Scheme for III Semester B.E.(Mechanical Engineering

S No	Course		Course Title	Teaching Department	Teaching hours/week			Examination				Credits
					Theory Lecture	Tutorial	Practical /Drawing	Duration in Hours	CIE Marks	SEE Marks	Total marks	
	Type	Code			L	T	P					
1	BSC	MVJ20MME31	Transforms and Statistical Methods	Mathematics	2	2	0	3	50	50	100	3
2	PCC	MVJ20ME32	Mechanics of Materials	ME	3	2	0	3	50	50	100	4
3	PCC	MVJ20ME33	Thermodynamics	ME	2	2	0	3	50	50	100	3
4	PCC	MVJ20ME34	Materials Engineering	ME	3	0	0	3	50	50	100	3
5	PCC	MVJ20ME35	Manufacturing Process	ME	3	0	0	3	50	50	100	3
6	PCC	MVJ20ME36	Machine Drawing	ME	2	0	2	3	50	50	100	3
7	PCC	MVJ20MEL37	Mechanics and Materials Testing-Lab	ME	0	1	3	3	50	50	100	2
8	PCC	MVJ20MEL38	Foundry, Forging and welding-Lab	ME	0	1	3	3	50	50	100	2
9	HSMC	MVJ20KAN39	Kannada	Humanities	1*	0	0	3*	50*	50*	100	1
		MVJ20CPH39	CPH		1	0	0	3	50	50		
10	BSC	MVJ20MATDIP31*	Additional Mathematics-1	Mathematics	2*	1*	0	3	50	50	100	-
11	HSMC	MVJ20UHV310	Universal Human Values-I	Humanities	1	0	0	3	50	50	100	1
				Total	17	8	8	33	550	550	1100	25

Note: BSC: Basic Science, PCC: Professional Core Course , HSMC: Humanity and Social Science, MVJ20MATDIP31*- Mandatory non-credit course for Lateral Entry (Diploma) Students

Course Title	TRANSFORMS AND STATISTICAL METHODS	Semester	III
Course Code	MVJ20MME31	**CIE**	50
Total No. of Contact Hours	40 L : T : P :: 2 : 2 : 0	**SEE**	50
No. of Contact Hours/week	04	**Total**	100
Credits	03	**Exam. Duration**	3 hrs

Course objective is to: This course will enable students to

- Comprehend and use of analytical and numerical methods in different engineering fields.
- Apprehend and apply Fourier Series.
- Realize and use of Fourier transforms.
- Realize and use of Z-Transforms.
- Use of statistical methods in curve fitting applications.

Module-1	**RBT Level** L1,L2,L3	08 Hrs.

Laplace Transform: Definition and Laplace transforms of elementary functions. Laplace transforms of Periodic functions and unit-step function and problems.

Inverse Laplace Transform: Definition and problems, Convolution theorem to find the inverse Laplace transforms and problems.

Applications: Solution of linear differential equations using Laplace transforms.

Web Link and Video Lectures:

https://www.youtube.com/watch?v=8oE1shAX96U

https://www.intmath.com/laplace-transformation/7-inverse-laplace-transform.php

https://www.youtube.com/watch?v=HSGgORdJAQg

https://www.youtube.com/watch?v=Pq-tUQzeSRw

Module-2	**RBT Level** L1,L2,L3	08 Hrs.

Fourier series: Recapitulation of Series, Continuous and Discontinuous functions, Periodic functions, Dirichlet's conditions, Fourier series of periodic functions of period 2l and arbitrary period 2π, Half-range Fourier sine and cosine series, Practical Harmonic Analysis and Problems.

Web Link and Video Lectures:

https://www.youtube.com/watch?v=Sq2FhCxcyI8

https://www.youtube.com/watch?v=4N-IwHUCFa0

https://www.youtube.com/watch?v=UGuOVeoo3QE

https://www.youtube.com/watch?v=x04dnqg-iPw

https://nptel.ac.in/courses/111106111/

Module-3	RBT Level L1,L2,L3	08 Hrs.

Fourier transforms: Infinite Fourier transform, Infinite Fourier sine and cosine transforms, Inverse Fourier transforms, Inverse Fourier sine and cosine transforms, Convolution theorem and problems.

Applications: Applications of Fourier Transforms.

Web Link and Video Lectures:

https://www.youtube.com/watch?v=spUNpyF58BY

https://www.youtube.com/watch?v=6spPyJH6dkQ

https://www.youtube.com/watch?v=WcNPUXfxCXA

Module-4	RBT Level L1,L2,L3	08 Hrs.

Z-Transforms: Difference Equations, basic definition, Z-Transforms - definition, Standard Z-transforms, Damping rule, Shifting rule, Initial-value and Final-value theorems (without proof) and problems, Inverse Z-transforms.

Applications: Application of Z- transforms to solve difference equations.

Web Link and Video Lectures:

http://www.eas.uccs.edu/~mwickert/ece2610/lecture_notes/ece2610_chap7.pdf

https://electricalbaba.com/final-value-theorem-and-its-application/

https://www.engr.siu.edu/staff/spezia/Web438A/Lecture%20Notes/ET%20438A%20Lecture%202%20pt%202.pdf

http://www.nptelvideos.in/

https://www.classcentral.com/

Module-5	RBT Level L1,L2,L3	08 Hrs.

Curve Fitting: Curve fitting by the method of least squares. Fitting of the curves of the form $y = ax^2 + bx + c$, $y = ae^{bx}$.

Statistical Methods: Introduction, Correlation and coefficient of correlation, Regression, lines of regression and problems.

Web Link and Video Lectures:

https://mathbits.com/MathBits/TISection/Statistics2/correlation.html

https://www.youtube.com/watch?v=xTpHD5WLuoA

https://www.youtube.com/watch?v=fNLeogEjMmM

https://www.youtube.com/watch?v=tl5QNhSe0Yk

Course outcomes:

CO1	Use Laplace transform and inverse transforms techniques in solving differential equations.
CO2	Learn to represent a periodic function in terms of sine and cosine functions.

CO3	Demonstrate Fourier Transform as a tool for solving Integral equations.
CO4	Apply Z Transform to solve Difference Equation. Use Method of Least Square for appropriate Curves.
CO5	Fit a suitable curve by the method of least squares and determine the lines of regression for a set of statistical data.

Text Books:	
1.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.
2.	Prof. G.B.Gururajachar, "Engineering Mathematics –III, Academic Excellent series publications, 2016 – 17.

Reference Books:	
1.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10th edition,2014.
2.	Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006.
3	Bali N. P. & Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 8th Edition.
4	Jain R. K. & Iyengar S.R.K., Advanced Engineering Mathematics, Narosa Publishing House, 2002.

CIE Assessment:

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- Quizzes/mini tests (10 marks)
- Assignment (10 marks)

SEE Assessment:

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.
ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.
iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	0	3	0	0	0	0	0	0	1	0
CO2	3	3	0	3	0	0	0	0	0	0	0	1
CO3	2	3	0	3	0	0	0	0	0	0	1	0
CO4	3	3	0	3	0	0	0	0	0	0	0	0
CO5	3	3	0	2	0	0	0	0	0	0	0	1

High-3, Medium-2, Low-1

Course Title	MECHANICS OF MATERIALS	Semester	III
Course Code	MVJ20ME32	CIE	50
Total No. of Contact Hours	50 L : T : P :: 3: 2 : 0	SEE	50
No. of Contact Hours/week	05	Total	100
Credits	04	Exam. Duration	03 Hrs

Course objective is to:

- This course will give details about various engineering materials behaviour when dealing under different load combinations and help us to study the induced stresses, strains and deformation.
- To study the distribution of various stresses in mechanical elements that deform under various loads.

Module-1	RBT Level L1, L2	10 Hrs.

Stresses and Strains: Stress and strain due to axial force, elastic limit, Hooke's law-factor of safety -stepped bars, uniformly varying sections, stresses in composite bar due to axial force and temperature. Strain Energy due to axial force- proof resilience, stresses due to gradual load, sudden load, and impact load.

Lab Sessions:

- The material property like modulus of elasticity can also be found for different engineering materials like copper, bronze, aluminium apart from mild steel (Material testing lab can be used).

Applications: The students will be asked to find stresses and strains induced in various applications like, chair/bench where the students are sitting, strain in the shoe while jogging, in the concrete building etc.

Video link:
https://www.mtu.edu/materials/k12/experiments/tensile/

Module-2	RBT Level L1, L2	10 Hrs.

Changes in Dimensions and Volume: Lateral strain - Poisson's ratio, volumetric strain, changes in dimensions and volume, shear stress, shear strain, relationship between elastic constants. Hoop and Longitudinal stresses in thin cylindrical and spherical shells under internal pressure- changes in dimensions and volume.

Lab Sessions:

- A practical observation of strain gauges will be given, one of the most important sensors of the electrical measurement technique applied to the measurement of mechanical quantities like forces, pressure etc (metrology and measurement lab can be used).

Applications: Change in dimensions in all three directions for different geometrical cross sections like square, rectangle can be found for a minimum two different materials with application of loads

Video link: https://www.youtube.com/watch?v=qHi8FPnWP6E

Module-3	RBT Level L1, L2, L3	10 Hrs.

Principal Stresses and Strains: (Two dimensional only) State of stress at a point - normal and tangential stresses on a given plane, principal stresses and their planes, plane of maximum shear stress, analytical method, Mohr's circle method, application to simple problems, Strain Rosettes.

Lab Sessions:

- Material subjected to 2D state of stress (wood and ply wood) and its analysis can be thought using Ansys software under static condition (Computer Aided Modelling and Analysis lab can be used).

Applications: Mohr's circle can be used to find the principal plane in wood materials.

Video link: https://www.youtube.com/watch?v=wbkvJmUEKHY

Module-4	RBT Level L1, L2, L5	10 Hrs.

Bending Moment and Shear Force: Relationship between load, shear force and bending moment - shear force and bending moment diagrams for cantilever, simply supported and overhanging beams under concentrated loads, uniformly distributed loads, uniformly varying loads, concentrated moments, maximum bending moment and point of contra flexure.

Flexure in Beams: Theory of simple bending and assumptions - derivation of equation, section modulus, normal stresses due to flexure.

Lab Sessions:

- A cantilever and simply supported beam subjected to different types of loads like point load, UDL, UVL couple can be thought using Ansys software under static condition (Computer Aided Modelling and Analysis lab can be used).

Applications: The importance of the beam cross section for a particular loading condition will be thought by taking some case studies like Metro Train pillars.

Video link: https://www.youtube.com/watch?v=-9DYHrqq51E		
Module-5	RBT Level L1, L2,L3	10 Hrs.
Deflection of Determinate Beams: Governing differential equation - Macaulay's method-moment area method, application to simple problems; Bending moment and shear force diagram of a typical shaft, elastic instability, Euler Formula. *Torsion:* Theory of torsion and assumptions-derivation of the equation, polar modulus, stresses in solid and hollow circular shafts, power transmitted by a shaft, close coiled helical spring with axial load. Lab Sessions: • Dynamic analysis of a shaft subjected to torque can be thought using Ansys software (Computer Aided Modelling and Analysis lab can be used). Applications: A propeller shaft of an automobile which transmits power and motion from engine to the wheels. Video link: https://www.youtube.com/watch?v=cZwg6XYpzRw		

Course outcomes:	
CO1	Upon completion of this course, the students can be able to apply mathematical knowledge to calculate the deformation behaviour of simple structures.
CO2	Critically analyse problem and solve the problems related to mechanical elements and analyse the deformation behaviour for different types of loads.
CO3	Analyse the deflection in beams.
CO4	Analyse buckling and bending phenomenon in columns, struts, and beams.
CO5	Analysis of shaft for various cross sections.

Text Books:	
1	Popov E P, "*Mechanics of Materials*", Prentice Hall Inc., Englewood Cliffs, New Jersey, 1976.
2	Heam E J, "*Mechanics of Materials*", Vol. I, Pergamon Press, 1977.
Reference Books:	
1	Ramamrutham S and Narayan R, "*Strength of Materials*", Dhanpat Rai and Sons, New Delhi, 1997.
2	Singh D K, "*Strength of Materials*", ANE Books, 2007.

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CO1	3	3	2	2	2	-	-	-	2	1	2	1
CO2	3	3	1	2	2	3	2	-	2	2	1	2
CO3	3	2	2	3	3	1	-	-	2	1	2	1
CO4	3	3	2	3	3	2	1	-	2	2	2	2
CO5	3	3	3	3	2	2	2	-	3	2	3	3

High-3, Medium-2, Low-1

Course Title	THERMODYNAMICS	Semester	III
Course Code	MVJ20ME33	CIE	50
Total No. of Contact Hours	40 L: T : P :: 2: 2:0	SEE	50
No. of Contact Hours/week	04	Total	100
Credits	03	Exam. Duration	3 hrs

Course objective is to:

- Introduce basic concepts of thermodynamics
- Learn first law and second law of thermodynamics.
- Learn entropy and ideal gas behaviour

Module-1	RBT Level L1,L2,L3	8 hrs

Fundamental Concepts & Definitions: Thermodynamics; definition and scope. Microscopic and Macroscopic approaches. Engineering Thermodynamics Definition. Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and units, intensive and extensive properties. Thermodynamic state, change of state, path and process, quasistatic process, Cycle. Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium- Zeroth law of thermodynamics, Temperature; concepts, scales, measurement.

Work & Heat: Mechanics, definition of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work; at part of a system boundary, at whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Shaft work; Electrical work. other types of work. Heat; definition, units and sign convention.

Applications: IC Engines, Thermometers, Dynamometer etc.

Video link:

1. https://www.youtube.com/watch?v=WFMIzS2jQQg&t=48s
2. https://nptel.ac.in/courses/112105123/

Module-2	RBT Level L1, L2, L3	8 hrs

First Law of Thermodynamics: Joule's experiments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non -cyclic processes, energy, energy as a property, modes of energy, Specific heat at constant volume, enthalpy, specific heat constant pressure. Extension of the First law to control volume; steady state-steady flow energy equation, important applications.

Laboratory Sessions Experimental learning:

First law for open system- (Use HMT Lab heat exchanger)

- Flow hot water through tubes, find the inlet temperature of water and outlet temperature of water. With the help of steam table find inlet and outlet enthalpy for the corresponding temperature. Use steady flow energy equation and continuity equation find the mass flow rate of water
- Making Model for Perpetual Motion Machine (PMM1) _ Group activity

Applications: Compressors, Turbines, IC engines etc

Video link:

1. https://www.youtube.com/watch?v=10FlW80XN64
2. https://nptel.ac.in/courses/112104113/

Module-3	RBT Level L1,L2,L3	8 hrs

Second Law of Thermodynamics: Devices converting heat to work; (a) in a thermodynamic cycle, (b) in a mechanical cycle. Thermal reservoir. Direct heat engine; schematic representation and efficiency. Reserved heat engine, schematic representation, coefficients of performance. Kelvin - Planck statement of the Second law of Thermodynamic; PMM I & PMM II . Clausius's statement of Second law of Thermodynamic; Equivalence of the two statements; Reversible and irreversible processes; factors that make a process irreversible, reversible heat engine, Carnot cycle, Carnot principles. Thermodynamic temperature scale.

Applications: Refrigerator, Heat Pump, Heat Engines etc

Video link :

1. https://www.youtube.com/watch?v=cobFAMZDS0o
2. https://nptel.ac.in/courses/112108148/

Module-4	RBT Level L1,L2,L3	8 hrs

Entropy: Clausius inequality; statement, proof, application to a reversible cycle. Q/T as independent of the path. Entropy; definition, a property, principle of increase of entropy, entropy as a quantitative test for irreversibility, calculation of entropy using Tds relations, entropy as a coordinate. Introduction to available and unavailable energy.

Pure Substances: P-T and P-V diagrams, triple point, and critical points. Sub-cooled liquid, saturated liquid, mixture of saturated liquid and vapor, saturated vapor, and superheated vapor states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality), T-S and H-S diagrams, representation of various processes on these diagrams. Steam tables and its use.

Laboratory Sessions/ Experimental learning:

- Take two fluids hot and cold measure temperature of hot fluid and cold fluid by thermometer and find mass. After mixing of both the fluid find the entropy change.
- Calculate the entropy change of universe for the following cases:
    a) Metal block of mass m1, Cp and T1 placed in water whose temperature is T2
    b) The same block at temp T1 is dropped from a height 100 into the water
    c) Two different blocks of different temperatures are joined together
- M1 mass of water at T1 temperature is brought into contact with heated water of temperature T2 when T1 temperaure of water reached T2 temperature find the entropy change. What will be the entropy change if water get T2 temperature in no of stages?
- Draw T-S diagram experimentally by taking T1 temperature of cold water which get heated to T2 temperature of water at 1 atm pressure

Applications: Air conditioning, Boilers etc

Video link :

1. https://www.youtube.com/watch?v=YM-uykVfq_E
2. https://nptel.ac.in/content/storage2/courses/112108148/pdf/Module_4.pdf

Module-5	RBT Level L1,L2,L3	8 hrs

Ideal gases: Ideal gas mixtures, Daltons law of partial pressures, Amagat's law of additive volumes, evaluation of properties of perfect and ideal gases, Air- Water mixtures and related properties.

Real gases – Introduction, Van-der Waal's Equation of state, Van-der Waal's constants in terms of critical properties, Beattie-Bridgeman equation, Law of corresponding states, compressibility factor; compressibility chart. Difference between Ideal and real gases.

Applications: Exhaust gas equipment designs, Compressor designs etc.

Video link:

1. https://www.youtube.com/watch?v=2mv4XqF4uZs
2. https://www.youtube.com/watch?v=o9ueYSKj9og

Course outcomes:	
CO1	Define the basic concepts of thermodynamics like systems, equilibrium, process etc. and its applications.
CO2	Realize the laws of thermodynamics and apply to solve engineering, problems.
CO3	Identify the different types of work and heat transfer mechanisms.
CO4	Differentiate reversible and irreversible process using second law and entropy concepts.
CO5	Understand the behaviour of ideal gases and real gases at various conditions.

Text Books:	
1	T R Sitaraman, " *Basic Thermodynamics*", Interline Publishing
2	Nag P.K. "*Basic & Applied Thermodynamics*". Tata McGraw Hill Pub. Co, 2nd edition
Reference Books:	
3	Yunus A. Cenegal and Michael A. Boles "*Thermodynamics -An Engineering Approach*". Tata McGraw-Hill, 7th edition
4	Claus Borgnakke, Richard Edwin Sonntag, "*Fundamentals of Thermodynamics*" 8th Edition, WILEY, ISBN - 9781306947732

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CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	-	-	-	-	-	-	-	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-
CO4	2	2	3	3	-	-	-	-	-	-	-	-
CO5	2	3	2	3	-	-	-	-	-	-	-	-

High-3, Medium-2, Low-1

Course Title	MATERIALS ENGINEERING	Semester	III
Course Code	MVJ20ME34	CIE	50
Total No. of Contact Hours	40 L : T : P :: 3:0:0	SEE	50
No. of Contact Hours/week	04	Total	100
Credits	03	Exam. Duration	3 Hrs

Course objective is to:

- Understand various crystal structures of engineering materials and their mechanical properties.
- Understand different material failure criteria.
- Learn behaviour of different phases in the material.
- Understand different heat treatment processes used for engineering materials.
- Understand behaviour alloys and alloying elements.

Module-1	RBT Level L1,L2,L3	08 Hrs.

Crystal Structure: Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress

Mechanical Property measurement: Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery; Hardness: Rockwell, Brinell and Vickers and their relation to strength.

Laboratory Sessions/ Experimental learning:

- Making Models of all Crystal Structures using Tenis Balls or Thermocol.
- Plot stress strain curves from the raw data obtained from the laboratory equipment.
- Compare stress strain curves of different Engineering Materials

Applications: Crystal Structure and Mechanical Properties of all engineering materials used for developing products for engineering applications.

Video link / Additional online information:

http://vlab.amrita.edu/?sub=1&brch=282&sim=370&cnt=1

Module-2	RBT Level L1,L2,L3	08 Hrs.

Static failure theories: Ductile and brittle failure mechanisms, Tresca, Von-mises, Maximum normal stress, Mohr-Coulomb and Modified Mohr-Coulomb; Fracture mechanics:

intensity factor approach and Griffith criterion. Fatigue failure: High cycle fatigue, Stress-life approach, SN curve, endurance and fatigue limits, effects of mean stress using the Modified Goodman diagram; Creep, Fracture with fatigue, Introduction to non-destructive testing (NDT)

Laboratory Sessions/ Experimental learning:

- Demonstrate non-destructive tests, like dye penetrant test for a shaft collected from nearby garage.

Applications: Used in design the structural components **Video link / Additional online information**:

https://www.youtube.com/watch?v=_XgzMR-9cWk

Module-3	RBT Level L1, L2, L3	08 Hrs.

Alloys, substitutional and interstitial solid solutions: Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstructural aspects of ledeburite, austenite, ferrite and cementite, cast iron.

Laboratory Sessions/ Experimental learning*:*

- To generate pattern of change in colour of material when they are undergoing phase change from liquid to solid.

Applications: Developing different alloy metals.

Video link / Additional online information:
https://www.youtube.com/watch?v=waLo6Yqtsug

Module-4	RBT Level L1, L2, L3	08 Hrs.

Heat treatment of Steel: Annealing, tempering, normalising and spheroidising, isothermal transformation diagrams for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening

Laboratory Sessions/ Experimental learning:

- Use any one Heat treatment process for cooling of mild steel.

Applications: Used in engineering applications to develop products.

Video link / Additional online information:
https://www.youtube.com/watch?v=748_MEOpOAg

Module-5	RBT Level L1, L2, L3	08 Hrs.

Alloying of steel: properties of stainless steel and tool steels, maraging steels- cast irons; grey, white, malleable and spheroidal cast irons- copper and copper alloys; brass, bronze and cupro-nickel; Aluminium and Al-Cu – Mg alloys- Nickel based superalloys and Titanium alloys. Laboratory Sessions/ Experimental learning: • To observe the microstructure of the brass, bronze and Al alloys Applications: Used in engineering applications to develop products. Video link / Additional online information: https://www.youtube.com/watch?v=lExZrAcNTyw

Course outcomes:	
CO1	Understand different crystal structures applicable for engineering materials and basic mechanical properties of engineering materials.
CO2	Realize the different theories of failures and use to solve engineering problems.
CO3	Understand various phases of alloys and interpret their mechanical behaviour
CO4	To understand different heat treatment processes used in mechanical industries.
CO5	Understand the behaviour of alloy steels and their phases.

Text Books:	
1.	W. D. Callister, "*Materials Science and Engineering-An Introduction*", Wiley India, 6th Edition, 2006.
2.	Kenneth G. Budinski and Michael K. Budinski, *Engineering Materials*, Prentice Hall India, 4th Edition, 2002.
Reference Books:	
1.	V. Raghavan, "*Material Science and Engineering*", Prentice Hall India, 5th Edition, 2004

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CO3	3	3	2	1	-	-	-	-	-	-	-	-
CO4	2	2	3	2	-	-	-	-	-	-	-	-
CO5	2	3	2	1	-	-	-	-	-	-	-	-

High-3, Medium-2, Low-1

Course Title	MANUFACTURING PROCESS	Semester	3
Course Code	MVJ20ME35	CIE	50
Total No. of Contact Hours	40 L: T : P :: 3: 0 :0	SEE	50
No. of Contact Hours/week	04	Total	100
Credits	03	Exam. Duration	3hrs

Course objective is to:

- Recognize the various manufacturing principles and techniques. To gain theoretical and practical knowledge in material casting processes and develop an understanding of the dependent and independent variables which control materials casting in a production setting.
- Describe moulding, patterns and moulding furnaces. Determine the appropriate parameters for different manufacturing processes. Justify the most appropriate manufacturing process for a given product.
- To enable the students to acquire a fundamental knowledge on metal forming technology which is necessary for an understanding of industrial processes and to introduce students to the wide range of materials and processes in plastic region, which are currently used in manufacturing industry.
- To provide methods of analysis allowing a mathematical/physical description of polymer processing and powder metallurgy techniques in manufacturing.
- To enable the students to identify the processes characteristics, select the main operator parameters, the tool geometry and materials, and determine forces and power required to select the main and auxiliary equipment for all non-conventional machining.

Module-1	RBT Level L1,L2,L3	08 Hrs.

Prerequisites: Basics of materials Science.

Manufacturing Process: Introduction to basic manufacturing, Classification of manufacturing process, Primary manufacturing process of Iron and Aluminium, Primary and Secondary Manufacturing process classification and Applications. Introduction about metal casting.

Pattern Making: Functions of pattern, Classification of pattern, Different pattern materials, various pattern allowances in design of pattern, Simple problems in design of pattern.

Mould Making: Moulding sand ingredients, Types of Moulds, Mould making, Desirable properties of Sand Mould, functions of cores. Concept of gating system, different types of gating systems, gating system design, risering design.

Laboratory Sessions/ Experimental learning:

- Demonstration of casting and moulding process (sand casting) in foundry laboratory.

Applications:

- Engineering and Developments Limited: Sand Casting Foundry UK, Casting Foundry UK, Sand Castings Manufacturer
  https://youtu.be/1x3uJ-KSyjY
  https://www.youtube.com/watch?v=1x3uJ-KSyjY
- Society of Manufacturing Engineers - https://www.sme.org/
- Shell Mould Casting Process : https://www.youtube.com/watch?v=28_I7Bdz4yY
- Die Casting Process : https://www.youtube.com/watch?v=0XkDK46rwvQ
- Aluminium Casting Process :
  https://www.youtube.com/watch?v=UmVjLSDDHIY&list=PLUvI3up7Htf6kur1fu1yRIrdNBwqJQ4po&index=18

Video link / Additional online information:

- Sand Casting Process: https://www.youtube.com/watch?v=mx1qteRUYwI
- Fundamentals of manufacturing processes, Mechanical Engineering, Dr. D. K. Dwivedi IIT Roorkee, Video Lecture. --- https://nptel.ac.in/courses/112/107/112107219/
- Manufacturing Process Technology -Part I Mechanical Engineering, Dr. Shantanu Bhattacharya, IIT Kanpur, Video Lecture
  https://nptel.ac.in/courses/112/104/112104195/
- Sand Casting Animation by Force Beyond (https://www.forcebeyond.com)
  https://www.youtube.com/watch?v=fCyaJ8Q76U8

Module-2	RBT Level L1,L2,L3	08 Hrs.

Metal Forming Processes: Advantages of Mechanical Working Processes, Difference Between Hot and Cold Working, Advantages and Disadvantages of Cold and Hot Working Processes, Classification of Metal Forming Processes.

Forging: Introduction, Classification of Forging, Die Forging with Power Hammers, Open Die Forging, Impression Die Forging, Closed Die Forging, Forging Defects.

Rolling: Introduction, Nomenclature of Rolled Products, Mechanism of Rolling, and Types of Rolling Mill, Rolls and Roll Pass Design, Ring Rolling, Cold Rolling.

Laboratory Sessions/ Experimental learning:

- Demonstration of forging and rolling operations in Foundry laboratory.

Applications:

- MIT - Massachusetts Institute of Technology - http://web.mit.edu/2.810/www/files/lectures/2015_lectures/lec6-sheet-metal-forming-2015.pdf
- Simufact Engineering – manufacturing simulation specialists – https://www.simufact.com/fields-of-application-forming.html

Video link I Additional online information:

- Principles of Metal Forming Technology, Mechanical Engineering. Dr. Pradeep K. Jha IIT Roorkee, Video Lecture.
- https://nptel.ac.in/courses/112/107/112107250/

Module-3	RBT Level L1,L2,L3	08 Hrs.

Extrusion, Wire Drawing, Tube Drawing and Making: Introduction, Extrusion Processes, Machines for Extrusion, Extrusion Defects, Wire Drawing, Tube Drawing.

Press Work and Die-Punch Assembly: Tools, Bending, Deep Drawing, Coining and Embossing, Coining.

Special casting processes: Shell moulding, investment casting, Gravity die casting, Pressure die casting, Centrifugal casting, Continuous casting, Injection moulding. Defects in casting

Laboratory Sessions/ Experimental learning:

- Demonstration of tube bending, die and punch assembly and grinding operations in Machine Shop.

Applications: Reliable EDM - Tool and Die Making –

https://www.youtube.com/watch?v=z31J8Y4FeIU&list=PLC75FAAB1F1C22EED&index=3

Video link / Additional online information:

Society of Manufacturing Engineers (SME)

- Tool Materials

: https://www.youtube.com/watch?v=OuH9bIwTazE&list=PLB8F8FCFCB2E640DE

- Cutting Tool Design:

https://www.youtube.com/watch?v=GCQT4I99zX4&list=PLB8F8FCFCB2E640DE&index=2

- Fixture Design:

https://www.youtube.com/watch?v=SJ1nvKNwLRU&list=PLB8F8FCFCB2E640DE&index=3

- Progressive Die Design:

https://www.youtube.com/watch?v=S9qzJat3Mzk&list=PLB8F8FCFCB2E640DE&index=4

- Rapid Tooling Design:

https://www.youtube.com/watch?v=3CVEUVl61G8&list=PLB8F8FCFCB2E640DE&index=6

- Trouble Shooting Tool and Die Design:

https://www.youtube.com/watch?v=JFo7eooXE2w&list=PLB8F8FCFCB2E640DE&index=8

Module-4	RBT Level L1,L2,L3	08 Hrs.

Powder Metallurgy: Introduction to powder metallurgy, Preparation of powders (Atomization, Electrolysis, and Granulation Process, Mechanical Alloying), Powder Blending, Powder Compaction, Sintering. Finishing operations, application of powder metallurgy products, advantages and limitations. ***Plastic Products Manufacturing Process***: Injection moulding, Extrusion, and Blow moulding. Galvanizing Process and Electroplating Process.

Brief discussion on following topics: Micro Machining and Nano Machining Process, Super Plasticity, Solidification Mechanism and volume shrinkage.

Laboratory Sessions/ Experimental learning:

- Demonstration of welding process and sheet metal work in the Welding shop

Applications:

- European Powder Metallurgy Association :

https://www.epma.com/powder-metallurgy-process

- Comtec Mfg., Inc – Powder Metallurgy Specialist

https://www.youtube.com/watch?v=azGg68B-GlA

Video link / Additional online information:

1. NPTEL : Powder Metallurgy Material :

https://nptel.ac.in/content/storage2/courses/112101005/downloads/Module_3_Lecture_6_final.pdf

2. ASME *:* Powder Metallurgy and its Applications : www.asminternational.org

https://www.asminternational.org/documents/10192/1849770/Z05438L_Sample.pdf/fee7b45-917b-4911-bc5d-bd8dac26e153

3. EPMA : Powder Metallurgy Component Production Cycle :

https://youtu.be/_eM49JlmFp0

Module-5	RBT Level L1,L2,L3	08 Hrs.

Non-Conventional Machining Processes:

Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, Electrical Discharge Machining, principle and processes parameters with sketches. Electro-chemical machining (ECM), etchant & maskant, process parameters, MRR and surface finish. Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining Principle.

Laboratory Sessions/ Experimental learning:

Demonstration of crystal structure of various materials and etching process in Material Testing Laboratory.

Applications:

1. M/s Holepop Manufactures of EDM Machines :
   https://www.holepop.com/about-our-company
   https://www.holepop.com/common-applications-for-electrical-discharge-machining/
2. M/s Ainnovative International Pvt Ltd
   https://www.waterjet.co.in/waterjet-applications.htm

Video link / Additional online information:

1. Introduction to Non-Traditional Machining by N. Sinha Department of Mechanical Engineering
   IIT Kanpur -- http://home.iitk.ac.in/~nsinha/Non-traditional-machining.pdf
2. Introduction to Non-Traditional Machining by N. Sinha Department of Mechanical Engineering
   IIT Kanpur : Video Lecture -- https://nptel.ac.in/courses/112105212/
3. Society of Manufacturing Engineers :
   a) EDM Manufacturing Process : https://www.youtube.com/watch?v=L1D5DLWWMp8
   b) LBM Manufacturing Process : https://www.youtube.com/watch?v=PQuAr4bs-Mc
   c) Abrasive Machining Process: https://www.youtube.com/watch?v=N0iXh80_jXU
   d) Water Jet Machining Process : https://www.youtube.com/watch?v=4Begp-_zJ70

Course Outcomes:	
C01	Identify and explain all the steps involved in basic casting processes.
C02	Identify and explain the principle behind metal forming process and detail all the forging and rolling process.
C03	Categorise and explain all the special casting processes and Press and Die punch assembly
C04	Understand the process of Powder Metallurgy and Polymer product manufacturing process along with micro and Nano machining.
C05	Categorise and explain the non-conventional Machining Process and its applications.

Text Books:	
1.	Serope Kalpakjain and Steve R Schmid, "*Manufacturing Engineering and Technology*", 6th Edition SI Units, Pearson – Prentice Hall Publication.
2.	P.C. Pandey and H. S. Shan, "*Modern Machining Process*", Tata McGraw-Hill Publishing company Ltd. 33rd Reprint.
3.	Mikell. P. Groover, "*Fundamentals of Modern Manufacturing: Materials, Processes, and systems*".
Reference Books:	
1.	Degarmo, Black & Kohser, "*Materials and Processes in Manufacturing*"
2.	P N Rao, "*Manufacturing Technology: Foundry, Forming and Welding*", 2nd Edition Tata Mc Graw-Hill Publication.
3.	O.P Khanna, "*Foundry Technology*", Dhanpat rai publications-2003 reprint.

CIE Assessment:
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests - Quizzes/mini tests (10 marks) - Assignment (10 marks)
SEE Assessment:
i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO MAPPING												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	2	2	2	-	-	-	-	-	-	-	-	-
C02	2	2	2	-	-	-	-	-	-	-	-	-
C03	2	2	2	-	-	-	-	-	-	-	-	-
C04	2	2	2	-	-	-	-	-	-	-	-	-
C05	2	2	2	-	-	-	-	-	-	-	-	-
Avg	2	2	2	-	-	-	-	-	-	-	-	-

High-3, Medium-2, Low-1

Course Title	MACHINE DRAWING	Semester	III
Course Code	MVJ20ME36	CIE	50
Total No. of Contact Hours	40 L: T : P :: 2: 0 :2	SEE	50
No. of Contact Hours/week	4	Total	100
Credits	03	Exam. Duration	03 Hr

Course objective is:

- To acquire the knowledge of CAD software and its features. Make the students to understand of the devices, instruments.
- To inculcate understanding of the theory of projection and make drawings using orthographic projections and sectional views.
- To familiarize the students with Indian Standards on drawing practices.
- To impart knowledge of thread forms, fasteners, keys, joints, couplings and Assembly Drawings.

Module-1	RBT Level L1, L2	08 Hrs.

Limits, Fits and Tolerances: Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, Types of fits with symbols and applications, Geometrical tolerances on drawings, Standards followed in industry.

Orthographic views: Conversion of pictorial views into orthographic projections of simple machine parts with and without section. (Bureau of Indian Standards conventions are to be followed for the drawings), Hidden line conventions, Precedence of lines.

Laboratory Sessions/ Experimental learning:

- Conversion ISO view to orthogonal view of different machine components to be done using available software tool in the lab.

Applications: All manufacturing Industry.

Video link / Additional online information:

1. https://www.youtube.com/watch?v=-_qz8_sbhwY
2. https://www.youtube.com/watch?v=zO8coRhrJM0

Module-2	RBT Level L1,L2,L3	08 Hrs.

Thread forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External), BSW (Internal and External), square, Acme and Sellers thread, American Standard thread.

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut.

Laboratory Sessions/ Experimental learning:

- 2D drawing of a different type of threads are practiced using available software tool in the lab and same threads are manufactured in M/C shop.

Applications: Assembly and sub assembly of components.

Video link / Additional online information:

1. https://www.youtube.com/watch?v=TPURJnlekeo
2. https://www.youtube.com/watch?v=Z38Aq9ykUCM

Module-3	RBT Level L1,L2,L3	04 Hrs.

Riveted joints: Single and double riveted lap joints, Butt joints with single/double cover straps (Chain and zigzag using snap head riveters).

Laboratory Sessions/ Experimental learning:

- Lap and Butt joint of different plate thickness are drawn using soft wear.

Applications: Bridge construction, Boiler construction, Automobile sheet metal assembly. Video link / Additional online information:

https://www.youtube.com/watch?v=C5ZPaCvoigw

Module-4	RBT Level L3,L4	04 Hrs.

Joints: Cotter joint (socket and spigot), Knuckle joint (pin joint) for two rods.

Laboratory Sessions/ Experimental learning:

- 2D Drawing are drawn using software & 3D individual parts are made and assembled as per given drawing.

Applications: Power transmission assembly, Automobile (Heavy Trucks) industry.

Video link / Additional online information:

1. https://www.youtube.com/watch?v=J9Aj17MAyLY
2. https://www.youtube.com/watch?v=esfr74WhbYg
3. https://www.youtube.com/watch?v=qjGF08LvZ9M

Module-5	RBT Level L3,L4	16 Hrs.

Assembly Drawings: (Part drawings shall be given)

1. Plummer block (Pedestal Bearing)
2. I.C. Engine connecting rod
3. Screw jack (Bottle type)

4. Tailstock of lathe

5. Machine vice

6. Lathe square tool post

Laboratory Sessions/ Experimental learning:

- 3D individual parts are made and assembled as per given drawing.

Applications: Heavy equipment manufacturing, IC engine manufacturing, Automotive industry.

Video link / Additional online information:

1. https://www.youtube.com/watch?v=boyN1l3fA6g&list=PLQL-DlNb9_TVqG1Zrw-9F-S0LItg3T5fD
2. https://www.youtube.com/watch?v=yKl_FiUdAu4&list=PLQL-DlNb9_TUHs8CUXYw-Lna-Gp4rTu9g
3. https://www.youtube.com/watch?v=pyzsBiU-raE&list=PLQL-DlNb9_TXofoObUwlRjLzPst-sRbG3

Course outcomes:	
CO1	Students will be able to convert Orthographic views of machine parts with and without sectioning in 2D.
CO2	Able to understand design of thread forms and Sectional views for threads in 2D.
CO3	Students able to Draw the Hexagonal and square headed bolt and nut with washer, screw assemblies in 2D.
CO4	Students will be able to draw the single and double riveted joints, in 2D.
CO5	Students will be able to construct assemblies of mechanical component in 3D environment and able to generate 2D and 3D draft.

Text Books:	
1.	N.D.Bhat & V.M.Panchal, "*Machine Drawing*", Published by Charotar Publishing House, 1999.
2.	N.Siddeshwar, P.Kannaih, V.V.S. Sastri, "*Machine Drawing*" published by Tata Mc.Grawhill, 2006.
Reference Books:	
1.	S. Trymbakaa Murthy, "*A Text Book of Computer Aided Machine Drawing*" CBS Publishers, New Delhi, 2007.
2.	K.R. Gopala Krishna, "*Machine Drawing*" Subhash publication.

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

High-3, Medium-2, Low-1

Scheme of Examination: As per the MVJCE Autonomous Regulations, Semester End Examination (SEE) is to be conducted and evaluated for 100 marks which will be proportionately reduced and considered for 50 marks by the Grading authority.
Module 1 (Q1) or Module 2 (Q2): 12.5 Marks Weightage
Module 3 (Q3) or Module 4 (Q4): 12.5 Marks Weightage
Module 5 (Q5) or Module 5 (Q6): 25 Marks Weightage

Course Title	MECHANICS AND MATERIALS TESTING LAB	Semester	III
Course Code	MVJ20MEL37	CIE	50
Total No. of Contact Hours	20 L : T : P :: 00:01:03	SEE	50
No. of Contact Hours/week	04	Total	100
Credits	02	Exam. Duration	3 hrs

Course objective is to:

- Prepare and characterize the specimens for microstructure.
- Conduct standard tests to characterize the mechanical properties of engineering materials.
- Understand the significance of materials failure theories.
- To understand the influence of treatment processes on the mechanical properties of engineering materials.

EXPERIMENTS	
PART-A	
1.	Impact Test: Determining the impact strength of a given material using Charpy & IZOD tests.
2.	Tension Tests using Universal Testing Machine: Tension test on the given specimens (at least 2 materials for comparison) and to plot the stress strain graphs.
3.	Compression Tests using Universal Testing Machine: Compression test on the given specimens and to plot the stress strain graphs.
4.	Bending and Double Shear Tests using Universal Testing Machine: Bending test, Double Shear test on the given specimens and to plot the stress strain graphs.
PART-B	
5.	Hardness Test: Estimating the Hardness of different Engineering materials using Brinell"s & Rockwell Hardness Testers
6.	Preparation of specimen for Metallographic examination of different engineering materials. To report microstructures of any 3 of the following materials, plain carbon steel, tool steel, grey C.I, SG iron, Brass, Bronze & composites.

7.	Demonstration of any two NDT methods to students.
8.	Demonstration of wear test to students.
9.	Conduct of torsion test on Mild steel specimen.

Course outcomes:	
CO1	Develop experimentation skills in the field of material testing
CO2	Conduct Tension, Compression, Bending & Shear tests on UTM and evaluate material properties.
CO3	Conduct Hardness & Impact tests and determine various hardness numbers and impact energy
CO4	Apply the knowledge of testing methods in related areas.
CO5	Develop the aptitude for reading and understanding the microstructure of the materials

Reference Books:	
1.	Dieter, "*Mechanical Metallurgy*" 3rdEdition, 2013, McGraw Hill Education (India) Private Limited.

Scheme of Examination: As per the MVJCE Autonomous Regulations, Semester End Examination (SEE) is to be conducted and evaluated for 100 marks which will be proportionately reduced and considered for 50 marks by the Grading authority.

1	One question is to be set from Part-A: 20 Marks
2	One question is to be set from Part-B: 20 Marks
3	Viva – Voce: 10 marks

CO-PO Mapping

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

High-3, Medium-2, Low-1

Course Title	FOUNDRY, FORGING AND WELDING LAB	Semester	III
Course Code	MVJ20MEL38	CIE	50
Total No. of Contact Hours	20 L : T : P :: 00:01:03	SEE	50
No. of Contact Hours/week	04	Total	100
Credits	02	Exam. Duration	3 hrs

Course objective is to:

- Provide an insight into the testing of moulding sand and core sand properties.
- To provide an insight into different moulding practices.
- To provide training to students to enhance their practical skills in welding of different joints.
- To practically demonstrate precautions to be taken during the forging, foundry and welding practices.

EXPERIMENTS

PART-A

Testing of Moulding sand and Core sand (MINOR EXPERIMENT)

Preparation of sand specimen's and conduction of the following tests:

1. Compression, Shear, Transverse and Tensile tests on Universal Sand Testing Machine.
2. Permeability test
3. Core hardness & Mould hardness tests.
4. Sieve Analysis to find Grain Fineness number of Base Sand
5. Clay content determinations in Base Sand.
6. Moisture content test in Base Sand

Foundry Practice (MAJOR EXPERIMENT)

Use of foundry tools and equipment. Preparation of moulds using two moulding boxes using patterns or without patterns. (Split pattern, Match plate pattern and Core boxes). Preparation of one casting (Aluminium or cast iron-Demonstration only)

EXPERIMENTS

PART-B

Forging Operations (MAJOR EXPERIMENT)

1. Calculation of length of the raw material required to do the model.
2. Preparing minimum three forged models involving upsetting, drawing and bending operations.

Welding Practice (MINOR EXPERIMENT) Use of Arc welding tools and welding equipment, Preparation of welded joints using Arc Welding equipment, L-Joint, T-Joint, Butt joint, V-Joint, Lap joints on M.S. flats	
Course outcomes:	
CO1	Demonstrate the knowledge and necessary skills to perform sand testing and preparation of moulds and Foundry practices.
CO2	Demonstrate skills in forging different shapes and geometries.
CO3	Demonstrate skills in preparation of various welding joints on M.S flats using Arc welding

Reference Books:	
1.	Rao P N, "*Manufacturing Technology: Foundry, Forming and Welding*" Volume 14th Edition, 2013, McGraw Hill Education (India) Private Limited.
Scheme of Examination: As per the MVJCE Autonomous Regulations, Semester End Examination (SEE) is to be conducted and evaluated for 100 marks which will be proportionately reduced and considered for 50 marks by the Grading authority.	
1	One Major Question to be chosen from either PART A or PART B for 20 Marks
2	One Minor Question to be chosen from PART A for 10 Marks and PART B for 10 Marks
3	Viva – Voce: 10 marks

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

High-3, Medium-2, Low-1

Electronic Universal Testing Machine in Mechanics and Materials Testing Lab

LPG Fired Gas Furnace in Foundry, Forging and Welding Lab

Course Title	Additional Mathematics-I (Common to all branches)	Semester	III
Course Code	MVJ20MATDIP31*	CIE	50
Total No. of Contact Hours	40 L : T : P :: 2* : 1* : 0	SEE	50
No. of Contact Hours/week	03	Total	100
Credits	-	Exam. Duration	3 Hrs.

Course objective is to: This course viz., aims to prepare the students:

To familiarize the important and basic concepts of Differential calculus and Differential Equation, ordinary/partial differential equations and Vector calculus and analyse the engineering problems.

Module-1	RBT Level L1,L2	8 Hrs.

Differential calculus: Recapitulations of successive differentiations -n^{th} derivative -Leibnitz theorem and Problems, Mean value theorem -Rolle's theorem, Lagrange's Mean value theorem , Cauchy's theorem and Taylor's theorem for function of one variables.

Video Link:

https://users.math.msu.edu/users/gnagy/teaching/ode.pdf

Module-2	RBT Level L1,L2	8 Hrs.

Integral Calculus:

Review of elementary Integral calculus, Reduction formula

$\int_0^{\frac{\pi}{2}} sin^m x\, dx$, $\int_0^{\frac{\pi}{2}} cos^m x\, dx$, $\int_0^{\frac{\pi}{2}} sin^m cos^n x\, dx$ and problems.

Evaluation of double and triple integrals and Simples Problems.

Video Link:

https://www.youtube.com/watch?v=rCWOdfQ3cwQ

https://nptel.ac.in/courses/111/105/111105122/

Module-3	RBT Level L1,L2	8 Hrs.

Vector Calculus: Derivative of vector valued functions, Velocity, Acceleration and related problems, Scalar and Vector point functions, Gradient, Divergence, Curl, Solenoidal and Irrotational vector fields. Vector identities - div (ϕA), curl (ϕA), curl (grad ϕ), div (curl A).

Video Link: https://www.whitman.edu/mathematics/calculus_online/chapter16.html https://www.math.ust.hk/~machas/vector-calculus-for-engineers.pdf		
Module-4	**RBT Level L1,L2,L3**	8 Hrs.
Probability: Introduction-Conditional Probability, Multiplication theorem, Independent events, Baye's theorem and Problems. Video Link: https://www.khanacademy.org/math/statistics-probability/probability-library https://nptel.ac.in/courses/111/105/111105041/		
Module-5	**RBT Level L1,L2,L3**	8 Hrs.
Differential equation: Homogenous differential equation, Linear differential equation, Bernoulli's differential equation and Exact differential equation. Video Link: https://www.mathsisfun.com/calculus/differential-equations.html		

Course outcomes:	
CO1	Apply the knowledge of Differential calculus in the modeling of various physical and engineering phenomena
CO2	Apply the concept of change of order of integration and variables to evaluate multiple integrals and their usage in computing the area and volumes.
CO3	Study on Vector calculus to understand the various solution to Application to Engineering problems.
CO4	Understand the basic Concepts of Probability
CO5	Solve first order linear differential equation analytically using standard methods.

Text Books:	
1.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.
2.	Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006.

Reference Books:	
1.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10th edition, 2014.
2.	G. B. Gururajachar: Calculus and Linear Algebra, Academic Excellent Series Publication, 2018-19.

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (10 marks)
- Assignment (10 marks)

SEE Assessment:

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours..

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	0	3	0	0	0	0	0	0	1	1
CO2	2	3	0	3	0	0	0	0	0	0	1	1
CO3	2	2	0	2	0	0	0	0	0	0	1	0
CO4	3	2	0	3	0	0	0	0	0	0	0	1
CO5	3	3	0	2	0	0	0	0	0	0	0	0

High-3, Medium-2, Low-1

Course Title	UNIVERSAL HUMAN VALUES - I	Semester	III
Course Code	MVJ20UHV310	CIE	50
Total No. of Contact Hours	20 L : T : P :: 1 : 0 :0	SEE	50
No. of Contact Hours/week	1	Total	100
Credits	1	Exam. Duration	3 Hours

Course objective is to:

- Perceive the need for developing a holistic perspective of life
- Sensitise the scope of life – individual, family (inter-personal relationship), society and nature/existence, Strengthening self-reflection
- Develop more confidence and commitment to understand, learn and act accordingly

Module-1	L1, L2, L3	04 Hours

Welcome and Introductions: Getting to know each other (Self-exploration)

Aspirations and Concerns: Individual academic, career, Expectations of family, peers, society, nation, Fixing one's goals (Basic human aspirations Need for a holistic perspective Role of UHV)

Self-Management: Self-confidence, peer pressure, time management, anger, stress, Personality development, self-improvement (Harmony in the human Being)

Health: Health issues, healthy diet, healthy lifestyle, Hostel life (Harmony of the Self and Body Mental and physical health)

Relationships: Home sickness, gratitude, towards parents, teachers and, others Ragging and interaction, Competition and cooperation, Peer pressure (Harmony in relationship Feelings of trust, respect, gratitude, glory, love)

Society: Participation in society (Harmony in the society)

Natural Environment: Participation in nature (Harmony in nature/existence)

Video link:

1. https://youtube.com/playlist?list=PLYwzG2fd7hzc4HerTNkc3pS_IvcCfKznV
2. https://youtube.com/playlist?list=PLYwzG2fd7hzcZz1DkrAegkKF4TseekPFv

Presentation: https://fdp-si.aicte-india.org/AicteSipUHV_download.php

Module-2	L1, L2, L3	04 Hours
Introduction to Value Education: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Self-exploration as the Process for Value Education, Happiness and Prosperity – Current Scenario. **Video link:** 1. https://www.youtube.com/watch?v=85XCw8SU084 2. https://www.youtube.com/watch?v=E1STJoXCXUU&list=PLWDeKF97v9SP_Kt6jqzA3pZ3yA7g_OAQz 3. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw		
Module-3	**L1, L2, L3**	**04 Hours**
Introduction to Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, The Body as an Instrument of the Self, Harmony of the Self with the Body. **Video link:** 1. https://www.youtube.com/watch?v=GpuZo495F24 2. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw		
Module-4	**L1, L2, L3**	**04 Hours**
Introduction to Harmony in the Family and Society: Harmony in the Family – the Basic Unit of Human Interaction, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society. **Video link:** 1. https://www.youtube.com/watch?v=F2KVW4WNnS8 2. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw		
Module-5	**L1, L2, L3**	**04 Hours**
Introduction to Implications of the Holistic Understanding: Natural Acceptance of Human Values, Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Holistic Technologies, Production Systems and Management Models-Typical Case Studies. **Video link:** 1. https://www.youtube.com/watch?v=BikdYub6RY0 2. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw		
Course outcomes:		
CO2	Develop a holistic perspective about life	

CO3	Explore his/her role (value) in all aspects of living – as an individual, as a member of a family, as a part of the society as an unit in nature
CO4	Become more responsible in life, and in handling problems with sustainable solutions
CO5	Have better critical ability
	Become sensitive to their commitment

Reference Books:	
1	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
3	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

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

High-3, Medium-2, Low-1