Semester: III		
TRASNFORMS & STATISTICAL METHODS		
Course Code:	**MVJ21MAE31/ MAS31/MME31**	**CIE Marks:100**
Credits: L:T:P:S: 3:2:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Comprehend and use of analytical and numerical methods in different engineering fields.	
2	Apprehend and apply Fourier Series.	
3	Realize and use of Fourier transforms.	
4	Realize and use of Z-Transforms.	
5	Use of statistical methods in curve fitting applications.	

UNIT-I	
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	**10 Hrs**
UNIT-II	
Fourier series: Recapitulation of Series, Continuous and Discontinuous functions, Periodic functions, Dirichlet's conditions, Fourier series of periodic functions of period	**10 Hrs**

2π and arbitrary period $2l$, 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	
UNIT-III	
Fourier transforms: Infinite Fourier transform, Infinite Fourier sine and cosine transforms, Inverse Fourier transforms, Inverse Fourier sine and cosine transforms, Convolution theorem. **Web Link and Video Lectures:** https://www.youtube.com/watch?v=spUNpyF58BY https://www.youtube.com/watch?v=6spPyJH6dkQ	**10 Hrs**
UNIT-IV	
Z-Transforms: Z-transform: Difference equations, basic definition, z-transform -definition, Standard z-transforms, Damping rule, Shifting rule, Initial value and final value theorems (without proof) and problems, Inverse Z-transform. **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/	**10 Hrs**
UNIT-V	
Curve Fitting: Curve fitting by the method of least squares. Fitting of the curves of the form $y = ax + b$, $y = ax^2 + bx + c$, $y = ae^{bx}$. **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.htm https://www.youtube.com/watch?v=xTpHD5WLuoA	**10 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Use Laplace transform and inverse transforms techniques in solving differential equations.
CO2	Demonstrate Fourier Transform as a tool for solving Integral equations.
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.

Reference Books	
1.	Prof G.B.Gururajachar "Engineering Mathematics-III , Academic Excellent series Publications, 2016-17
2.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013
3.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10thedition,2014.
4.	Ramana B. V., "Higher Engineering Mathematics", Tata McGraw-Hill, 2006.
5.	Bali N. P. & Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 8th Edition.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

Semester: III		
THERMODYNAMICS		
Course Code:	**MVJ21AE32/ MVJ21AS32**	**CIE Marks:100**
Credits: L:T:P:S: 3:2:0:0		**SEE Marks: 100**
Hours: 40L+26T		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	Understand various concepts and definitions of thermodynamics.	
2	Comprehend the I-law of thermodynamics.	

3	Comprehend the II-law of thermodynamics
4	Acquire the knowledge of Pure Substances & Ideal Gases
5	Acquire the knowledge of various types of gas cycles.

UNIT-I	
Fundamental Concepts & Definitions: Thermodynamics definition and scope, Microscopic and Macroscopic approaches. Some practical applications of engineering thermodynamic Systems, Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and Modules, intensive and extensive properties. Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic; processes; Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium. Zeroth law of thermodynamics, Temperature; concepts, scales, fixed points and measurements. **Work and Heat:** Mechanics-definition of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work; as a part of a system boundary, as a whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Shaft work; Electrical work. Other types of work Laboratory Sessions / Experimental learning: To determine the unknown area of a given drawing using planimeter Applications: 1.For temperature measurements 2.To obtain displacement work Video link / Additional online information (related to module if any): https://nptel.ac.in/courses/101/104/101104067/	**10 Hrs**
UNIT-II	
First Law of Thermodynamics: Joules 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, pure substance; definition, two-property rule, Specific heat at constant volume, enthalpy, specific heat at constant pressure. Extension of the First law to control volume; steady state-steady flow energy equation, important	**10 Hrs**

applications, analysis of unsteady processes such as film and evacuation of vessels with and without heat transfer Laboratory Sessions/ Experimental learning: https://www.youtube.com/watch?v=suuTC9uGLrIhttps://www.youtube.com/watch?v=7bJywbP7ZIU Applications: 1. Conservation of energy principle to Heat and Thermodynamic processes 2. Compressors, Blowers, Steam or Gas Turbines, IC engines Video link / Additional online information (related to module if any): https://nptel.ac.in/courses/101/104/101104067/	
UNIT-III	
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. Devices converting work to heat in a thermodynamic cycle; reversed heat engine, schematic representation, coefficients of performance. Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clausius statement of Second law of Thermodynamics, Equivalence of the two statements; Reversible and Irreversible processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Carnot principles. **Entropy:** Clasius inequality; Statement, proof, application to a reversible cycle. Entropy; definition, a property, change of entropy, principle of increase in entropy, entropy as a quantitative test for irreversibility, calculation of entropy using Tds relations, entropy as a coordinate. Available and unavailable energy. Laboratory Sessions/ Experimental learning: https://www.youtube.com/watch?v=7OJG-ZHrbD8https://www.youtube.com/watch?v=7bJywbP7ZIUhttps://www.youtube.com/watch?v=2vHLJjlinjw Applications: 1. All types of heat engine cycles including Otto, Diesel, etc 2. Refrigerators and heat pumps based on the Reversed Carnot Cycle	**10 Hrs**

3. Mixing of two fluids, heat transfer through a finite temperature difference Video link / Additional online information (related to module if any): https://nptel.ac.in/courses/101/104/101104067/	
UNIT-IV	
Pure Substances & Ideal Gases: Mixture of ideal gases and real gases, ideal gas equation, compressibility factor use of charts. P-T and P-V diagrams, triple point and critical points. Sub-cooled liquid, Saturated liquid, mixture of saturated liquid and vapour, saturated vapour and superheated vapour states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality), T-S and HS diagrams, representation of various processes on these diagrams. **Thermodynamic relations:** Maxwell`s equations, Tds relations, ratio of heat capacities, evaluation of thermodynamic properties from an equation of state Laboratory Sessions/ Experimental learning: https://www.youtube.com/watch?v=Juz9pVVsmQQhttps://www.youtube.com/watch?v=L1AHGHRvv9s Applications: Working fluids and its properties, in power plants for power generations. Video link / Additional online information (related to module if any): https://nptel.ac.in/courses/101/104/101104067/	**10 Hrs**
UNIT-V	
Gas Cycles: Efficiency of air standard cycles, Carnot, Otto, Diesel cycles, P-V & T-S diagram, calculation of efficiency, Numerical **vapour power cycle:** Carnot vapour power cycle, simple Rankine cycle, Analysis and performance of Rankine Cycle, Ideal and practical regenerative Rankine cycles – Reheat and Regenerative Cycles, Binary vapour cycle. Laboratory Sessions/ Experimental learning: To determine the unknown area of a given drawing using planimeter to calculate the thermal efficiency of Petrol cycle. To calculate the thermal efficiency of Diesel cycle. Applications:	**10 Hrs**

IC engines, Gas turbine engines etc.. Video link / Additional online information (related to module if any): https://nptel.ac.in/courses/101/104/101104067/	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the concepts of thermodynamics in various engineering problems.
CO2	Differentiate thermodynamic work and heat and apply I law of thermodynamics to different process
CO3	Differentiate thermodynamic work and heat and apply II law of thermodynamics to different process
CO4	Apply the concepts of Pure Substances & Ideal Gases
CO5	Apply the principles of various gas cycles

Reference Books	
1.	A Venkatesh, Basic Engineering Thermodynamics, Universities Press, India, 2007, ISBN 13: 9788173715877
2.	P K Nag, Basic and Applied Thermodynamics, 2nd Ed., Tata McGraw Hill Pub. 2002, ISBN 13: 9780070151314
3.	YunusA.Cenegal and Michael A.Boles, Thermodynamics: An Engineering Approach, TataMcGraw Hill publications, 2002, ISBN 13: 9780071072540
4.	J.B.Jones and G.A.Hawkins, Engineering Thermodynamics, Wiley 1986, ISBN 13: 9780471812029

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The

three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

High-3, Medium-2, Low-1

Semester: III		
ELEMENTS OF AERONAUTICS		
Course Code:	**MVJ21AE33**	**CIE Marks:100**
Credits: L:T:P:S: 3:0:0:0		**SEE Marks: 100**
Hours: 40L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	To know the history and basic principle of aviation	
2	To understand the foundation of flight, aircraft structures, material aircraft propulsion	
3	To develop an understanding stability of an aircraft along with its different systems	

UNIT-I	
Introduction to Aircrafts History of aviation; Atmosphere and its properties; Classification of aircrafts; Basic components of an aircraft; structural members; aircraft axis system; aircraft motions; control surfaces and high lift devices; classification of aircraft; conventional design configurations; principle of operation of each major part; Helicopters, their parts and functions. **Aircraft Structures and Materials:** Introduction; general types of construction; monocoque, semi-monocoque and geodesic structures; typical wing and fuselage structure; metallic and non-metallic materials for aircraft application. Laboratory Sessions/ Experimental learning: Visualization of structural members of a wing in Structural Lab Applications: Identify and describe various components of an aircraft. Video link 1. https://nptel.ac.in/courses/101/101/101101079/	**8 Hrs**
UNIT-II	
Basic principles of flight – significance of speed of sound; airspeed and groundspeed; standard atmosphere; Bernoulli's theorem and its application for generation of lift and measurement of airspeed; forces over wing section, aerofoil nomenclature, pressure distribution over a wing section. Lift and drag components – generation of lift and drag; lift curve, drag curve, types of drag, factors affecting lift and drag; centre of pressure and its significance;	**8 Hrs**

aerodynamic centre, aspect ratio, Mach number and supersonic flight effects; simple problems on lift and drag. Laboratory Sessions/ Experimental learning: Visualization of airfoil cross-section in Aerodynamics Lab Applications: Understand and explain lift production theories for 2-D and their extension to 3-D Video link: https://nptel.ac.in/courses/101/101/101101079/ https://nptel.ac.in/courses/101/101/101101079/	
UNIT-III	
Aircraft Propulsion: Aircraft power plants, classification based on power plant and location and principle of operation. Turboprop, turbojet and turbofan engines; ramjets and scramjets; performance characteristics. Aircraft power plants – basic principles of piston, turboprop and jet engines; Brayton cycle and its application to gas turbine engines; use of propellers and jets for production of thrust; comparative merits and limitations of different types of propulsion engines; principle of thrust augmentation. Laboratory Sessions/ Experimental learning: Visualization of engines in Propulsion Lab Applications: Understand various configurations layouts, power-plant options available. Video link: https://nptel.ac.in/courses/101/101/101101079/ https://nptel.ac.in/courses/101/101/101101079/	**8 Hrs**
UNIT-IV	
Aircraft Stability : Forces on an aircraft in flight; static and dynamic stability; longitudinal, lateral and roll stability; necessary conditions for longitudinal stability; basics of aircraft control systems. Effect of flaps and stats on lift, control tabs,stalling, gliding, landing, turning, aircraft maneuvers; stalling, gliding, turning. Simple problems on these. Performance of aircraft – power curves, maximum and minimum speeds for horizontal flight at a given altitude; effect of changes in engine power and altitude on performance; correct and incorrect angles of bank; aerobatics, inverted manoeuvre, manoeuvrability. Simple problems.	**8 Hrs**

Laboratory Sessions/ Experimental learning: Creating paper planes to have hands on experience of understanding the concepts Applications: Identify the required performance characteristics of different class of aircraft Video link: https://nptel.ac.in/courses/101/101/101101079/ https://nptel.ac.in/courses/101/101/101101079/	
UNIT-V	
Aircraft Systems: Mechanical systems and their components; hydraulic and pneumatic systems; oxygen System; environmental Control System; fuel system. Electrical systems, flight deck and cockpit systems; navigation system, communication system. **Aircraft systems (Mechanical)** – hydraulic and pneumatic systems and their applications; environment control system; fuel system, oxygen system. **Aircraft systems (Electrical)** – flight control system, cockpit instrumentation and displays; communication systems; navigation systems; power generation systems – engine driven alternators, auxiliary power Module, ram air turbine; power conversion, distribution and management. Applications:Identify the main components, subsystems of aircraft and their functionality and various flight control systems, fuel and hydraulic control systems Video link: https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-885j-aircraftsystems-engineering-fall-2005/video-lectures/lecture-7/	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Appreciate and apply the basic principle of aviation.
CO2	Apply the concepts of fundamentals of flight, basics of aircraft structures.
CO3	Aircraft propulsion and aircraft materials during the development of an aircraft.
CO4	Understand the basic concepts of aircraft stability and control
CO5	Understand and Comprehend the complexities involved during development of flight vehicles

Reference Books	
1.	John D. Anderson, Introduction to Flight, McGraw-Hill Education, 2011. ISBN 9780071086059.
2.	Lalit Gupta and O P Sharma, Fundamentals of Flight Vol-I to Vol-IV, Himalayan Books, 2006, ISBN: 706.
3.	A.C. Kermode, Flight without formulae, Pearson Education India, 1989. ISBN: 9788131713891.
4.	Nelson R.C., Flight stability and automatic control, McGraw-Hill International Editions, 1998. ISBN 9780071158381

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping

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

High-3, Medium-2, Low-1

Semester: III		
MECHANICS OF MATERIALS + MATERIAL TESTING LAB (Theory and Practice)		
Course Code:	**MVJ21AE34/ MVJ21AS34**	**CIE Marks:50+50**
Credits: L:T:P: 3:0:2		**SEE Marks: 50 +50**
Hours:40 L+ 26 P		**SEE Duration: 03+03 Hours**
Course Learning Objectives: The students will be able to		
1	Comprehend the basic concepts of strength of materials.	
2	Acquire the knowledge of stresses due to bending	
3	Understand the different failure in materials	
4	Understand the relations among materials and their properties.	
5	Acquire the practical knowledge of metallographic testing of engineering materials.	

UNIT-I	
Basics of linear elasticity: The concept of stress& strain, state of stress & Strain at a point, Equilibrium equations, The state of plane stress and plane strain. Compatibility equations, Constitutive Laws (Hooke's Law), Stressstrain	**10 Hrs**

curves for brittle and ductile materials, Allowable stress, Material selection for structural performance. **Simple & Compound Stresses:** Extension / Shortening of a bar, bars with cross sections varying in steps, bars with continuously varying cross sections. Elongation due to self-weight. Volumetric strain, expression for volumetric strain, elastic constants, simple shear stress, shear strain, temperature stresses, Introduction to Plane stress, stresses on inclined sections, principal stresses & strains, Analytical & graphical method (Mohr's Circle) to find principal stresses & strains. Laboratory Sessions/ Experimental learning: UTM in Material Testing Lab Applications: Testing of Mild steel components, Bricks Video link / Additional online information (related to module if any): Prof.Dr.Suraj Prakash Harsha,Indian Institute of Technology, Roorkee. Lecture – 12 for Ductile and Brittle Materials	
UNIT-II	
Bending Moment and Shear Force in Beams: Introduction, Types of beams, loads and reactions, shear forces and bending moments, rate of loading, sign conventions, relationship between shear force and bending moments. Shear force and bending moment diagrams for different beams subjected to concentrated loads, uniformly distributed load, (UDL) uniformly varying load (UVL) and couple for different types of beams. **Euler-Bernoulli beam theory:** The Euler-Bernoulli assumptions, Implications of the Euler-Bernoulli assumptions, the Euler-Bernoulli Beam theory derivation, Bending stress equation, Moment carrying capacity of a section. Shearing stresses in beams, shear stress across rectangular, circular, symmetrical I and T sections (Only Numerical). Laboratory Sessions/ Experimental learning: Different load conditions can be practiced in Structures Lab Applications: Civil Construction with Symmetrical I & T sections Video link / Additional online information (related to module if any): Prof: S .K.Bhattacharya, IIT, Kharagpur, Lecture no 24. Bending of Beams- III	**10 Hrs**
UNIT-III	

Deflection of Beams: Introduction, Differential equation for deflection. Equations for deflection, slope and bending moment. Double integration method for cantilever and simply supported beams for point load, UDL, UVL and Couple. Macaulay's method. **Torsion of Circular Shafts and Elastic Stability of Columns:** Introduction. Pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts. Power transmitted by solid and hollow circular shafts. Laboratory Sessions/ Experimental learning: Beam Expt in Structures lab and Torsion Test apparatus available in MT Lab. Applications: Civil Construction and Automobile Transmission. Video link / Additional online information (related to module if any): Prof. S. K. Bhattacharyya Indian Institute of Technology, Kharagpur Lecture - 33 Deflection of Beams – IV Prof. S. K. Bhattacharya Dept. of Civil Engineering I.I.T Kharagpur Lecturer#20 Torsion-III	**10 Hrs**
UNIT-IV	
Virtual work principles: Introduction, Equilibrium and work fundamentals, Principle of virtual work, Principle of virtual work applied to mechanical systems, Principle of virtual work applied to truss structures, Principle of virtual work applied to beams. Principle of complementary virtual work, internal virtual work in beams and solids. Energy methods: Conservative forces, Principle of minimum total potential energy, Strain energy in springs, Strain energy in beams, Strain energy in solids, Applications to trusses, Development of a finite element formulation for trusses, Principle of minimum complementary, Energy theorems, Reciprocity theorems, Saint-Venant's principle Laboratory Sessions/ Experimental learning: Few of the Energy Method Theorems can be explained from Structures Lab. Applications: Virtual work arises in the application of the principle of least action to the study of forces and movement of a mechanical system. Video link / Additional online information (related to module if any): Energy Methods in Structural Analysis Version 2 CE IIT, Kharagpur	**10 Hrs**

UNIT-V	
Mechanical Properties of materials: **Fracture**: Type I, Type II and Type III. **Creep**: Description of the phenomenon with examples. Three stages of creep, creep properties, stress relaxation. **Fatigue**: Types of fatigue loading with examples, Mechanism of fatigue, fatigue properties, fatigue testing and S-N diagram. Laboratory Sessions/ Experimental learning: Impact Tests in MT lab for Fracture. Applications: Boilers, Rotating Machine Elements Video link / Additional online information (related to module if any): Creep Deformation of Materials Dr.SrikantGollapudi Indian Institute of Technology, Bhubaneswar Prof.K.Gopinath&Prof.M.M.Mayuram, Machine Design II, Indian Institute of Technology Madras	**10 Hrs**
LABORATORY EXPERIMENTS	
1.Hardness Testing-Brinell and Rockwell Hardness test	
2.Tensile Test	
3.Flexural Test	
4.Torsional Test	
5.Preparation of specimen for metallographic examination of different engineering materials	
6.Dye penetration testing	
7.Magnetic particle inspection	
8.Heat treatment: annealing, normalizing, hardening and tempering of steel	
9.Impact Test – Izod and Charpy Test	
10.Shear Test	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the basic concepts of strength of materials.
CO2	Compute stress, strain under different loadings.
CO3	Acquire the knowledge of deflection of beams
CO4	Acquire the knowledge of virtual work principle and energy methods
CO5	Identify different failures
CO6	Examine the relations among materials properties.
CO7	Apply the knowledge of metallographic testing in aircraft materials.

Reference Books	
1.	T.H.G Megson "Introduction to Aircraft Structural Analysis", Butterworth-Heinemann Publications, 2007, ISBN 13: 9781856179324
2.	Beer F.P. and Johnston.R, Mechanics of Materials, McGraw Hill Publishers, 2006, ISBN13:978-0073380285.
3.	Timoshenko and Young, Elements of Strength of Materials, East-West Press, 1976, ISBN 10: 8176710199
4.	Maximum four books

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50.

The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

High-3, Medium-2, Low-1

Semester: III		
MECHANICS OF FLUIDS + FLUID MECHANICS LAB (Theory and Practice)		
Course Code:	**MVJ21AE35/ MVJ21AS35**	**CIE Marks:50+50**
Credits: L:T:P: 3:0:2		**SEE Marks: 50 +50**
Hours:40 L+ 26 P		**SEE Duration: 03+03 Hours**
Course Learning Objectives: The students will be able to		
1	Understand the basic fluid properties.	
2	To estimate velocity, acceleration and stream function for an incompressible and inviscid flow along with governing equations of fluid flow.	
3	Understand the dimensional analysis and apply Bernoulli's and Euler's equation for flow measuring devices	
4	To calculate boundary layer thickness and drag co-efficient for laminar and turbulent flows	
5	Acquire the knowledge of compressible flows and boundary Layers	

UNIT-I	
Basic Considerations: Introduction, Dimensions- Modules and physical quantities, Continuum view of gases and liquids, Pressure and Temperature scales, Physical properties of fluids. **Fluid Statics:** Pressure distribution in a static fluid, Pressure and its measurement, hydrostatic forces on plane and curved surfaces, buoyancy, illustration by examples. Laboratory Sessions/ Experimental learning: Use of piezometer and manometers	**10 Hrs**

Applications: For pressure measurements by using different types of manometers. Video link / Additional online information (related to module if any): https://nptel.ac.in/courses/101/103/101103004/	
UNIT-II	
Fluids in motion: Methods of describing fluid motion, types of fluid flow, continuity equation in 3 dimensions, velocity potential function and stream function. Types of motion, Source sink, doublet, plotting of stream lines and potential lines Numerical problems. **Fluid Kinematics:** Kinematics of fluid motion and the constitutive equations, Integral (global) form of conservation equations (mass, momentum, energy) and applications, Differential form of conservation equations (continuity, Navier-Stokes equations, energy equation). Laboratory Sessions/ Experimental learning: An experimental study of the continuity equation and Bernoulli's equation by using Venturimeter, Orificemeter and pitot tube. Applications: For rotational and irrotational fluid flows, laminar and turbulent fluid flows. Video link / Additional online information (related to module if any): https://nptel.ac.in/courses/101/103/101103004/	**10 Hrs**
UNIT-III	
Fluid Dynamics: Equations of motion: Euler's and Bernoulli's equation of motion for ideal and real fluids. Momentum equation, Fluid flow measurements. Numerical problems. **Dimensional analysis and similarity:** Dimensional homogeneity, methods of dimensional analysis, model analysis, types of similarity and similitude. Dimensionless numbers. Model laws. Numerical problems Laboratory Sessions/ Experimental learning: An experimental study of the continuity equation and Bernoulli's equation by using Venturimeter, Orificemeter and pitot tube. Applications: flow measuring devices and model studies.	**10 Hrs**

Video link / Additional online information (related to module if any): https://nptel.ac.in/courses/101/103/101103004/	
UNIT-IV	
Flow past Immersed bodies: Introduction to boundary layer, boundary layer thickness, karman's integral momentum theory, drag on a flat plate for laminar and turbulent flow, Drag on immersed bodies. Expression for drag and lift. Kutta –joukowsky theorem; Fundamentals of airfoil theory Numerical problems. Laboratory Sessions/ Experimental learning: Determination of boundary layer thickness. Applications: Flow over a sloid body, separation point and Understanding of lift and drag. Video link / Additional online information (related to module if any): https://nptel.ac.in/courses/101/103/101103004/	**10 Hrs**
UNIT-V	
Compressible flow and Boundary Layers theory: Steady, one-dimensional gas dynamics, Propagation of pressure waves in a compressible medium, velocity of sound , Mach number, Mach cone, Stagnation properties , Bernoulli's eqn for isentropicflow, normal shock waves . Numerical Problem; Laminar and turbulent boundary layers. Laboratory Sessions/ Experimental learning: Propagation of disturbance for different Mach number Applications: Compressible flows through nozzles, diffusers, turbines etc… Video link / Additional online information (related to module if any): https://nptel.ac.in/courses/101/103/101103004/	**10 Hrs**
LABORATORY EXPERIMENTS	
1.Calibration of Venturimeter.	
2.Determination of Coefficient of discharge for a small orifice by a constant head method.	
3.Determination of coefficient of friction of flow in a pipe	
4.Calibration of contracted Rectangular Notch.	

5.Verification of Bernoulli's equation.
6.Pipe friction apparatus with loss of head on pipe fittings.
7.Estimate performance of hydraulic Pumps -Single stage centrifugal pumps
8.Estimate performance of hydraulic Pumps –Multi- stage centrifugal pumps
9.Calibration of contracted V-Notch.
10.Determination of Coefficient of loss of head in a sudden contraction and friction factor.

Course Outcomes: After completing the course, the students will be able to	
CO1	Evaluate the effects of fluid properties
CO2	Estimate velocity, acceleration and stream function for an incompressible and invisid flow along with governing equations of fluid flow.
CO3	Perform dimensional analysis and apply Bernoulli's and Eulers equation for various flow situations involving venturimeter, orificemeter and pitot-tube
CO4	Calculate boundary layer thickness and drag co-efficient for laminar and turbulent flows.
CO5	Illustrate the basic concepts of compressible flows.

Reference Books	
3.	Bansal, R.K, Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi 2015,ISBN-13: 978-8131808153
4.	Yunus A. Cengel& John M Cimbala, Fluid Mechanics and Applications, McGraw Hill Education; 3rd edition, 2013, ISBN-13: 978-0073380322.
3.	Rathakrishnan. E, Fluid Mechanics, Prentice-Hall of India Pvt.Ltd, 2010, ISBN 13: 9788120331839.

4.	Ramamritham. S, Hydraulic Fluid Mechanics and Fluid Machines, Dhanpat Rai& Sons, Delhi, 1988, ISBN 13: 9788187433804

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the self -study are 20 (2 presentations are be held for 10 marks each). The marks obtained in test, quiz and self -studies are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

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

High-3, Medium-2, Low-1

Semester: III		
Balike Kannada		
Course Code:	**MVJ21BK36**	**CIE Marks:50**
Credits: L:T:P:S: 1:0:0:0		**SEE Marks: 50**
Hours: 20L		**SEE Duration: 3 Hrs**
Course Learning Objectives: This course will enable students to understand Kannada and communicate in Kannada language		
1	Vyavharika Kannada –Parichaya (Introduction to Vyavharikakannada)	
2	Kannada Aksharamaalehaaguuchcharane(Kannada Alphabets and Pronounciation.	
3	Sambhashanegaagi Kannada Padagalu (Kannada Vocubulary for Communication).	
4	Kannada Grammer in Conversations(Sambhasaneyalli Kannada Vyakarana)	
5	Activities in Kannada	

UNIT-I	
Vyavharika Kannada –Parichaya (Introduction to Vyavharikakannada)	**8 Hrs**
UNIT-II	
Kannada Aksharamaalehaaguuchcharane(Kannada Alphabets and Pronounciation	**8 Hrs**
UNIT-III	
Sambhashanegaagi Kannada Padagalu (Kannada Vocubulary for Communication)	**8 Hrs**
UNIT-IV	
Kannada Grammer in Conversations(Sambhasaneyalli Kannada Vyakarana)	**8 Hrs**
UNIT-V	
Activities in Kannada	**8 Hrs**

Scheme of Evaluation:

Details		**Marks**
Average of three Internal Assessment (IA) Tests of 30 Marks each i.e. Σ (Marks Obtained in each test) / 3	**CIE(50)**	**30**
ASSIGNMENT		**20**
Semester End Examination	**SEE (50)**	**50**
	Total	**100**

Semester: III		
SAMSKRUTHIKA KANNADA		
Course Code:	**MVJ21SK36**	**CIE Marks:50**
Credits: L:T:P:S: 1:0:0:0		**SEE Marks: 50**
Hours: 20L		**SEE Duration: 3 Hrs**
Course Learning Objectives: This course will enable students to understand Kannada and communicate in Kannada language		
1	Samskruthika Kannada –Parichaya (Introduction to Adalitha kannada)	
2	Kannada Kavyagala parichaya (Kannada D Ra Bendre, Siddalingaiha)	
3	Adalithdalli Kannada Padagalu (Kannada Kagunitha Balake, Patra Lekhana, Prabhandha)	
4	Kannada Computer Gnyana (Kannada Shabdha Sangraha, Computer Paribashika padagalu)	
5	Activities in Kannada.	

UNIT-I	
PÀ£ÀßqÀ ¨sÁµÉ-¸ÀAQë¥ÀÛ «ªÀgÀuÉ.	**8 Hrs**
UNIT-II	
¨sÁµÁ ¥ÀæAiÉÆÃUÀ¯ÁèUÀÄªÀ ¯ÉÆÃ¥ÀzÉÆÃµÀUÀ¼ÀÄ ªÀÄvÀÄÛ CªÀÅUÀ¼À ¤ªÁgÀuÉ.	**8 Hrs**
UNIT-III	
¯ÉÃR£À aºÉßUÀ¼ÀÄ ªÀÄvÀÄÛ CªÀÅUÀ¼À G¥ÀAiÉÆÃU.À	**8 Hrs**
UNIT-IV	
¥ÀvÀæ ªÀåªÀºÁgÀ.	**8 Hrs**
UNIT-V	
DqÀ½vÀ ¥ÀvÀæUÀ¼ÀÄ.	**8 Hrs**
UNIT-VI	
¸ÀPÁðgÀzÀ DzÉÃ±À ¥ÀvÀæUÀ¼ÀÄ	**8 Hrs**
UNIT-VII	
¸ÀAQÃ¥ÀÛ ¥Àæ§AzsÀ gÀZÀ£É, ¥Àæ§AzsÀ ªÀÄvÀÄÛ ¨sÁµÁAvÀgÀ	**8 Hrs**
UNIT-VIII	
PÀ£ÀßqÀ ±À§Ý¸ÀAUÀæºÀ	**8 Hrs**

UNIT-IX	
PÀA¥ÀÆålgï ºÁUÀÆ ªÀiÁ»w vÀAvÀæeÁÕ£À	**8 Hrs**
UNIT-X	
¥Áj¨sÁ¶PÀ DqÀ½vÀ PÀ£ÀßqÀ ¥ÀzÀUÀ¼ÀÄ ªÀÄvÀÄÛ vÁAwæPÀ/PÀA¥ÀÆålgï ¥Áj¨sÁ¶PÀ ¥ÀzÀUÀ¼ÀÄ.	**8 Hrs**

Scheme of Evaluation:		
Details		**Marks**
Average of three Internal Assessment (IA) Tests of 30 Marks each i.e. Σ (Marks Obtained in each test) / 3	**CIE(50)**	**30**
ASSIGNMENT		**20**
Semester End Examination	**SEE (50)**	**50**
	Total	**100**

Semester: III		
CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW		
Course Code:	**MVJ21CPH36/46**	**CIE Marks:50**
Credits: L:T:P:S: 1:0:0:0		**SEE Marks: 50**
Hours: 20L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	To know the fundamental political codes, structure, procedures, powers, and duties of Indian constitution, Indian government institutions, fundamental rights, directive principles and the duties of the citizens.	
2	To provide overall legal literacy to the young technograts to manage complex societal issues in the present scenario.	
3	To understand engineering ethics & their responsibilities, identify their individual roles and ethical responsibilities towards society.	

UNIT-I	
Introduction to Indian Constitution The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian Constitution, The Making of the Constitution, The role of the Constituent Assembly – Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and Limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and Significance in Nation Building.	**8 Hrs**
UNIT-II	
Union Executive and State Executive Parliamentary System, Federal System, Centre-State Relations. Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism. State Executives –	**8 Hrs**

Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Special Provisions (Article 370, 371, 371J) for some States.	
UNIT-III	
Elections, Amendments and Emergency Provisions Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments – 7,9,10,12,42,44,61,73,74,75,86, and 91,94,95,100,101,118 and some important Case Studies. Recent Amendments with explanation. Important Judgements with Explanation and its impact on society (from the list of Supreme Court Judgements). Emergency Provisions, types of Emergencies and it's consequences. **Constitutional Special Provisions:** Special Constitutional Provisions for SC & ST, OBC, Special Provision for Women, Children & Backward Classes.	**8 Hrs**
UNIT-IV	
Professional / Engineering Ethics Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India) : Profession, Professionalism, Professional Responsibility. Clash of Ethics, Conflicts of Interest. **Responsibilities in Engineering** - Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility.Trust and Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering.	**8 Hrs**
UNIT-V	
Internet Laws, Cyber Crimes and Cyber Laws: Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship, Cybercrimes and enforcement agencies.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Have constitutional knowledge and legal literacy
CO2	Understand Engineering and Professional ethics and responsibilities of Engineers.
CO3	Understand the cyber crimes and cyber laws for cyber safety measure.

Reference Books	
1.	Constitution of India and Professional Ethics, T.S. Anupama, Sunstar Publisher
2.	Durga Das Basu (DD Basu): "Introduction to the Constitution on India", (Students Edition.) Prentice –Hall EEE, 19th/20th Edn., (Latest Edition) or 2008.
3.	Shubham Singles, Charles E. Haries, and Et al : "Constitution of India and Professional Ethics" by Cengage Learning India Private Limited, Latest Edition – 2018.
4.	M.Govindarajan, S.Natarajan, V.S.Senthilkumar, "Engineering Ethics", Prentice –Hall of India Pvt. Ltd. New Delhi, 2004.
5.	M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.
6.	Latest Publications of NHRC - Indian Institute of Human Rights, New Delhi.

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 (40 marks each), the final IA marks to be awarded will be the average of three tests

- Assignment (10 marks)

SEE Assessment:

i. Question paper for the SEE consists one part. It is compulsory and consists of objective type 1 mark each for total of 50 marks covering the whole syllabus.

ii. Ten questions 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	2	2	1	1	1	2	2	1	1	1	1	2

CO2	1	2	2	1	1	2	1	1	1	1	1	2
CO3	2	1	2	1	1	1	1	1	1	1	1	2
CO4	2	2	1	1	1	1	1	1	1	1	1	2
CO5	2	2	1	1	1	2	1	1	1	1	1	2

High-3, Medium-2, Low-1

Semester: III		
AEROSAPCE MATERIALS		
Course Code:	**MVJ21AE37/AS37**	**CIE Marks:100**
Credits: L:T:P:S: 2:0:0:0		**SEE Marks: 100**
Hours: 22L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	To impart knowledge on the basics of phase diagrams and their applications.	
2	To make the students to understand the use of non-ferrous materials in aircraft construction:	
3	To introduce various ferrous materials for aircraft construction	

UNIT-I	
Phase diagrams and Microstructures: Basic concepts - Gibbs phase rule – Unary phase diagram (iron) - Binary phase diagrams: isomorphous systems (Cu-Ni). The Fe-Fe3C phase diagram: phases, invariant reactions, development of microstructure in eutectoid, hypoeutectoid and hypereutectoid alloys – influence of other alloying elements in the Fe-C system. Microstructures: pearlite, bainite, spheroidite and martensite. Video link / Additional online information (related to module if any): https://nptel.ac.in/courses/101/103/101103004/	**8 Hrs**

https://www.youtube.com/watch?v=woNUlqu8ReE	
UNIT-II	
Non-ferrous materials in aircraft construction: Aluminium and its alloys: Types and identification. Properties - Castings - Heat treatment processes - Surface treatments. Magnesium and its alloys: Cast and Wrought alloys - Aircraft application, features specification, fabrication problems, Special treatments. Titanium and its alloys: Applications, machining, forming, welding and heat treatment. Video link / Additional online information (related to module if any): https://nptel.ac.in/courses/113/105/113105021/ https://www.intechopen.com/books/aluminium-alloys-recent-trends-in-processing-characterization-mechanical-behavior-and-applications	**7 Hrs**
UNIT-III	
Ferrous materials in aircraft construction: Steels : low, medium and high carbon steels , alloy steels, corrosion resistant steels, structural applications. Maraging Steels: Properties and Applications. Super Alloys: Use - Nickel base - Cobalt base - Iron base - Forging and Casting of Super alloys - Welding, Heat treatment. Video link / Additional online information (related to module if any): https://nptel.ac.in/courses/113/105/113105057/ https://nptel.ac.in/courses/113/104/113104059/	**7 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the knowledge about the phase diagrams and microstructure of alloys.
CO2	Explain the applications of Non-ferrous alloys in Aircraft and Aerospace industry.
CO3	Gain knowledge about the application of Ferrous alloys in Aircraft construction

Reference Books	
1.	Titterton G F, Aircraft Material and Processes, English Book Store, New Delhi, 5th edition, 1998, ISBN-13: 978-8175980136

2.	Introduction to Physical Metallurgy by Sydney Avner, Tata McGraw-Hill Edition 1997.
3.	Hill E T, The Materials of Aircraft Construction, Pitman London.
4.	C G Krishnadas Nair, Handbook of Aircraft materials, Interline publishers, Bangalore, 1993

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

High-3, Medium-2, Low-1

Semester: III		
Diploma Mathematics-I		
Course Code:	**MVJ21MATDIP31**	**CIE Marks:100**
Credits: L:T:P:S: 1:2:0:0		**SEE Marks: 100**
Hours: 30L+26T		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	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.	

UNIT-I	
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	**8 Hrs**
UNIT-II	
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	**8 Hrs**

https://nptel.ac.in/courses/111/105/111105122/	
UNIT-III	
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	**8 Hrs**
UNIT-IV	
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/	**8 Hrs**
UNIT-V	
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	**8 Hrs**

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

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

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

High-3, Medium-2, Low-1