, solidus and liquidus phases **Teaching component**: Solidification and Solid Solutions: Mechanism of solidification, Homogenous and Heterogeneous nucleation, crystal growth, cast metal structures, solid solutions- types and rules governing the formation of solid solutions. Phase Diagram: Basic terms, phase rule, lever rule, cooling curves, construction and interpretation of different phase diagrams (eutectic, eutectoid, peritectic and peritectoid). Iron - Carbon Equilibrium Diagram: Iron-cementite diagram. Irons, steels and cast irons.,	**8 Hrs.**	**Apply**
Module-4: Heat Treatment and Metallography		
Pre-requisite: Mechanical properties of alloys and application of different alloys **Teaching component**: Heat treatment: - TTT, CCT diagram, applications- annealing, normalizing, hardening and tempering; micro structural effects brought about by these processes and their influences on mechanical properties; factor affecting hardenability, surface hardening of steels. Age hardening of aluminum alloys. Microstructures of iron-carbon alloys. Aluminum copper system. Metallographic specimen preparation, etchants, principle of X – ray diffraction, SEM and TEM.	**8 Hrs.**	**Apply**
Module-5: Advanced Materials		
Pre-requisite: Properties of Thermo setting and Thermo plastics **Teaching component**: Composite materials: Definition, classification, type of matrix materials and reinforcements, advantages and application of composites.	**8 Hrs.**	**Apply**

Production of composites, FRP composites- filament winding, pultrusion, autoclave moulding, RTM / VARTM, metal matrix composites- stir casting, powder metallurgy, ceramic matrix composites- selective laser sintering, tape casting		
	Total	**40 Hrs**

Course Outcomes: After completing the course, the students will be able to	
24MEC132.1	Apply the basic chemical bonds, crystal structures (BCC, FCC, and HCP), and their relationship with the properties.
24MEC132.2	Apply the basic principles of diffusion mechanism and electron microscopy to study the microstructure characteristic of materials
24MEC132.3	Analyze the microstructure of metallic materials using phase diagrams and modify the microstructure and properties using different heat treatments.
24MEC132.4	Apply the basic principle of wear mechanism to study the advance surface modification technique
24MEC132.5	illustrate the properties and potentialities of polymeric, ceramic materials and composite materials their processing along with its applications.

Reference Books

1. Crystals and Crystal structures, R.J.D. Tilley, John Wiley and Sons, 2006
2. Materials Science and Engineering – W.D. Callister, Jr. Wiley India(P) Ltd., 2007
3. Materials Science and Engineering, G.S. Upadhyaya and Anish Upadhyaya, Viva books, 2010
4. Fundamentals of Materials Science-the microstructure-property relationship using metals as model systems, E.J. Mittemeijer, Springer, 2010
5. Microstructural Characterization of Materials – D. Brandon and W.D. Kaplan, John Wiley and Sons, 2008
6. Science of Microscopy, P.W. Hawkes and J.C.H. Spence, Springer, 2007
7. Scanning Electron Microscopy & X-Ray Microanalysis, J. Goldstein et.al, Springer, 2003
8. Transmission Electron Microscopy – B. D. Williams & C. B. Carter, Springer, 2009
9. Materials Characterization Techniques, S. Zhang, Lin Li and Ashok Kumar, CRC Press, 2009

CO-PO Mapping											
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-
CO6	3	3	-	-	-	-	-	-	-	-	-

Scheme of evaluation for CIA & SEA

<table>
<tr><th rowspan="2">PCC</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th></th><th colspan="3">CIA (50)</th><th rowspan="2">SEA
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Reduced to: 50 M</th></tr>
<tr><th></th><th>I</th><th>II</th><th>III</th></tr>
<tr><td rowspan="5">Conduction</td><td rowspan="5">50</td><td rowspan="5">50</td><td rowspan="2">Written Test</td><td>30</td><td>30</td><td>30</td><td rowspan="4">Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module</td></tr>
<tr><td colspan="3">Average of three tests – 30 Marks</td></tr>
<tr><td>Assignment</td><td colspan="2"></td><td>10</td></tr>
<tr><td>AAT</td><td colspan="2"></td><td>10</td></tr>
<tr><td></td><td colspan="3">Total – 50 marks</td><td>Total – 50 marks</td></tr>
</table>

i) CIA: 50%

IA Test: 3 IA tests - Each of 30 Marks	Average of 3 tests – scaled down to 30 Marks
Assignment – Two assignments – one for 10 marks and another for 10 marks	10 Marks
Additional Assessment Tools (AAT) – Oral /Online Quizzes, Presentations, Group discussions, Case studies, Term Paper, Open ended experiments, Mini industrial/social/rural Projects, Two-minute video on latest topic, Short MOOC courses, Practical Orientation on Design thinking, creativity & Innovation, Participatory & Industry integrated learning, Practical activities, Problem solving exercises, Participation in seminars/academic events/symposia and any other activity	10 Marks
Total	**50 Marks**

ii) SEA : 50%

Theory Exam	5 questions to answer each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	20 M x 5 = **100 M** **reduced to 50 M**
	Total	**50 Marks**

Department of Mechanical Engineering

Course Name	**Additive and Subtractive Manufacturing**	**Credits**	**03**
Course code	**24MEC133**	**CIE Marks**	**50**
Number of Lecture Hours/Week	**3L**	**SEE Marks**	**50**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**

Module-I: Conventional and Non-Conventional Machining Process		
Pre-requisite: Metals, alloys and their properties, working principles of machine tools. **Teaching component**: **Conventional Machining:** Orthogonal cutting, Single and multi-point cutting tools, Tool wear and tool life, Surface finish and integrity, Machinability, cutting tool materials, cutting fluids. **CNC Machining**: NC Part Programming, Introduction to ISO based G & M codes for NC part programming, Concepts of tool length and radius compensation, Standard canned cycles used in CNC turning and milling centers. **Non-Conventional Machining Process**: Machining, principle of working and processes parameters - wire EDM, Electrochemical machining(ECM), Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining(EBM).	**8 Hrs**	**Apply**
Module-2: Plastic & Ceramic Components Manufacturing		
Pre-requisite: Types and uses of plastics & ceramics along with their impacts on environment. **Teaching component**: **Casting and Moulding**: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses. Classification of Plastics, Ingredients of Moulding compounds, General Properties of Plastics, Plastic part manufacturing processes such as compression moulding, transfer moulding, Injection moulding, Extrusion moulding, blow moulding, Thermoforming, slush moulding, laminating. Ceramic Structure, Properties, and	**8 Hrs**	**Apply**

Applications, Shaping Ceramics, Glasses Structure, Properties, and Applications,		
Module-3: Introduction to Additive Manufacturing		
Pre-requisite: Basic understanding of physics and mathematics **Teaching component**: **Introduction and Basic Principles:** Generic AM process, distinction between AM and CNC, AM related technologies- reverse engineering technology. **Development of Additive Manufacturing Technology:** Introduction, computer-aided sign technology, other associated technologies, the use of layers, classification of AM processes, metals systems, hybrid systems. **Additive Manufacturing Process Chain:** Introduction, the eight steps in additive manufacture, variations from one AM machine to another, maintenance of equipment, materials handling issues, design for AM, and application areas.	**8Hrs**	**Apply**
Module-4: Solid, Liquid and Powder Based Methods		
Pre-requisite: Essentials about sintering phenomena, concepts of extrusion and polymerization **Teaching component**: **Photo Polymerization Processes:** Stereo lithography (SL), Materials, resin curing process, Process Benefits and Drawbacks, Applications of Photo Polymerization Processes. **Powder Bed Fusion Processes:** Introduction, Selective laser Sintering (SLS), Materials, Electron Beam melting (EBM), Process Benefits and Drawbacks, Applications of Powder Bed Fusion Processes. **Extrusion-Based Systems**: Fused Deposition Modelling (FDM), Principles, Materials, Bio-Extrusion, Process Benefits and Drawbacks, Applications of Extrusion-Based Processes. **Printing Processes**: Material Jetting Fundamentals, Materials, Commercial material jetting machines, process benefits and drawbacks. Binder Jetting working principle, Materials, BJ Machines, Process benefits and Drawbacks in Binder Jetting.	**8Hrs**	**Apply**
Module-5: Post Processing Methods and Software's for Additive Manufacturing		
Pre-requisite: Awareness of CAD softwares required for AM, concepts of process and production planning. **Teaching component**:	**8Hrs**	**Apply**

Guidelines for Process Selection: Introduction, selection methods for a part, challenges of selection, example system for preliminary selection, production planning and control. **Software Issues for Additive Manufacturing**: Introduction, preparation of cad models – the STL file, problems with STL files, STL file manipulation. **Post- Processing**: Support material removal, surface texture improvements, preparation for use as a pattern, property enhancements using non-thermal techniques and thermal techniques. **The Use of Multiple Materials in Additive Manufacturing**: Introduction, multiple material approaches, discrete multiple material processes, porous multiple material processes, blended multiple material processes, commercial applications using multiple materials, future directions. Additive Manufacturing Applications -Engineering analysis models, Aerospace, defense, automobile, Bio-medical and general engineering industries.		
Total		**40 Hrs**

Course Outcomes: After completing the course, the students will be able to	
24MEC133.1	Illustrate the knowledge of fundamental principles of conventional, non-traditional machining techniques in comparison with CNC technology.
24MEC 133.2	Demonstrate the procedure of metal casting, plastic processing, ceramics and glass manufacturing techniques to assess their impact on product development and environment.
24MEC 133.3	Demonstrate additive manufacturing process chain, know the differences between CNC machining and 3d printing, relation of AM with reverse engineering and CAE technologies.
24MEC 133.4	Realize the need and importance of Photo polymerization, FDM, SLS, material jetting and binder jetting techniques of AM with their benefits, drawbacks and applications.
24MEC 133.5	Recognize different softwares used and effective selection methods of AM and know the significance of concepts of direct write technologies in additive manufacturing techniques.

Reference Books

1. Manufacturing Engineering and Technology By S. Kalpak Jain and Steven R Schmid, Seventh Edition, Pearson, 2018.
2. Production Technology by HMT, McGraw Hill Education, 2017
3. Degarmon's Materials and Processes in Manufacturing, 11th Ed. Black, Ronald A Kohser, Wiley India, 2017.
4. Ceramic and glass materials by James F. Shackelford, Springer Publications, 2008
5. Non-Traditional Machining Process by Harsiman Singh Sodhi and Jagjit Singh, 2020
6. Additive Manufacturing Technologies by I. Gibson l D. W. Rosen l B, Stucker Third Edition, Springer, 2021
7. Additive manufacturing by C P Paul and A N Jinoop, first edition, McGraw Hill, 2021

8. Additive manufacturing: Fundamentals and advancements, first edition, CRC Press, 2019.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	-	3	-	-	-	-	-	-
CO2	3	2	3	-	3	-	-	-	-	-	-
CO3	3	2	3	-	3	-	-	-	-	-	-
CO4	3	2	3	-	3	-	-	-	-	-	-
CO5	3	2	3	-	3	-	-	-	-	-	-

Scheme of evaluation for CIA & SEA

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<tr><td colspan="3">Average of three tests – 30 Marks</td></tr>
<tr><td>Assignment</td><td></td><td colspan="2">10</td></tr>
<tr><td>AAT</td><td></td><td colspan="2">10</td></tr>
<tr><td></td><td colspan="3">Total – 50 marks</td><td>Total – 50 marks</td></tr>
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i) CIA: 50%

IA Test: 3 IA tests - Each of 30 Marks	Average of 3 tests – scaled down to 30 Marks
Assignment – Two assignments – one for 10 marks and another for 10 marks	10 Marks
Additional Assessment Tools (AAT) – Oral /Online Quizzes, Presentations, Group discussions, Case studies, Term Paper, Open ended experiments, Mini industrial/social/rural Projects, Two-minute video on latest topic, Short MOOC courses, Practical Orientation on Design thinking, creativity & Innovation, Participatory & Industry integrated learning, Practical activities, Problem solving exercises, Participation in seminars/academic events/symposia and any other activity	10 Marks
Total	**50 Marks**

ii) SEA : 50%

Theory Exam	5 questions to answer each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	20 M x 5 = **100 M** **reduced to 50 M**
	Total	**50 Marks**

B.N.M. Institute of Technology

An Autonomous Institution under VTU

Department of Mechanical Engineering

Course Name	**Fluid Mechanics and Pneumatics**	**Credits**	**04**
Course code	**24MEC134**	**CIA Marks**	**50**
Number of Lecture Hours/Week	**3L:T:2P:J**	**SEA Marks**	**50**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**

Course objectives:

1. To learn about the basic concepts of fluid properties and to calculate the forces exerted by a fluid at rest on submerged surfaces.
2. To understand the force of buoyancy
3. To discuss the basic concepts of fluid flow measuring equipment such as venture meter, orifice meter, notches and losses in flow through pipes
4. To discuss laminar and understand the importance of dimensional analysis
5. To analyze the flow in centrifugal pumps and turbines

Pre-requisite: Calculus and differential equations, Dynamics of Rigid bodies, Numerical analysis.

Module-I: Properties of Fluids and Fluid Statics

Teaching component: **Properties of Fluids**-Introduction to fluid mechanics & its applications, properties of fluids, viscosity, surface tension, capillarity, vapour pressure and cavitation. **Fluid Statics:** Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, absolute, gauge, atmosphere and vacuum pressure. Manometers, simple and differential manometers, total pressure and location of centre of pressure on horizontal/vertical/inclined plane surfaces.	**Th+lab 6+2 hrs**	**Apply**

Practical Component: 1. Measurements of pressure and pressure head by U-tube manometer 2. Determination of force exerted by a jet on flat and curved vanes		
Module-2: Buoyancy, Fluid Kinematics & Dynamics		
<u>Teaching component</u>: **Buoyancy:** Buoyancy, centre of buoyancy, meta-centre and meta-centric height, conditions of equilibrium of floating and submerged bodies. **Fluid Kinematics:** Types of fluid flow-introduction, continuity equation in three dimensions (Cartesian co-ordinate system only), velocity and acceleration, velocity potential function and stream function. **Fluid Dynamics**: Introduction, equations of motion, Euler's equation of motion, Bernoulli's equation from Euler's equation, limitation of Bernoulli's equation, fluid flow measurements: Venturi-meter, orifice meter, Pitot tube, V-notch and Rectangular notch. **Practical Component:** 1. Determination of Cd for Venturimeter and Orifice meter 2. Determination of Cd for Rectangular and Triangular notch 3. To find the coefficient of discharge for the given rectangular, &V notch	**Th+lab 6+4 hrs**	**Apply**
Module-3: Flow through pipes and Hydraulic prime movers		
<u>Teaching component</u>: **Flow through pipes**: Frictional loss in pipe flow, Darcy's-equation and Chezy's equation for loss of head due to friction in pipes, hydraulic gradient line and total energy line **Hydraulic prime movers:** Classification, Construction, working principle and application of Pelton wheel, Francis turbine and Kaplan turbine. Selection criteria of Prime movers. **Practical Component:** 1. To determine the coefficient of friction of a given pipe 2. Determination of efficiency of Pelton wheel turbine 3. Determination of efficiency of Francis turbine	**Th+lab 8+4 hrs**	**Apply**

Module-4: Hydraulics		
Teaching component: **Fluid Power-** Introduction – Basic law, Applications of fluid power, properties of hydraulic oils, Basic elements of hydraulic system, Principles of working of Positive displacement pump – classifications, Types of Hydraulic cylinders, Hydraulic control elements and components, Hydraulic symbols, Hydraulic Circuits, Practical applications of hydraulics. **Practical Component:** 1. Study of Speed Control Circuit on Hydraulic Trainer 2. Determination of efficiency of centrifugal pump/ Reciprocating pump	**Th+lab 8+2 hrs**	**Apply**
Module-5: Pneumatics		
Teaching component: **Pneumatic System-** Basic pneumatic system, identification of standard pneumatic symbols, pneumatic control elements and components, Basic pneumatic circuits – principle of working of power operated holding devices – chuck and clamping device, comparison of hydraulic-pneumatic and hydro-pneumatic system, applications, study on design of different pneumatics circuits and its simulation - Introduction to electro pneumatics - Practical applications of pneumatics. **Practical Component:** 3. Design and assembly of pneumatic circuit 4. Performance test on a two stage Reciprocating Air Compressor. 5. Performance test on an Air Blower.	**Th+lab 8+2 hrs**	**Apply**
Total		**50 Hrs**

Course Outcomes: After completing the course, the students will be able to	
24MEC134.1	Identify and calculate the key fluid properties used in the analysis of fluid behavior and understand the principles of continuity, momentum and energy equation as applied to fluid motions
24MEC134.2	Apply the knowledge of buoyancy and the concepts of fluid kinematics
24MEC134.3	Apply fundamental laws of fluid mechanics and the Bernoulli's principle for practical applications
24MEC134.4	Identify and analyse the functional requirements of a fluid power system for a given application
24MEC134.5	Chose hydraulic and pneumatic circuit for a given application

Reference Books

1. Fluid Mechanics F M White McGraw Hill Publications Eighth edition. 2016
2. Fluid Mechanics (SI Units) Yunus A. Cengel John M.CimbalaTataMcGraw Hill 3rd Ed., 2014.
3. A Text Book of Fluid MechanisAnd Hydraulic Machines Dr R.K Bansal Laxmi Publishers
4. Hydraulics and pneumatics Andrew Par Jaico Publishing House 2005
5. Fluid Power with applications Anthony Esposito Pearson edition 2000
6. Pneumatic systems - Principles and Maintenance Majumdar S.R Tata McGraw-Hill 2005

CO-PO Mapping

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
24MEC134.1	3	3	-	2	-	-	-	-	-	-	-
24MEC134.2	3	3	2	-	-	-		-	-	-	-
24MEC134.3	3	3	-	-	-	-	2	-	-	-	-
24MEC134.4	3	3	-	-	-	-	2	-	-	-	-
24MEC134.5	3	3	-	-	-	-	-	-	-	-	-

Scheme of evaluation for CIA & SEA

<table>
<tr><th rowspan="2">PCI</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="2">CIA (50)</th><th></th><th rowspan="2">SEA
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<tr><td colspan="3">Average of three tests – 30 marks scaled down to 15 marks</td></tr>
<tr><td>Assignment</td><td colspan="3">Average of 2 Assignments – 10M</td></tr>
<tr><td>Practical</td><td colspan="3">Weekly Assessment – 10 Marks
IA test – 15 Marks
(IA test to be conducted for 50 M and scaled down to 15M)</td></tr>
<tr><td colspan="4">Total – 50 Marks</td><td>Total – 50 Marks</td></tr>
</table>

i) CIA: 50%

Theory	**IA Test** (Theory): 3 IA tests - each of 30 Marks – Average of 3 tests scaled down to 15 Marks **Assignment** : 2 Assignments – each of 10 marks	25 Marks
Lab	**Weekly Assessment** – 10 Marks **Practical test (1)** - 15 marks	25 Marks
	Total	**50 Marks**

ii) SEA : 50%

Question Paper:

Theory Exam	5 questions to answer, each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	20 M x 5 = **100 M** **Reduced to 50 M**
	Total	**50 Marks**

B.N.M. Institute of Technology

An Autonomous Institution under VTU

Department of Mechanical Engineering

Course Name	**Machine Drawing and GD & T**	**Credits**	**04**
Course code	**24MEC135**	**CIA Marks**	**50**
Number of Lecture Hours/Week	**3L:T:2P:J**	**SEA Marks**	**50**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**

Course Learning Objectives: The students will be able to

1. To acquire the Knowledge of CAD software and its features
2. To familiarize the students with Indian Standards on Drawing Practices
3. To impart knowledge of threads forms, Fasteners, Keys, Joints, couplings, Clutch and Brakes
4. To make students to analyse and interpret drawing of machine components to model the assembly drawing manually and using CAD package
5. To acquire the knowledge of limits, fits and tolerances and indicating them on the machine drawing as per BIS standards
6. To understand the part drawings and develop Assembly drawings of Mechanical Systems

Pre-requisite: Knowledge of mathematics and measurement process, Knowledge of sectional views and individual components identification and its working principles, Basic knowledge of different types of joints and its functions.

Module-1: Introduction to Metrology and System of Limits, Fits, Tolerance and Gauging

Introduction to Metrology: Definition, objectives and concept of metrology, Need of inspection, Principles, process, methods of measurement, Accuracy, precision and errors in measurement. System of measurement, Material Standard, Wavelength Standards, Subdivision of standards, Line and End standards, Traceability, calibration of End bars and standardization. **System of Limits, Fits, Tolerance and Gauging:** Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly, limits of size, Indian standards, concept of limits of size and tolerances, definition of fits, hole basis system, shaft basis system, types of fits and their designation (IS 919- 1963), geometric tolerance, position-tolerances. .	**Th+lab 4+2 hrs**	**Apply**

Module-2: Section of solids, Orthographic Projections of Machine components and Fasteners		
Drawing standards: Code of practice for Engineering Drawing, BIS specifications –Sectional views, Riveted joints, keys, fasteners –bolts, nuts, screws, keys etc. Section of Solids, (Pyramids, Prisms, Cylinder and Cones) Orthographic Projections (with and Without Section). Drawings of various views of Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.	**Th+lab 2+6 hrs**	**Apply**
Module-3: 2-D drawings of Mechanical Assembly with sectional Views		
Shaft joints: Cotter joint and Knuckle joint. Keys & Shaft coupling: Muff, Flanged, Flexible, Universal and Oldham's coupling, Rivets: Classification: Butt, Lap (with single and double cover plate	**Th+lab 2+8 hrs**	**Apply**
Module-4: Assembly Drawing of Mechanical Systems		
Conventional representation of surface finish, Roughness number symbol, Symbols of Machine elements. Limits, Fits – Tolerances of individual dimensions–Specification of Fits. Preparation of production drawings and reading of part and assembly drawings. Assembly Drawings - Screws jack, Plummer block, Connecting Rod, Machine Vice.	**Th+lab 4+12 hrs**	**Apply**
Module-5: Surface modelling		
Motion studies of Bolt and Nut, Universal joint, Shaft with Gear pair Assembly, Sheet metal modeling of Mechanical Components. (Practice in software only) Surface Modeling (using Solid Edge) – Hair drier, Coke bottle, Ear phone, etc.	**Th+lab 2+8 hrs**	**Apply**

Course Outcomes: After completing the course, the students will be able to	
24MEC135.1	Apply the Measurement and Metrology techniques for all engineering applications as per industry standards
24MEC135.2	Prepare the orthographic views from the given pictorial view of machine components & Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs and ribs.
24MEC135.3	Preparation of 2D Drawings of Mechanical Components and assemblies manually and in CAD software
24MEC135.4	Prepare engineering and working drawings with dimensions and bill of material during design and development. Developing assembly drawings using part drawings of machine components.
24MEC135.5	Prepare Drawings for welded joints and surface modeling of machine components

Reference Books

1. Machine Drawing –R.K Dhavan
2. Machine drawing -N.D.Bhatt., published by R.C. Patel Charotar Book Stall Tulshi Sadan, Station Road, Annad, India
3. Solidworks Tutorial by SDC publication
4. K.R. Gopalakrishna, "Machine Drawing", Subash Publishers Bangalore.
5. Machine Drawing –K.L. Narayana, P. Kannaiah & K. Venkata Reddy. New Age/ Publishers
6. Geometric Dimensioning & Tolerancing by P.S. Gill. S.K. Kataria & Sons

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11
24MEC135.1	3	3	-	-	3	-	-	-	3	-	-
24MEC135.2	3	3	-	-	3	-	-	-	3	-	-
24MEC135.3	3	3	-	-	3	-	-	-	3	-	-
24MEC135.4	3	3	-	-	3	-	-	-	3	-	-
24MEC135.5	3	3	-	-	3	-	-	-	3	-	-

Continuous Internal Assessment (CIA) Procedure:

i. The CIA marks awarded for **Machine Drawing and GD & T** course shall be based on
   a. Class work for **30 marks** (Sketching and Computer Aided Engineering Drawing).
   b. One class test similar to SEE will be conducted after completion of the syllabus for 100 marks and scaled down to **20 marks**

ii. The final CIA marks awarded for Engineering Graphics and Design course shall be the sum of class work marks (a) and test marks (b).

Semester End Assessment (SEA)

i. SEA shall be conducted and evaluated for maximum of 100 Marks obtained shall be accounted for SEA final marks, reducing it by 50%.

ii. Module -1 and Module -5 are for practice and CIA and not for SEA.

iii. Separate question paper shall be set and made available for each batch as per the schedule.

iv. A maximum of THREE questions will be set as per the following pattern (No mixing of questions from different Modules).

Q. No.	**From Modules**	**Marks Allotted**
1	Module 2 Section of solids, Orthographic Projections of Machine components and Fasteners (answer any one out of two questions)	20
2	Module 3 2-D drawings of Mechanical Assembly with sectional Views in Solid Edge software- part drawing with dimensions to be provided (answer any one out of two questions)	20
3	Module 4 Assembly Drawing of Mechanical Systems (answer any one out of two questions)	60
Total		**100**

Q. No.	Solutions and sketching in the sketch book	Computer display and printout	Total Marks
1	10	10	20
2	-	20	20
3	20	40	60
Total	**30**	**70**	**100**

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Course Name	**Data Structure Using C**	**Credits**	**03**
Course Code	**24MEL136**	**CIA**	**50**
Number of lecture hours per week	**2L:T:1P:1J**	**SEA marks**	**50**
Total number of lecture hours	**40**	**Exam hours**	**3**

Course Objective: This course will enable students to

- Explain fundamentals of data structures and their applications essential for programming/problemsolving.
- Illustratelinearrepresentationofdatastructures:Stack,Queues,Lists,TreesandGraphs.
- Demonstratesortingandsearchingalgorithms.
- Findsuitabledatastructureduringapplicationdevelopment/ProblemSolving.

Module-1:Introduction to Data Structures		
Introduction: Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Review of Arrays, Structures, Self-Referential Structures, and Unions. Pointers and Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, Dynamically allocated arrays. **Array Operations:** Traversing, inserting, deleting, searching, and sorting. Multidimensional Arrays, Polynomials and Sparse Matrices. **Strings:** Basic Terminology, Storing, Operations and Pattern Matching algorithms. Programming Examples.	8 Hrs	
Module-2:Stacks		
Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression. Recursion - Factorial, GCD, Fibonacci Sequence, Tower of Hanoi, Ackerman's function.	8 Hrs	
Module-3: Queues		
Queues: Definition, Array Representation, Queue Operations, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues.	8 Hrs	
Module-4:Linked Lists		
Linked Lists: Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix	8 Hrs	

representation. Programming Examples		
Module-5:Trees		
Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Additional Binary tree operations. Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees-Evaluation of Expression, Programming Examples	8 Hrs	Apply

COURSE OUTCOMES: After completing the course	
24MEL136.1	Students will be able to comprehend the fundamental data structures such as arrays, linked lists, stacks, and queues, and demonstrate their implementation using the C programming language.
24MEL136.2	Students will learn to design and implement efficient algorithms using various data structures, optimizing for time and space complexity in solving computational problems.
24MEL136.3	Students will gain the ability to work with complex data structures like trees and graphs, understanding their properties, traversal techniques, and applications in real-world scenarios.
24MEL136.4	Students will be proficient in dynamic memory management in C, using pointers for the creation, manipulation, and deletion of data structures during program execution.
24MEL136.5	Students will apply their knowledge of data structures to develop small-scale applications, enhancing their problem-solving skills and coding efficiency

TEXT BOOKS:

1. Ellis Horowitz and SartajSahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press,2014.
2. SeymourLipschutz,DataStructuresSchaum'sOutlines,Revised1stEd,McGrawHill,2014.
3. Data Structures and Algorithm Analysis in C" by Mark Allen Weiss
4. Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5. Algorithms in C" by Robert Sedgewick

Reference Books:

1. Gilberg&Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, CengageLearning,2014.
2. ReemaThareja,DataStructuresusingC,3rdEd,Oxfordpress,2012.
3. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications,2ndEd, McGrawHill, 2013
4. AMTenenbaum,DataStructuresusingC,PHI,1989
5. RobertKruse,DataStructuresandProgramDesigninC,2ndEd,PHI,1996.
6. Data Structures Using C" by ReemaThareja

BNM Institute of Technology

Syllabus for Softskills-1
SEMESTER – III

Subject Name	Softskills-1 (Soft skills for Industry & Quantitative Aptitude and Logical Reasoning)	**Weekly Continuous Assessment Marks (6 tests)**	Max 10 Min 4
Subject Code	23SFT	**Practice Tests for Internal Assessment Marks (6 tests)**	Max 15 Min 6
Number of Contact Hours/Week	2	**Final Assessment Marks (during 3rd test on Tab MCQ)**	Max 25 Min 10
Total Number of Contact Hours	24	**Credits**	1

1.Understanding Corporate Communication: (2hrs)	Define corporate communication and its importance. Identify key stakeholders in corporate. Understand workplace etiquette: communication tone, addressing colleagues, and handling conflicts. Resume Writing.
2.Cross Culture Sensitivity: (2hrs)	Knowledge, awareness and acceptance of other cultures/caste/creed. Being of oneness and understanding the work environment.
3. Effective Communication and Interpersonal Skills (2hrs)	Skills we use daily when we communicate and interact with other people, both individually and in groups. Active listening, right response and clear message. Conduct mock presentations on technical topics relevant to engineering.
4. Collaboration and Team Communication: (2hrs)	Participate in team-based activities and projects to practice collaboration. Understanding types of Leadership and inculcating leadership skills
5. Written Communication (2hrs)	Passage / Email writing Identify your goal. Before you write an email, ask yourself what you want the recipient to do after they've read it. Writing technical documentation and reviews
6. Goal Setting & Mind Mapping (2hrs)	Development of an action plan designed to motivate and guide a person or group toward a goal. Gives one's life direction and boosts your motivation and self-confidence. Developing career Action plans
7. Quantitative Aptitude - 1(6hrs)	**Speed Math** : Number System, Multiple and factors, Divisibility Rules HCF & LCM, Squares and Cubes, BODMAS & Tables, Approximation, Decimals, Fractions, Surds & Indices
	Profit & Loss - Concepts of SP, CP, Profit, Loss, Gain or Loss %. Marked Price & Discount problems, Successive Selling Tye, Discount
	Percentages – Percent to Decimal or Fraction Conversion, Inverse Case – Value From Percentage, relative Percentage, Successive Selling type, Dishonest Dealings, partnerships **Averages** - Understanding Averages, relevance, meaning, properties of average, deviation method, weighted average, & solving problems.
8. Logical Reasoning - 1 (6hrs)	**Logical Aptitude** – Syllogism, Venn diagram method, three statement syllogism, deductive and inductive reasoning, introduction to puzzle and games organizing information, parts of an argument, common flaws, arguments and assumptions.

Coding & Decoding – Letter Coding, Number coding, symbol coding, **Crypt arithmetic** – basic concepts, addition, subtraction, multiplication of coded alphabets, types of cryptarithmetic Concept of EJOTY, Opposite Letter, Reversing thealphabets. Jumbling of Letter, Finding Codes of Derivatives.
Image Analysis - Paper cutting & Folding, Mirror & Water Image, Cubes andDice, Analogy, Find the odd one out, Rule Detection. Cubes and dice
Series Completion - Basics of Next no, Missing no and Wrong no and problemson that. Solving various types of Letter series and understanding different types.
Odd Man Out - Following certain patterns and groups. Identifying the errors/odd one in the group.
Visual sequence, visual analogy and classification, single & multiple comparisons, linear sequencing
Logical Puzzles - K-level thinking, Arithmetic Puzzles and stick puzzles

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SEMESTER – III

INNOVATIVE PROJECT LAB

Credit : 1

Course Code	**24MEI139**	**CIA Marks**	**100**
Teaching Hours/Week (L: T: P: J)	**0:0:0:2**	**SEA Marks**	**-**
Total Number of Lecture Hours	**15**	**Exam Hours**	**03**

Course objectives:

This course will enable students to

- Support independent learning and innovative attitude.
- Develop interactive, communication, organization, time management and presentation skills.
- Identify real world problems for solution.

Project Work:

- Each student of the project batch shall involve in carrying out the project work jointly in consultation with internal guide.
- The project topic should have social relevance and solve the real world problem that is not included in any of the Project Based Learning (PBL) courses.
- Student can implement project after approval of panel in feasibility seminar.
- Student has to prepare project report as per the norms.

Course outcomes:

The students will be able to

- Design solutions for problems considering factors including but not limited to environment, Safety and health. (Create)
- Implement the project work using appropriate tools and technologies. (Apply)
- Exhibit project management principles in project work. (Apply)
- Function effectively as an individual or in a team with ethical principles. (Apply)
- Communicate clearly on the phases of the project implemented in both written and oral. (Apply)

a. Internship (In-house): Internship I & II

INT	CIA	CIA (100)
Conduction	100	Internship/Project report – 50 M Presentation & Demonstration – 30 M Viva voce – 20 M
		Total – 100 Marks

b. Industrial Internship: II & III

INT	CIA	CIA (100)
Conduction	100	Internship report – 20 M Presentation & Demonstration – 60 M Industrial assessment – 20 M
		Total – 100 Marks

Department of Mathematics

Syllabus

Semester: IV

Course: Complex Analysis, Probability and Random Process
Course Code: 24MAE141 (Common to ECE, EEE & ME)

L:T:P:J	**2:2:0:0**	**CIA :50**
Credits:	**03**	**SEA : 50**
Hours:	**40**	**SEA Duration: 03 Hours**

Course Learning Objectives: The students will be able to

1 Provide an insight into applications of complex variables and conformal mapping arising in potential theory, quantum mechanics, heat conduction and field theory.

2 Develop the knowledge of probability, joint probability distribution and Random process occurring in digital signal processing, design engineering and microwave engineering.

Module-1: Complex Analysis	No. of hours	Blooms cognitive Levels
Examples from Engineering that require complex analysis. Review of function of a complex variable, limits, continuity and differentiability. Analytic functions. Cauchy-Riemann equations in Cartesian and polar forms. Consequences of Cauchy-Riemann equations (only statement), construction of analytic function using Milne-Thomson method. *Experiential Learning component: Problems on construction of analytic functions*	**L: 04** **T: 04**	**L1** **L2** **L3**
Module-2: Conformal Mapping & Complex Integration		
Examples from Engineering that require Conformal Mapping & Complex Integration. **Conformal mapping:** Introduction, discussion of transformations: $w = e^z$, $w = z^2$, $w = z + \frac{1}{z}(z \neq 0)$. Bilinear transformations. **Complex integration:** Introduction to complex integration, Cauchy's theorem and Cauchy's integral formula. Poles and residues, Taylor series, Laurent series and Residue theorem (without proof) *Experiential Learning component: Problems on Cauchy's integral formula*	**L: 04** **T: 04**	**L1** **L2** **L3**
Module-3: Probability Distributions & Joint probability distribution		
Examples from Engineering that require Probability and Joint probability distribution. **Probability Distributions:** Review of basic probability theory. Discrete and continuous Random variables, probability mass/density functions (definitions only). Binomial, Poisson, exponential and normal distributions (without proof). **Joint probability distribution:** Joint Probability distribution for two discrete random variables, expectation, covariance and correlation. *Experiential Learning component: Problems on Binomial, Poisson, Exponential and Normal distributions*	**L: 04** **T: 04**	**L1** **L2** **L3**
Module-4: Random Process		
Examples from Engineering that require random process. Introduction, classification of random process, methods of description of a random process, stationary, auto-correlation function, Ergodicity, Spectral representation, Weiner-Kinchine theorem, Poisson process, pure birth process, birth and death process with a constant rate, death process with a linear rate. *Experiential Learning component: Problems on Poisson process, pure birth process, birth and death process*	**L: 04** **T: 04**	**L1** **L2** **L3**

Module-5: Markov Chain & Sampling Theory		
Examples from Engineering that require Markov Chain and Sampling Theory. **Markov Chain**: Introduction to Stochastic process, Probability vectors, Stochastic matrices, Regular stochastic matrices, Markov Chains, Higher transition probabilities, Stationary distribution of Regular Markov chains and absorbing states, Markovian processes. **Sampling Theory**: Introduction to sampling theory, Testing of hypothesis, level of significance, confidence limits, test of significance of mean and difference of means for large samples-z-test, test of significance of small samples-Student's t- distribution. *Experiential Learning component: Problems on Markovian processes and, Sampling Theory*	**L: 04** **T: 04**	**L1** **L2** **L3**

Course Outcomes: After completing the course, the students will be able to

CO1: Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory.

CO2: Utilize conformal mapping and complex integral arising in aerofoil theory, fluid flow visualization and image processing.

CO3: Apply discrete and continuous probability and joint probability distributions in analyzing the probability models arising in engineering field.

CO4: Use the concepts of random process in dealing with signals in engineering problems.

CO5: Use Markov chain in prediction of future events and demonstrate the validity of testing the hypothesis.

CO - PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2			2							
CO 2	3	2			2							
CO 3	3	2			2							
CO 4	3	2			2							
CO 5	3	2			2							

Reference Books:

1. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Edition(Reprint), 2016.
2. B. S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
3. S. D. Sharma : "Operations Research", KedarNath Ram Nath & Co. Meerut, 2014.
4. T. Veerarajan : "Probability, Statistics and Random processes", McGraw Hill Education (India) Private Limited, Third edition, Nineteenth reprint 2017.
5. C. Ray Wylie, Louis C. Barrett : "Advanced Engineering Mathematics", 6th Edition, 2. McGraw-Hill Book Co., New York, 1995.
6. B. V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
7. Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics", Oxford University Press, 3rd Reprint, 2016.

Web links and Video Lectures:

1. https://nptel.ac.in/courses/111106141
2. https://www.digimat.in/nptel/courses/video/111107119/L29.html
3. https://archive.nptel.ac.in/courses/122/107/122107036/
4. https://archive.nptel.ac.in/courses/105/105/105105045/
5. https://archive.nptel.ac.in/courses/111/102/111102014/
6. https://archive.nptel.ac.in/courses/111/103/111103159/

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Department of Mechanical Engineering

SEMESTER – IV

Introduction to AI&ML

Credit: 03

Course Code	24MEC142	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	2L:1T:0P:1J	SEA Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

Course Learning Objectives:

This course will enable students to

1. Gain a historical perspective of AI and familiar with basic principles
2. Understand the basic theory underlying ML and differentiate supervised, unsupervised and reinforcement learning
3. Understand the basic concepts of learning and decision trees.
4. Understand Bayesian techniques for problems appear in machine learning
5. Perform statistical analysis of machine learning techniques.

	Number of Hours	Bloom's Level
Module-1		
Introduction to AI: The Foundation of AI, History of AI and the State of the Art, Intelligent Agents, foundation and sub area of AI, applications, current trend and development of AI. **Problem solving:** State Space Search and Control Strategies.	**8**	**Apply**
Module-2		
Machine learning Landscape: what is ML?, Why use ML?, Types of ML, Main challenges of ML **End to end Machine learning Project:** Working with real data, Look at the Big picture, Get the data, Discover and visualize the data, Prepare the data for ML Algorithm, Select and train the model, Fine tune your model.	**8**	**Understand**
Module-3		
Decision Tree Learning: Introduction, Decision Tree Representation, Appropriate Problem for Decision Tree Learning, The Basic Decision Tree Learning Algorithm, Hypothesis Space Search in Decision Tree Learning.	**8**	**Apply**
Module-4		
Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and Concept Learning, Maximum Likelihood and Least Square Error Hypotheses, Naïve Bays Classifier.	**8**	**Analyze**
Module-5		
Instance Based Learning: Introduction, k-Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case Based Reasoning	**8**	**Analyze**

Course outcomes:

The students will be able to

- Apply the knowledge of AI to write simple algorithm and to solve problems on search algorithm (Apply)
- Understand the concepts of Machine Learning (Understand)
- Analyze the data to understand the distribution of the data. (Analyze)

- Apply the classification techniques to classify the data. (Apply)
- Analyze the problems on Decision tree, Bayesian and Instant learning techniques. (Analyze)
- Develop an algorithm in ML for mechanical engineering application (Create)

Text Books /Reference Books:

1. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 1st Edition 2011.
2. Anindita Das Bhattacharjee, "Practical Workbook Artificial Intelligence and Soft Computing for beginners, Shroff Publisher-X team Publisher.
3. Yuxi (Hayden) Liu, "Python Machine Learning by Example", Packet Publishing Limited, 2017.
4. Tom Mitchell, Machine Learning, McGraw Hill, 2017.
5. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2011.

Scheme of evaluation for CIA & SEA

<table>
<tr><th rowspan="2">PCC</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th rowspan="2"></th><th colspan="3">CIA (50)</th><th rowspan="2">SEA
Conduction: 100 M
Reduced to: 50 M</th></tr>
<tr><th>I</th><th>II</th><th>III</th></tr>
<tr><td rowspan="5">Conduction</td><td rowspan="5">50</td><td rowspan="5">50</td><td rowspan="2">Written Test</td><td>30</td><td>30</td><td>30</td><td rowspan="4">Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module</td></tr>
<tr><td colspan="3">Average of three tests – 30 Marks</td></tr>
<tr><td>Assignment</td><td colspan="2"></td><td>10</td></tr>
<tr><td>AAT</td><td colspan="2"></td><td>10</td></tr>
<tr><td></td><td colspan="3">Total – 50 marks</td><td>Total – 50 marks</td></tr>
</table>

i) CIA: 50%

IA Test: 3 IA tests - Each of 30 Marks	Average of 3 tests – scaled down to 30 Marks
Assignment – Two assignments – one for 10 marks and another for 10 marks	10 Marks
Additional Assessment Tools (AAT) – Oral /Online Quizzes, Presentations, Group discussions, Case studies, Term Paper, Open ended experiments, Mini industrial/social/rural Projects, Two-minute video on latest topic, Short MOOC courses, Practical Orientation on Design thinking, creativity & Innovation, Participatory & Industry integrated learning, Practical activities, Problem solving exercises, Participation in seminars/academic events/symposia and any other activity	10 Marks
Total	**50 Marks**

ii) SEA : 50%

Theory Exam	5 questions to answer each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	20 M x 5 = **100 M** **reduced to 50 M**
	Total	**50 Marks**

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Department of Mechanical Engineering

Course Name	**Mechanics of Materials**	**Credits**	**04**
Course code	**24MEC143**	**CIA Marks**	**50**
Number of Lecture Hours/Week	**3L:T:2P:J**	**SEA Marks**	**50**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**

Course Objectives:

1. Classify the stresses into various categories and define elastic properties of materials and compute stress and strain intensities caused by applied loads in simple and compound sections and temperature changes.
2. Derive the equations for principal stress and maximum in-plane shear stress and calculate their magnitude and direction. Draw Mohr circle for plane stress system and interpret this circle.
3. Determine the shear force, bending moment and draw shear force and bending moment diagrams, describe behavior of beams under lateral loads.
4. Explain the structural behavior of members subjected to torque, calculate twist and stresses induced in shafts subjected to bending and torsion.
5. Understand the concept of stability and derive crippling loads for columns.
6. Understand the concept of strain energy and compute strain energy for applied loads.

Pre-requisite: Fundamental of mechanics, basics concept of materials and its uses.

Module-I: Simple Stresses and Strain

Teaching component: Simple Stresses and Strain: Introduction, Definition and concept and of stress and strain. Hooke's law, Basics of Stress-Strain diagrams, Linear and non-linear elastic properties, mechanical properties in plastic range, factor of safety, Elongation of tapering bars of circular and rectangular cross sections, Elongation due to self-weight. Compound bars, Temperature stresses, Compound section subjected to temperature stresses, Elastic constants and their relationship.	**L: 8 hrs.** **P: 2 hrs.**	**Apply**

Practical Component: • Brinell, Rockwell and Vickers's Hardness tests on untreated and heat-treated specimens • Tensile, shear and compression tests of steel, aluminum and cast iron specimens using Universal Testing Machine		
Module-2: Analysis of stress & strain and Stresses in Cylinders		
<u>Teaching component</u>: **Compound Stresses:** Introduction, state of stress at a point, General two dimensional and three-dimensional stress system, Principal stresses in two-dimensional stress system and principal planes. Mohr's circle of stresses. **Thin and Thick Cylinders**: Introduction, Thin cylinders subjected to internal pressure; Hoop stresses, Longitudinal stress and change in volume. Thick cylinders subjected to both internal and external pressure; Lame's equation, radial and hoop stress distribution. **Practical Component:** • Simulation of cylindrical pressure vessel using finite element model	**L: 8 hrs.** **P: 2 hrs.**	**Appl y**
Module-3: Shear force, Bending moment and stresses in Beams		
<u>Teaching component</u>: Introduction to types of beams, Definition of bending moment and shear force, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate beams subjected to points load, uniformly distributed loads, uniformly varying loads, couple and their combinations. **Stresses in Beams** Bending and shear stress distributions in rectangular, I and T section Beams. **Practical Component** • Bending Test on steel and wood specimens • Simulation of beams using finite element analysis tool for different loading conditions	**L: 8 hrs.** **P: 2 hrs.**	**Apply**

Module-4: Columns and Struts and Energy Methods		
Teaching component: **Columns:** Buckling and stability, critical load, columns with pinned ends, columns with other support conditions, Effective length of columns, Secant formulae for columns. **Strain Energy:** Strain energy due to axial, shear, bending, torsion and impact load. Castigliano's theorem I and II and their applications. **Practical Component** • Simulation of buckling of columns using Solidworks • Izod and Charpy Tests on Mild steel and C.I Specimen	**L: 8 hrs.** **P: 2 hrs.**	**Apply**
Module-5: Torsion of shaft and Theories of Failure.		
Teaching component: **Torsion in Circular Shaft:** Introduction, pure torsion, Assumptions, derivation of torsion equation for circular shafts, torsional rigidity and polar modulus, Power transmitted by a shaft, Shaft subjected to combined bending and torsion. **Theories of Failure:** Introduction, maximum principal stress theory (Rankine's theory), Maximum shearing stress theory (Tresca's theory), Strain energy theory (Beltrami and Haigh), and maximum strain theory (St. Venant's theory), Distortion theory. **Practical Component** • Torsion Test on steel bar	**L: 8 hrs.** **P: 2 hrs.**	**Apply**
Total		**40 Hrs.**

Course Outcomes: After completing the course, the students will be able to	
24MEC143.1	Determine simple, compound, thermal stresses and strains their relations, Poisson's ratio, Hooke's law, mechanical properties including elastic constants and their relations.
24MEC143.2	Analyze structural members for principal stresses, strains and deformations and also stress distribution in thick and thin cylinders.
24MEC143.3	Compute shear force, bending moment , bending stress, shear stress and its distribution for different types of beams.
24MEC143.4	Determine the dimensions of shafts based on torsional strength, rigidity and flexibility.
24MEC143.5	Analyze the stability of columns using Rankin's and Euler's theory and also Strain energy due to axial, shear, bending, torsion and impact load.

Reference Books

1. Mechanics of Materials by R.C.Hibbeler, Prentice Hall. Pearson Edu, 6th edition ,2011.
2. Mechanics of materials", James M.Gere, Thomson, 9th edition 2017.
3. Mechanics of materials", in SI Units, Ferdinand Beer & Russell Johston, 8thedition, TATA McGraw Hill- 2020.
4. Strength of Materials, S.S. Rattan, Tata McGraw Hill, 3rd edition 2017.
5. Strength of Materials, S.S.Bhavikatti, Vikas publications House -1 Pvt. Ltd., 5th edition, 2013.
6. Strength of materials, Ramamrutham, 6th edition,2011.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-

Scheme of evaluation for CIA & SEA

PCI	CIA	SEA	CIA (50)				SEA Conduction: 100 M Reduced to: 50 M
				I	II	III	
Conduction	50	50	Written Test	30	30	30	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module
				Average of three tests – 30 marks scaled down to 15 marks			
			Assignment	Average of 2 Assignments – 10M			
			Practical	Weekly Assessment – 10 Marks IA test – 15 Marks (IA test to be conducted for 50 M and scaled down to 15M)			
			Total – 50 Marks				**Total – 50 Marks**

i) CIA: 50%

Theory	**IA Test** (Theory): 3 IA tests - each of 30 Marks – Average of 3 tests scaled down to 15 Marks **Assignment** : 2 Assignments – each of 10 marks	25 Marks
Lab	**Weekly Assessment** – 10 Marks **Practical test (1)** - 15 marks	25 Marks
	Total	**50 Marks**

ii) SEA : 50%

Question Paper:

Theory Exam	5 questions to answer each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	20 M x 5 = **100 M reduced to 50 M**
	Total	**50 Marks**

B.N.M. Institute of Technology

An Autonomous Institution under VTU

Department of Mechanical Engineering

Course Name	Thermal Engineering	Credits	04
Course Code	24MEC144	CIE Marks	50
Number of Lecture Hours/ Week	3L+2P	SEE Marks	50
Total Number of Lecture Hours	50	Exam Duration	03

Course Objectives:

This course will enable the students to:

1. Introduce the fundamentals of thermodynamics
2. Model processes and systems using principles of thermodynamics
3. Analyse energy interactions and performance of thermodynamic cycles
4. Conduct performance test of IC engines

Pre-requisite: Calculus, Physics

Module-1: First Law of thermodynamics and Reversible & Irreversible Processes		
Introduction and the First Law of thermodynamics: Heat, Work and the System, State of the Working Fluid, Reversible Work, First Law of thermodynamics, Non-Flow Equation, Steady-Flow Equation. (Numerical Problems on Non Flow process) **Reversible and Irreversible Processes**: Reversible Non-Flow Processes, Reversible Adiabatic Non-Flow Processes, Polytropic Processes, Reversible Flow Processes, Irreversible Processes. (No Numerical Problems)	Th: Lab 8:0 Hrs	Apply
Module-2: Second Law of thermodynamics & Air standard cycles		
Second Law of thermodynamics: Heat Engine-Statements of Second Law, Carnot Cycle, Absolute Temperature Scale, Entropy: Clausius Inequality, Entropy Increase Principle, T-S Diagram, Entropy and Irreversibility. (No Numerical Problems on Entropy) **Air Standard Cycles**: Carnot Cycle for a Perfect Gas, Air Standard Cycle (Otto Cycle, Diesel Cycle and Dual Combustion Cycle): Expression for Air Standard Efficiency and Mean Effective Pressure. (Numerical problems on Otto cycle and diesel cycle only.)	Th: Lab 8:0 Hrs	Apply

Module-3: IC Engines, Vapour & Gas Power cycles		
IC Engines: Performance Parameters - Calculations and its Measurement - Motoring Method, Willan's Line Method, Morse Test, Heat Balance Sheet, Engine Performance Curves. (Numerical Problems on More test and Heat balance sheet only) **Steam Cycles:** Rankine Cycle, Rankine Cycle with Superheat, Enthalpy-Entropy Chart, (Numerical problems on Rankine cycle only) Reheat Cycle, Regenerative Cycle **Gas Turbine Cycles** – Constant Pressure Cycle, Ideal Brayton Cycle (Numerical problems on Bryton cycle only) – Intercooling, Reheat, Regeneration Process. **Practical Component** 1. Determination of calorific value of gaseous fuels using Boy's gas calorimeter. **2.** Assembly and Disassembly of Four Stroke Multi cylinder engine 3. Performance testing of single cylinder four stroke petrol and diesel engine. **4.** Performance testing of single cylinder Variable compression ratio IC engine.	Th: Lab 6:4 Hrs	Analyze
Module-4: Refrigeration, Psychrometrics and Air Conditioning Systems		
Teaching Component: **Refrigeration:** Reversed Heat Engine Cycles, Vapour Compression Cycles, Refrigeration Load, Pressure-Enthalpy Diagram, Refrigerants. (numerical Problems) **Psychrometry:** Specific and Relative Humidity of Air, Dew Point Temperature, Adiabatic Saturation and Wet Bulb Temperature, Psychometric Chart, (Numerical problems using analytical and Psychometric Chart). Summer and winter Air Conditioning, Air Conditioning Processes. **Practical Component** 1. Performance Testing on a Vapour Compression Refrigeration **2.** Performance Testing on Air Conditioning System	Th: Lab 8:4 Hrs	Analyze
Module-5: Heat Transfer		
Teaching Component: Definitions, Fourier Equation and Thermal conductivity, Steady State Conduction, Conduction with Heat Generation, Heat Transfer from Extended Surfaces, (Numerical Problems on Composite wall and cylinders only), Convection: Processes and Properties, Free and Forced Convection, Hydrodynamic and Thermal Boundary Layers, Basics of Radiation, Classification of Heat Exchangers. **Practical Component** 1. Determination of Thermal Conductivity of the material.	Th: Lab 8:4 Hrs	Analyze

2. Determination of Overall Heat Transfer Coefficient of a Composite wall. 3. Determination of Emissivity of a Surface and Stefan Boltzmann Constant 4. Heat transfer Simulation using Solid Edge Software. **5.** Demonstration of Data logger for thermal Data Acquisition and processing		
Total	50 Hrs	

Course Outcomes: After completing the course, the students will be able to	
24MEC144.1	Apply the principles of first law of thermodynamics to the analysis of closed systems processes/cycles and control volume applications.
24MEC144.2	Demonstrate an understanding of second law of thermodynamics and the concepts related to entropy.
24MEC144.3	Analyze the heat and work interactions in air standard, IC engine cycles, gas and vapour power cycles
24MEC144.4	Analyze the heat and work interactions in refrigeration and air conditioning processes.
24MEC144.5	Ability to solve conduction, convection, radiation and heat exchanger problems

Reference Books

1. Yunus Cengel and Michael Boles (2019). *Thermodynamics: An Engineering Approach*, 9th ed., McGraw-Hill Education
2. Michael J. Moran and Howard N. Shapiro (2006). *Fundamentals of Engineering Thermodynamics*, 5th ed., John Wiley & Sons, Inc.
3. V Ganesan (2017) *Internal Combustion Engines,* 4th ed. McGrawHill Education.
4. Incropera F. P. and DeWitt D. P. (2006). *Fundamentals of Heat and Mass Transfer*, 5th ed., John Wiley and Sons.
5. Eastop T. D. and Mcconkey A. (1993).*Applied Thermodynamics for Engineering Technologists*, 5th ed., Pearson Education, Ltd.
6. G.F.C. Rogers and Yon Mayhew (1992). *Engineering Thermodynamics: Work and Heat Transfer*, 4th ed., Pearson Education, Ltd.
7. S. K. Som (2008). *Introduction to Heat Transfer*, Prentice Hall India Pvt. Ltd.

Scheme of evaluation for CIA & SEA

<table>
<tr><th rowspan="2">PCI</th><th rowspan="2">CIA</th><th rowspan="2">SEA</th><th colspan="4">CIA (50)</th><th rowspan="2">SEA
Conduction: 100 M
Reduced to: 50 M</th></tr>
<tr><th></th><th>I</th><th>II</th><th>III</th></tr>
<tr><td rowspan="5">Conduction</td><td rowspan="5">50</td><td rowspan="5">50</td><td rowspan="2">Written Test</td><td>30</td><td>30</td><td>30</td><td rowspan="5">Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module</td></tr>
<tr><td colspan="3">Average of three tests – 30 marks scaled down to 15 marks</td></tr>
<tr><td>Assignment</td><td colspan="3">Average of 2 Assignments – 10M</td></tr>
<tr><td>Practical</td><td colspan="3">Weekly Assessment – 10 Marks
IA test – 15 Marks
(IA test to be conducted for 50 M and scaled down to 15M)</td></tr>
<tr><td colspan="4">Total – 50 Marks</td><td>Total – 50 Marks</td></tr>
</table>

i) CIA: 50%

Theory	**IA Test** (Theory): 3 IA tests - each of 30 Marks – Average of 3 tests scaled down to 15 Marks **Assignment** : 2 Assignments – each of 10 marks	25 Marks
Lab	**Weekly Assessment** – 10 Marks **Practical test (1) -** 15 marks	25 Marks
	Total	**50 Marks**

ii) SEA : 50%

Question Paper:

Theory Exam	5 questions to answer, each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	20 M x 5 = **100 M** **Reduced to 50 M**
	Total	**50 Marks**

B.N.M. Institute of Technology

An Autonomous Institution under VTU

Department of Mechanical Engineering

Course Name	**Hybrid and Electric Vehicles**	**Credits**	**02**
Course code	**24MEC145**	**CIA Marks**	**50**
Number of Lecture Hours/Week	**1L:T:2P:J**	**SEA Marks**	**50**
Total Number of Lecture Hours	**26**	**Exam Hours**	**03**

Course objectives:

1. To understand the models, describe hybrid vehicles and their performance.
2. To understand the different possible ways of energy storage.
3. To understand the different strategies related to hybrid vehicle operation & energy management

Module-I: Introduction to Hybrid Electric Vehicle		
Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.	**5 Hrs**	**Apply**
Module-2: Conventional Vehicles		
Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance.	**5 Hrs**	**Apply**
Module-3: Hybrid Electric Drive:		
Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis	**5 Hrs**	**Apply**

Module-4: Electric Drive-trains		
Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.	**5 Hrs**	**Apply**
Module-5: Battery Management Systems and Charging station:		
Types of Battery sources, energy storage, battery based energy storage, Battery management system. Introduction to smart charging: Grid to vehicle and vehicle to grid, smart metering and ancillary services, preliminary discussion on vehicle to vehicle and vehicle to personal communication systems, introduction battery charging station.	**6 Hrs**	**Apply**
Total		**26 Hrs**

Lab Experiments

1. Experiment to study the components of Electric Vehicle.

2. Experiment to study the power transmission in Electric Vehicle.

3. Experiment to find the Battery life of electric Vehicle.

4. Experiment to compare the performance characteristics of Electric Vehicle

with Internal Combustion Engine.

5. Experiment to find the heat transmission efficiency of Electric Vehicle.

Course Outcomes: After completing the course, the students will be able to	
24MEC145.1	Understand the architecture and vehicle dynamics of electric and hybrid vehicles
24MEC145.2	Analyze the power management systems for electric and hybrid vehicles
24MEC145.3	Understand different motor control strategies for electric and hybrid vehicles
24MEC145.4	Analyze various components of electric and hybrid vehicles with environment concern
24MEC145.5	Understand the domain related grid interconnections of electric and hybrid vehicle.

Reference Books

1. Iqbal Hussain, "Electric and Hybrid Vehicles Design Fundamentals", 1st Edition, CRC Press, 2003
2. James Larminie, John Lowry "Electric Vehicle Technology Explained", 1st Edition, John Wiley and Sons, 2003.
3. Chris Mi, M. Abul Masrur, David Wenzhong Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", Wiley publication ,2011
4. Allen Fuhs, "Hybrid Vehicles and the future of personal transportation", CRC Press, 2009.

CO-PO Mapping											
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
24MEC145.1	3	3	-	2	-	-	-	-	-	-	-
24MEC145.2	3	3	2	-	-	-		-	-	-	-
24MEC145.3	3	3	-	-	-	-	2	-	-	-	-
24MEC145.4	3	3	-	-	-	-	2	-	-	-	-
24MEC145.5	3	3	-	-	-	-	-	-	-	-	-

Scheme of evaluation for CIA & SEA

PCI	**CIA**	**SEA**	**CIA (50)**				**SEA**
				I	II	III	**Conduction: 100 M Reduced to: 50 M**
Conduction	50	50	Written Test	30	30	30	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module
				Average of three tests – 30 marks scaled down to 15 marks			
			Assignment	Average of 2 Assignments – 10M			
			Practical	Weekly Assessment – 10 Marks IA test – 15 Marks (IA test to be conducted for 50 M and scaled down to 15M)			
			Total – 50 Marks				**Total – 50 Marks**

i) CIA: 50%

Theory	**IA Test** (Theory): 3 IA tests - each of 30 Marks – Average of 3 tests scaled down to 15 Marks **Assignment** : 2 Assignments – each of 10 marks	25 Marks
Lab	**Weekly Assessment** – 10 Marks **Practical test (1)** - 15 marks	25 Marks
	Total	**50 Marks**

ii) SEA : 50%

Question Paper:

Theory Exam	5 questions to answer, each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	20 M x 5 = **100 M** **Reduced to 50 M**
	Total	**50 Marks**

Department of Mechanical Engineering

Course Name	**Fabrication of Advanced Materials**	**Credits**	**02**
Course code	**24MEL146**	**CIA Marks**	**50**
Number of Lecture Hours/Week	**L:T:2P:2J**	**SEA Marks**	**50**
Total Number of Lecture Hours	**26**	**Exam Hours**	**03**

Part A -Casting, Welding and Forging		
1. Design and preparation of pattern - for the given component drawing. 2. Determination of sand properties-Green strengths, and permeability. 3. Preparation of Mould for a Casting machine component. 4. Preparation of welded joints. 5. Preparation of Square head bolt by forging (Demonstration only)	**10 Hrs**	**Apply**
Part B- Machining and Measurements		
1. Preparation of model by performing operation such as plane turning and taper turning on lathe and measuring its taper angle using sine center and slip gauges 2. Preparation of machine component by performing operation such as thread cutting and knurling and measuring the thread pitch using pitch gauge 3. Gear cutting operation using milling machine and measurement of gear tooth profile. 4. Measurements of cutting forces using lathe tool dynamometers for the models prepared on lathe machine	**10 Hrs**	**Apply**
Part C- 3-D Printing		
1. To study the effect of manufacturing parameters (layer thickness, printing pattern, speed, material types) on the Mechanical strength of 3D-printed parts. 2. Design & processing of IC Engine components by 3D printing 3. Production of consumer products using FDM printer.	**6 Hrs**	**Apply**
Project		
Projects		

1. Wax casting of Connecting Rod 2. Wax casting of different types of gears 3. Design and 3-D printing of universal joint 4. Design and Welding of pressure vessel end closure 5. CNC machining of Dovetail Slot 6. 3D Printing of Radial piston cylinder system 7. CNC taper turning and knurling operation		
Total		**26 Hrs**

Course Outcomes: After completing the course, the students will be able to	
24MEL146.1	Apply the principles of casting to prepare the mould cavities for the given geometry.
24MEL146.2	Analyze the process parameters followed in welding and forging techniques to form the materials.
24MEL146.3	Prepare the prototype models from the given alloys on lathe and shaper machine.
24MEL146.4	Apply the basic principle of measurements to accurately read the dimensions of the systems and components.
24MEL146.5	Demonstrate the working principles of CNC machines and 3D printers with production perspective.

Reference Books

1. Manufacturing & Technology": Foundry Forming and Welding,P.N.Rao, 3rd Ed., Tata McGraw Hill, 2003.
2. "Manufacturing Technology", Serope Kalpakjian, Steuen. R. Sechmid,Pearson Education Asia, 5th Ed. 2006.
3. "Manufacturing Process-I", Dr.K.Radhakrishna, Sapna Book House,5th Revised Edition 2009.

Text Books

1. Fundamental of Machining and Machine Tools, Geoffrey Boothroyd and Winston A. Knight, CRC Taylo Francis, Third Edition.
2. Fundamentals of metal cutting and Machine Tools, B.L. Juneja, G.S. Sekhon and Nitin Seth, New Age Publishers 2nd Edition, 2003

3. "Manufacturing & Technology": Foundry Forming and Welding,P.N.Rao, 3rd Ed., Tata McGraw Hill, 2003.

CO-PO Mapping											
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	2	-	-	-	2
CO2	3	2	-	-	2	-	-	-	-	-	-
CO3	3	2	2	-	2	-	-	-	2	-	-
CO4	3	2	-	-	3	-	-	3	-	-	-
CO5	3	2	-	-	3	2	-	-	-	-	2

Scheme of evaluation for CIA & SEA

<table>
<tr><th>PBL</th><th>CIA</th><th>SEA</th><th colspan="3">CIA (50)</th><th>SEA
Conduction: 100 M
Reduced to: 50 M</th></tr>
<tr><td rowspan="4">Conduction</td><td rowspan="4">50</td><td rowspan="4">50</td><td rowspan="2">Theory</td><td>I IA</td><td>II IA</td><td rowspan="3">Project
Assessed for 100 marks
reduced to 50 Marks</td></tr>
<tr><td>25</td><td>25</td></tr>
<tr><td colspan="2">Average of 2 tests – 25 M</td></tr>
<tr><td>Practical</td><td colspan="2">Weekly Assessment
(Record/ project) – 10 Marks
Lab IA Test – 15 Marks</td><td></td></tr>
<tr><td colspan="4">Total – 50 Marks</td><td>Total – 50 Marks</td></tr>
</table>

i) CIA: 50%

Theory - 2 IA tests - Each of 25 Marks	25 Marks
Practical **Weekly Assessment** - Lab record / Project– 10 Marks Lab I A Test – 15 Marks	25 Marks
Total	**50 Marks**

ii) SEA : 50%

Project	Write up – 10 Marks Project report – 25 Marks Presentation & Demonstration - 50 Marks Viva-Voce – 15 Marks	100 Marks Reduced to 50 Marks
	Total	**50 Marks**

BNM Institute of Technology

Syllabus for Softskills-2
SEMESTER – IV

Subject Name	Softskills-2 (Quantitative Aptitude & Logical Reasoning)	**Weekly Assessment Marks (6 tests)**	Max 10 Min 4
Subject Code	23SFT147 /148	**Practice Tests for Internal Assessment Marks (6 tests)**	Max 15 Min 6
Number of Contact Hours/Week	2	**Final Assessment Marks (during 3rd test on Tab MCQ)**	Max 25 Min 10
Total Number of Contact Hours	24	**Credits**	1

Module 1 (Quantitative Aptitude - 2) (6hrs)	**Ratio and Proportion** · Simple Ratios, Compound Ratios · Comprehend and Dividend · Direct & Indirect Proportions · Problems on ages,
	Mixtures & Alligation– technique, general representation, the straight-line approach, application of weighted allegation methods in problems involving mixtures, application of allegation on situations other than mixtures problems & Coin problems.
	Data Interpretation – Simple arithmetic, rules for comparing fractions, calculating(approximation)fractions, shortcut ways to find the percentages, Classification of data tables, Bar Graph, Tabular Form, Line Chart, case let Form. Pie Chart, Radar/Web, combination of graphs, combination of graphs and tables. and Missing Data Interpretation.
	Simple interest and Compound Interest - Simple Interest, Basic Difference b/w both the Interests. Mixed interest, CI with a Fractional Rate, to find Installments of both SI and CI.
Module 2 (Logical Reasoning -	**Ages & Blood Relation** - Generation Tree, Family Tree Problems, Statement Based Questions, Coded Blood Relation Question, Blood Relation Based Puzzles.
	Seating Arrangement - Single or Double rows facing each other or away from each other in the same direction Circular Seating Arrangement · Uni- & Bi-directional problems on · Circular, Square, Rectangular, Hexagonal tables

2) (6hrs)	**Distance & Direction** - Distance and Displacement between any two points as well as puzzles based on that, Concept of Shadows.
Module 3 (Quantitative aptitude - 3) (6hrs)	**Speed, Time & Distance** - Relative speed, Average speed, Problems on Races when somebody gives a start to other Person. Persons moving opposite & same direction in circular track, problems on train, Boat & Stream,
	Permutation & Combination - Arrangement, law of addition & multiplication, factorial function, concept of step arrangement, permutation of similar things, circular things, find the rank of word in dictionary. Concepts of selections using combination.
	Time & Work - Partial work done problems Work done on Alternate days. Problems related to efficiency. Division of Wages According to Work. Work & wages, pipes & cisterns
Module 4 (Logical Reasoning - 3) (6hrs)	**Clocks & Calendars** - Understanding concepts and basic formula along with solving different types of problems. **Probability** - Single event probability, multi event probability, independent events and dependent events, mutually exclusive events, non-mutually exclusive events, combination method for finding the outcomes.
	Analogies - Drawing similarity between different but sufficiently similar events, situations, or circumstances using tips and tricks, find the odd one out, rule detection,

B.N.M. Institute of Technology

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Semester: III/IV

COURSE: CONSTITUTION OF INDIA, PROFESSIONAL ETHICS, IKS and UHV

Course Code:	**L:T:P:J: 0:2:0:0**	**CIA Marks:** 50
Credits:	**1**	**SEA Marks: 50**
Hours:	**15 hrs**	**SEA Duration:2Hr**

Course Learning Objectives: The students will be able to

1	know the fundamental political codes, structure, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and the duties of citizens
2	know the Indian top civil service positions and the exams conducted by UPSC and SPSC for the same
3	Understand engineering ethics and their responsibilities; identify their individual roles and ethical responsibilities towards society.

MODULE 1: Foundations of the Indian Constitution and Governance	**RBT**	**Hrs**
Necessity, relevance, and historical background of the Constitution; Constituent Assembly – role and functioning; Preamble – vision, philosophy, and objectives; Salient features of the Indian Constitution; Parliamentary vs. Presidential systems Federal features of Indian polity	**1,2,3**	**3**
MODULE 2: Rights, Duties, and Policy Framework	**RBT**	**Hrs**
Fundamental Rights – scope, reasonable restrictions, and landmark cases; Directive Principles of State Policy – classification and implementation; Fundamental Duties – legal status and significance; Union Executive: President, Vice-President, Prime Minister & Cabinet; State Executive: Governor, Chief Minister & Cabinet; Bicameral and unicameral legislatures.	**1,2,3**	**3**
MODULE 3: Legislature, Judiciary, and Emergency Provisions	**RBT**	**Hrs**
Parliament: Lok Sabha & Rajya Sabha – composition, powers, sessions; Legislative procedure: quorum, language, joint session; Judiciary – Supreme Court & High Courts: structure, powers, and jurisdiction; Judicial review and judicial activism; Constitutional Amendments – methods and significant amendments; Emergency provisions – types, impact, and case studies.	**1,2,3**	**3**
MODULE 4: Elections, Institutions, and Public Administration	**RBT**	**Hrs**
Election Commission of India – structure, powers, conduct of elections; Electoral reforms and use of EVMs; Constitutional bodies: UPSC, SPSC, GST Council – functions; Non-Constitutional bodies: CIC, SIC – role and relevance; Role of democratic and public institutions in a constitutional democracy.	**1,2,3**	**3**

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MODULE 5: Professional Ethics, Universal Human Values, and Indian Knowledge System	RBT	Hrs
Scope and relevance of Engineering and Professional Ethics; Responsibilities of engineers – legal, moral, and social; Risk, safety, liability, and ethical dilemmas; Intellectual Property Rights (IPR) – overview; Indian Knowledge System – components, contributions to science and sustainability; Universal Human Values – truth, peace, non-violence, harmony; Role of education in value inculcation Integrating values in professional and personal life Case studies from daily life and professions.	1,2,3	3

Course outcome: On completion of this course, students will be able to,

CO1: Have constitutional knowledge and legal literacy.

CO2: Have knowledge on All India Services and State Civil Services.

CO3: Understand Engineering and Professional Ethics and responsibilities of Engineers.

CO4: Have knowledge on Universal Human Values

CO5: Understand Indian Knowledge System

Reference Books

Suggested Learning Resources:

1.**Title of the Book - Indian Polity**

Name of the Author - M Lakshmikanth

Name of the Publisher-Mc Graw Hill Education

Edition and Year- 2019

2.**Title of the Book - Engineering Ethics**

Name of the Authors - M. Govindarajan, S.Natarajan, V.S. Senthilkumar

Name of the Publisher- Prentice-Hall

Edition and Year-2004

3. Durga Das Basu (DD Basu): "Introduction to the Constitution on India", (Students Edition.) Prentice –Hall EEE, 19th / 20th Edn., (Latest Edition) or 2008.

4. Shubham Singles, Charles E. Haries, and Et al : "Constitution of India and Professional Ethics" byCengage Learning India Private Limited, Latest Edition – 2018.

5. M.Govindarajan, S.Natarajan, V.S.Senthilkumar, "Engineering Ethics", Prentice –Hall of IndiaPvt. Ltd. New Delhi, 2004

6. **M.V.Pylee,** "An Introduction to Constitution of India", Vikas Publishing, 2002.

7. Latest Publications of **NHRC - Indian Institute of Human Rights**, New Delhi.

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Web Links and Video Lectures

www.unacademy.com/lesson/future-perfect-tense/YQ9NSNQZ https://successesacademy

Question paper pattern for SEA and CIA.

- The SEA question paper will be set for 50 marks and the pattern of the question paper will be objective type (MCQ). Students should score 40% marks to pass.
- The CIA question paper will be set for 50 marks and the pattern of the question paper will be objective type (MCQ). Students should score 40% marks to pass.

Final Marks = CIA + SEA = 50+50 = 100 Marks

Class Internal Assessment

IA1	Objective type questions 50Marks	Sum of IA1 and SEA= 100 Marks
SEA	Objective type questions 50Marks	
	Total CIA	**100 Marks**

Final Marks = CIA + SEA = 50+50 = 100 Marks

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