VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
B.E. in MECHANICAL ENGINEERING
Scheme of Teaching and Examinations 2021
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021 - 22)

V SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	/	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	BSC 21ME51	Theory of Machines	TD: ME PSB: ME	2	2	0	0	03	50	50	100	3
2	IPCC 21ME52	Thermo-fluids Engineering	TD: ME PSB: ME	3	0	2	0	03	50	50	100	4
3	PCC 21ME53	Finite Element Analysis	TD: ME PSB: ME	2	0	2	0	03	50	50	100	3
4	PCC 21ME54	Modern Mobility and Automotive Mechanics	TD: ME PSB: ME	3	0	0	0	03	50	50	100	3
5	PCC 21MEL55	Design lab	TD: ME PSB: ME	0	0	2	0	03	50	50	100	1
6	AEC 21XX56	Research Methodology & Intellectual Property Rights	TD: Any Department PSB: As identified by University	2	0	0	0	02	50	50	100	2
7	HSMC 21CIV57	Environmental Studies	TD: Civil/ Environmental /Chemistry/ Biotech. PSB: Civil Engg	2	0	0	0	1	50	50	100	1
8	AEC 21ME58X	Ability Enhancement Course-V	Concerned Board	If offered as Theory courses: 0	2	0		01	50	50	100	1
				If offered as lab.Courses: 0	0	2		02				
								Total	**400**	**400**	**800**	**18**

Ability Enhancement Course – IV

21ME581	Basics of MATLAB(0-0-2-0)	21ME583	VFX – Visual Effects (0-2-0-0)
21ME582	Digital Marketing (0-2-0-0)		

Note: BSC: Basic Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, AEC –Ability Enhancement Course INT –Internship, HSMC: Humanity and Social Science & Management Courses.
L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). Theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

Semester - V

THEORY OF MACHINES			
Course Code	**21ME51**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2-2-0-0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To understand the concept of machines, mechanisms and to analyze a mechanism for displacement, velocity and acceleration at any point in a moving link.
- To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms
- To understand the theory of gears and gear trains.
- To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
- To understand the principles in mechanisms used for speed control and stability control.
- To compute the natural and damped frequencies of free 1-DOF mechanical systems and to analyze the vibrational motion of 1-DOF mechanical systems under harmonic excitation conditions.

Teaching-Learning Process (General Instructions)

These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
- Chalk and Talk method for Problem Solving.
- Adopt flipped classroom teaching method.
- Adopt collaborative (Group Learning) learning in the class.
- Adopt Problem Based Learning (PBL), which fosters students' analytical skills and develops thinking skills such as evaluating, generalizing, and analysing information.

Module-1	
Introduction: Mechanisms and machines, Kinematic pairs-types, degree of freedom, Kinematic chains and their classification, Kinematic inversions, **Velocity and Acceleration analysis of planar mechanisms Graphical method:** Velocity and Acceleration Analysis of Mechanisms Velocity and acceleration analysis of four bar mechanism, slider crank mechanism. Mechanism illustrating Corioli's component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing. **Velocity and Acceleration Analysis of Mechanisms (Analytical Method):**Velocity and acceleration analysis of four bar mechanism, slider crank mechanism using complex algebra method.	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board
Module-2	
Static force analysis: Static equilibrium, analysis of four bar mechanism, slider crank mechanism. **Dynamic force analysis**: D'Alembert's principle, analysis of four bar and slider crank mechanism. **Flywheel:** Introduction to Flywheel and calculation of its size for simple machines like punching machine, shearing machine	
Teaching-Learning Process	. 1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board
Module-3	

Spur Gears: Gear terminology, law of gearing, path of contact, arc of contact, contact ratio of spur gear. Interference in involute gears, methods of avoiding interference, condition and expressions for minimum number of teeth to avoid interference. **Gear Trains**: Simple gear trains, compound gear trains. Epicyclic gear trains: Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains, torque calculation in epicyclic gear trains. Discussions on applications of gear trains.	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board
Module-4	
Balancing of Rotating Masses: Static and Dynamic Balancing, Balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes. Discussions on applications. **Balancing of Reciprocating Masses**: Inertia Effect of crank and connecting rod, Single cylinder Engine, Balancing in multi cylinder-inline engine (primary and secondary forces). Discussions on applications **Governors:**Types of Governors; Force Analysis of Porter and Hartnell Governors. Controlling Force, Stability, Sensitiveness, Isochronism, Effort and Power. Discussion on applications.	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board
Module-5	
Free vibrations: Basic elements of vibrating system, Types of free vibrations, Longitudinal vibrations- Equilibrium method, D'Alembert's principle, Determination of natural frequency of single degree freedom systems, Damped free vibrations: Under damped, over damped and critically damped systems. Logarithmic decrement. **Forced vibrations**: Undamped forced vibration of spring mass system, Damped forced vibrations, Rotating unbalance, Reciprocating unbalance, Vibration isolation, Critical speed. Discussions on applications.	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board
Course outcome (Course Skill Set) At the end of the course the student will be able to : • Knowledge of mechanisms and their motion and the inversions of mechanisms • Analyse the velocity, acceleration of links and joints of mechanisms.. • Analyse the mechanisms for static and dynamic equilibrium. • Carry out the balancing of rotating and reciprocating masses • Analyse different types of governors used in real life situation. • Analyze the free and forced vibration phenomenon.	

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester
- Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

- At the end of the 13th week of the semester
- The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

- The question paper will have ten questions. Each question is set for 20 marks.Marks scored shall be reduced proportionally to 50 marks
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

Suggested Learning Resources:

Books

1 Theory of Machines Kinematics and Dynamics Sadhu Singh Pearson Third edition 2019

2 Mechanism and Machine Theory G. Ambekar PHI 2009

Reference Books

1 Theory of Machines Rattan S.S Tata McGraw-Hill Publishing Company 2014

2 Mechanisms and Machines- Kinematics, Dynamics and Synthesis Michael M Stanisic Cengage Learning 2016

Web links and Video Lectures (e-Resources):

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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Course Seminar
- Term project
- Assignment

Semester - V

THERMO-FLUIDS ENGINEERING (IPCC)			
Course Code	**21ME52**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 13 Lab slots*	Total Marks	100
Credits	04	Exam Hours	03

**** Additional one hour may be considered as Instructional duration wherever required***

Course objectives:

Student will be able

- To understand the concepts of testing of I. C. Engines and methods to estimate Indicated, Brake and Frictional Power and efficiencies.
- To understand theory and performance Calculation of Reciprocating compressor and positive displacement pumps.
- To understand the concepts related to Refrigeration, refrigeration cycles and Air conditioning and get conversant with Psychrometric Charts, Psychrometric processes, human comfort conditions.
- Understand typical construction of a Turbo machine, their working principle, application and conversion of fluid energy to mechanical energy in Turbo machine with utilization factor and degree of reaction.
- Understand the working principle of hydraulic turbines and steam turbine

Teaching-Learning Process (General Instructions)

These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
- Chalk and Talk method for Problem Solving.
- Adopt flipped classroom teaching method.
- Adopt collaborative (Group Learning) learning in the class.
- Adopt Problem Based Learning (PBL), which fosters students' analytical skills and develops thinking skills such as evaluating, generalizing, and analysing information.

MODULE-1 **8 HOURS**

Performance Testing of IC Engines: Two-stroke and Four-stroke I.C. engines - Measurement of speed, air flow, fuel consumption, Measurement of Brake Power and Indicated Power, Performance curves, Heat Balance sheet., Frictional power: various methods – Willan's line, Morse test, motoring etc.

Reciprocating Air Compressors: Operation of a single stage reciprocating compressors: work input through p-v diagram, effect of clearance and volumetric efficiency, adiabatic, isothermal and mechanical efficiencies. Multi-stage compressor, saving in work, optimum intermediate pressure, inter-cooling, minimum work for compression. Discussion on application.

Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving/White board

MODULE-2 **8 HOURS**

Refrigeration: Vapour compression refrigeration system; description, analysis, refrigerating effect, capacity, power required, units of refrigeration, COP, reversed Carnot cycle, vapour absorption refrigeration system and Air refrigeration system. Use of refrigeration tables and p-h chart. Classification of Refrigerants. Desirable properties of refrigerants.

Psychrometries: Atmospheric air and Psychrometric properties: DBT, WBT, DPT, partial pressure, specific and relative humidity and relation between the enthalpy and adiabatic saturation temperatures. Construction and use of psychrometric chart. Analysis of various processes: Heating, cooling, dehumidifying and humidifying. Adiabatic mixing of stream of moist air. Analysis of summer and winter air-conditioning systems. Discussion on commercial Air conditioning systems.

Teaching-Learning Process	. 1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board

MODULE-3	**8 HOURS**
Introduction to Turbo machines: Classification of Turbomachines, Basic constructional details, Euler's equation for a Turbo machine, Impulse & Reaction machine - Axial flow and radial flow machines, utilization factor, degree of reaction & efficiencies of Turbo machines, **Introduction to positive displacement machines:** Classification, comparison with turbomachines. Construction and working of reciprocating pump, gear and vane pumps. Discussion on engineering applications.	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving/White board

MODULE-4	**8 HOURS**
Hydraulic Turbines: Classification of hydraulic turbines, Various heads and efficiencies, working principle, Velocity triangles, work done, efficiencies etc in Pelton wheel, Francis turbine and Kaplan turbine. Draft tubes, Cavitation in reaction turbines, characteristic curves.Significance of Specific speed and Unit quantities. **Centrifugal Pumps:** Main Parts of centrifugal pump, Various heads and efficiencies, work done, minimum speed for starting centrifugal pump, Classifications- Performance characteristics of centrifugal pumps, Cavitation in pumps and NPSH. Pumps in series and parallel, casings. Discussion on engineering applications.	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving/White board

MODULE 5	**8 HOURS**
Centrifugal Fans, Blowers & Compressors: types; velocity triangles, work done and degree of reaction, size & speed; vane shape & efficiency; vane shape & characteristics; actual performances characteristics; Concept of slip and slip coefficient. Discussion on engineering applications. **Steam and gas Turbines:** Impulse turbines, Staging - expression for work done in a 2-stage velocity compounded turbine-effect of blade & nozzle losses- Reaction staging- reheat factor- performance characteristics, problems using Mollier's chart & introduction to gas turbines.	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board

PRACTICAL COMPONENT OF IPCC

Use of modern computing tools preferred in analysis of performance and estimations

Sl.NO	**Experiments**
1	Determination of calorific value of solid/liquid fuels using Bomb Calorimeter
2	Determination of calorific value of gaseous fuels using Junker's Gas Calorimeter.
3	Performance test on single cylinder engine four/two stroke and draw Heat balance sheet
4	Performance test on multi cylinder engine, draw Heat balance sheet and perform Morse test
5	Performance test on Vapour compression refrigeration -test rig.
6	Performance test on Air conditioning-test rig.
7	Performance test on single/multi stage Reciprocating compressor.
8	Performance test on single / multi-stage centrifugal pump.
9	Performance test on Pelton turbine and draw main and operating characteristics.
10	Performance test on Franci's turbine and draw main and operating characteristics.
11	Performance test on Kaplan turbine and draw main and operating characteristics.

12	Performance test on centrifugal blower and draw performance characteristics for different vane shapes.
13	Demonstration on Computerised IC Engine test rig for its performance and analysis.

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Apply the concepts of testing of I. C. Engines and evaluate their performance, and evaluate the performance of Reciprocating compressor.
- Apply and analyse the concepts related to Refrigeration and Air conditioning, and get conversant with Psychrometric Charts, Psychrometric processes, human comfort conditions.
- Explain the construction, classification and working principle of the Turbo machines and apply of Euler's turbine equation to evaluate the energy transfer and other related parameters. Compare and evaluate the performance of positive displacement pumps.
- Classify, explain and analyse the various types of hydraulic turbines and centrifugal pumps.
- Classify, explain and analyse various types of steam turbines and centrifugal compressor.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The**15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

- The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be reduced proportionally to 50 marks
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3

sub-questions), **should have a mix of topics** under that module.

- The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Text Books

1. Engineering Thermodynamics P.K. Nag Tata McGraw Hill 6th Edition 2018
2. Applications of Thermodynamics V.Kadambi, T. R.Seetharam, K. B. Subramanya Kumar Wiley Indian Private Ltd 1st Edition 2019
3. Turbo machines M. S. Govindegowda and A. M. Nagaraj M. M. Publications 7Th Ed, 2012
4. Thermodynamics Yunus A, Cengel, Michael A Boles Tata McGraw Hill 7th Edition
5. An Introduction to Energy Conversion, Volume III, Turbo machinery, V. Kadambi and Manohar Prasad New Age International Publishers reprint 2008
6. Turbo Machines B.U.Pai Wiley India Pvt, Ltd 1st Edition

Reference Books

1. Principles of Engineering Thermodynamics Michael J, Moran, Howard N. Shapiro Wiley 8th Edition
2. An Introduction to Thermodynamics, Y.V.C.Rao Wiley Eastern Ltd 2003.
3. Thermodynamics Radhakrishnan PHI 2nd revised edition
4. I.C.Engines M.L.Mathur& Sharma. Dhanpat Rai& sons- India
5. Turbines, Compressors & Fans S. M. Yahya Tata McGraw Hill Co. Ltd 2nd edition, 2002
6. Principals of Turbo machines D. G. Shepherd The Macmillan Company 1964
7. Fluid Mechanics & Thermodynamics of Turbo machines S. L. Dixon Elsevier 2005

Web links and Video Lectures (e-Resources):

E- Learning

- Nptel.ac.in
- VTU, E- learning
- MOOCS
- Open courseware

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- **Course seminar**
- **Term project**

Semester - V

FINITE ELEMENT ANALYSIS			
Course Code	**21ME53**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2-0-2*-0	SEE Marks	50
Total Hours of Pedagogy	25 hrs +13 practical sessions	Total Marks	100
Credits	03	Exam Hours	03
**** Additional One hour may be considered for instructions if required***			

Course objectives:

Students will be able

- To learn the basic principles of finite element analysis procedure
- To understand heat transfer problems with application of FEM.
- Solve 1 D, 2 D and dynamic problems using Finite Element Analysis approach.
- To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses.

Teaching-Learning Process (General Instructions)

These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Adopt flipped classroom teaching method.
4. Adopt collaborative (Group Learning) learning in the class.
5. Adopt Problem Based Learning (PBL), which fosters students' analytical skills and develops thinking skills such as evaluating, generalizing, and analysing information.

MODULE-1

Introduction to Finite Element Method: General steps of the finite element method. Engineering applications of finite element method. Advantages of the Finite Element Method.

Potential energy method, Displacement method of finite element formulation. Convergence criteria, Discretization process, ***Rayleigh Ritz method, Galerkin's method (for study purpose only)***

Types of elements: 1D, 2D and 3D, Node numbering, Location of nodes. Strain- displacement relations, Stress-strain relations, Plain stress and Plain strain conditions, temperature effects.

Interpolation models: Simplex, complex and multiplex elements, linear interpolation polynomials in terms of global coordinates 1D, 2D, 3D Simplex Elements.

Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board

MODULE-2

Introduction to the stiffness (Displacement) method: Introduction, One-Dimensional Elements-Analysis of Bars and Trusses, Linear interpolation polynomials in terms of local coordinate's for1D, 2D elements. Higher order interpolation functions for 1D quadratic and cubic elements in natural coordinates, Constant strain triangle, Four-Noded Tetrahedral Element (TET 4), Eight-Noded Hexahedral Element (HEXA 3 8), 2D iso-parametric element,

Numerical Problems: Solution for displacement, stress and strain in 1D straight bars, stepped bars and tapered bars using elimination approach and penalty approach

Teaching-Learning Process	. 1. Power-point Presentation, 2. Video demonstration or Simulations,

	3. Chalk and Talk are used for Problem Solving./White board

MODULE-3

Beams and Shafts: Boundary conditions, Load vector, Hermite shape functions , Beam stiffness matrix based on Euler-Bernoulli beam theory, Numerical problems on simply supported, fixed straight and cantilever beams, propped cantilever beams with concentrated and uniformly distributed load.
Torsion of Shafts: Finite element formulation of shafts, determination of stress and twists in circular shafts.

Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board

MODULE-4

Heat Transfer: Basic equations of heat transfer: Energy balance equation, Rate equation: conduction, convection, radiation, 1D finite element formulation using variational method, Problems with temperature gradient and heat fluxes, heat transfer in composite sections, straight fins.
Fluid Flow: Flow through a porous medium, Flow through pipes of uniform and stepped sections, Flow through hydraulic networks.

Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board

MODULE 5

Axi-symmetric Solid Elements: Derivation of stiffness matrix of axisymmetric bodies with triangular elements, Numerical solution of axisymmetric triangular element(s) subjected to surface forces, point loads, angular velocity, pressure vessels.
Dynamic Considerations: Formulation for point mass and distributed masses, Consistent element mass matrix of one dimensional bar element, truss element, triangular element, beam element. Lumped mass matrix of bar element, truss element, Evaluation of eigen values and eigen vectors, Applications to bars, stepped bars, and beams.

Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk are used for Problem Solving./White board

PRACTICAL COMPONENT

Sl.NO	Experiments
1	**Introduction to FEA software , Pre-processing tools, Solver tools and Post-processing tools.**
2	Analysis of Bars of constant cross section area, tapered cross section area and stepped bar subjected to Point forces, Surface forces and Body forces(Minimum 2 exercises of different types)
3	Analysis of trusses (Minimum 2 exercises of different types)
4	Analysis of Beams – Simply supported, cantilever, Propped cantilever beams with point load , UDL, beams with varying load etc.
5	
6	Stress analysis of a rectangular plate with a circular hole.
7	Thermal Analysis – 1D & 2D problem with conduction and convection boundary conditions (Minimum 2 exercises of different types)
8	
9	Dynamic Analysis to find: Natural frequency of beam with fixed – fixed end condition, Response of beam with fixed – fixed end conditions subjected to forcing function

10	Dynamic Analysis to find: Natural frequency of bar, Response of Bar subjected to forcing functions
11	Demonstrate the use of graphics standards (IGES, STEP etc) to import the model from modeler to solver.
12	Demonstrate one example of contact analysis to learn the procedure to carry out contact analysis.
13	Demonstrate at least two different types of example to model and analyze bars or plates made from composite material.

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Identify the application and characteristics of FEA elements such as bars, beams, plane and isoparametric elements.
- Develop element characteristic equation and generation of global equation.
- Formulate and solve Axi-symmetric and heat transfer problems.
- Apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi-symmetric and dynamic problems.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

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SEE for

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

- The question paper will have ten questions. Each question is set for 20 marks.Marks scored shall be reduced proportionally to 50 marks
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Textbooks

1. A first course in the Finite Element Method, Logan, D. L, Cengage Learning, 6th Edition 2016.
2. Finite Element Method in Engineering, Rao, S. S, Pergaman Int. Library of Science 5th Edition 2010.
3. Finite Elements in Engineering Chandrupatla T. R PHI 2nd Edition 2013

Referencebooks

1. Finite Element Method, J.N.Reddy, McGraw -Hill International Edition.
2. Finite Elements Procedures Bathe K. J PHI

Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- **Course seminar**
- **Term project**

V Semester

MODERN MOBILITY & AUTOMOTIVE MECHANICS			
Course Code	**21ME54**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

- To understand the different chassis design & main components of automobile
- To understand the working of transmission and control system employed in automobiles
- To understand the automotive pollution and alternative automotive technologies under trail
- To understand the upcoming electric vehicle technology

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Explain clearly through Power Point presentations
2. showing live Videos for working of components
3. Demonstration of live working of components through cut section models
4. Inspecting live vehicles
5. Visiting nearby service centres

Module-1	**Chassis & Power Plant**
History of Automobile, Classification of Automobile w.r.t Usage, Chassis, Body, Power Sources, capacity, main components of Internal Combustion Engines and their Functions, Fuel supply system, Cooling System, Lubrication System & Ignition System, Engine Management System, super charged engines, hybrid engines, modern GT engines	
Teaching-Learning Process	Power Point presentations Live Videos for working of components Explaining through live components in class room

Module-2	**Transmission & Suspension System**
Clutches; Plate Clutches, Cone Clutch, Centrifugal Clutch, Fluid Flywheel **Gear Box;** Gear Shifting mechanism, synchromesh Gear box, Torque converter, Automatic Manual Transmission (AMT), Automatic Transmission (AT), intelligent manual Transmission (IMT) Continuously Variable Transmission (CVT), Infinitely Variable Transmission (IVT)- Working of Differential, Rear Axle types &construction. **Suspension** – layout & working of Hydraulic& Air suspension, Independent suspension, Functions& advantages of Leaf Spring, Coil Spring, Telescopic Shock Absorber, Torsion Bar	
Teaching-Learning Process	Power Point presentations Live Videos for working of components Explaining through live components in class room

Module-3	**Control & Safety systems**
Steering system- mechanisms & Linkages, Steering gear boxes- Rack & pinion, worm & wheel construction & working,, power Steering construction & working, steering geometry, Wheel balancing **Braking System**- Mechanism and Linkages; Mechanical Brakes, Hydraulic Brakes, Power Brakes, Parking brakes, ABS, **Safety system** – Safety measures in modern vehicle – safety frames – working of - air bags, seat belt, collapsible steering, spoilers, defoggers, fire safety measures in heavy vehicles, bullet proof vehicles	
Teaching-Learning	Power Point presentations Live Videos for working of components

Process	Explaining through live components in class room
Module-4	**Automotive Emission & Alternate Vehicles**
Exhaust gas pollutants and their effects on environment, Emission norms, IC engine fuels types, extraction& availability, BIO Fuels – Production and impact. Ethanol engines, CNG vehicles- operation, advantages& disadvantages, over view of Hydrogen - fuel cell vehicles, advantages & disadvantages, IC engine/ electric hybrid vehicles over view, layout, transmission & control system, solar powered vehicles- wind powered vehicles, super capacitors, supply rails	
Teaching-Learning Process	Power Point presentations Live Videos for working of components
Module-5	**Electric Vehicles& Storage Batteries**
Electric vehicles principle and components- layout of two & 4 wheeler, Motors used in Electric vehicles –types- over view of construction and working, power transmission & control system in Electric vehicles. Batteries –construction & working principle of Lead acid, nickel based, sodium based, Lithium & Metal Air batteries. Battery charging types and requirements, battery cooling, fire safety measures in EV vehicles	
Teaching-Learning Process	Power Point presentations Live Videos for working of components

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

5. Understand the working of different systems employed in automobile
6. Analyse the limitation of present day automobiles
7. Evaluate the energy sources suitability
8. Apply the knowledge for selection of automobiles based on their suitability

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester
- Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

- At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(To have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

- The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be reduced proportionally to 50 marks
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

Suggested Learning Resources:

Books

- Electric Vehicle Technology Explained James Larminie Oxford Brookes University, Oxford, UK John Lowry Acenti Designs Ltd., UK
- Automobile engineering, Kirpal Singh, Vol I and II (12th Edition) Standard Publishers 2011 2
- Automotive Mechanics, S. Srinivasan, (2nd Edition) Tata McGraw Hill 2003.
- Automotive Systems & Modern Mobility by Dr T Madhusudhan, et al., Cengage publications
- Automotive mechanics, William H Crouse & Donald L Anglin (10th Edition) Tata McGraw Hill Publishing Company Ltd., 2007.
- Modren Electric, Hybrid Electric, and Fuel Cell Vehicles,MehrdadEhsani, YiminGao, CRC Press, Taylor & Francis Group
- Automotive mechanics: Principles and Practices, Joseph Heitner, D Van Nostrand Company, Inc
- . Fundamentals of Automobile Engineering, K.K.Ramalingam, Scitech Publications (India) Pvt. Ltd. 4.
- Automobile Engineering, R. B. Gupta, SatyaPrakashan,(4th Edition) 1984.

Web links and Video Lectures (e-Resources):

https://archive.nptel.ac.in/courses/107/106/107106088/
https://onlinecourses.nptel.ac.in/noc20_de06/preview
https://www.digimat.in/nptel/courses/video/107106088/L01.html
https://nptel.ac.in/courses/107106088
https://www.youtube.com/watch?v=LZ82iANWBL0&list=PLbMVogVj5nJTW50jj9_gvJmdwFWHaqR5J

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Operate the cut section models of complete vehicle chassis and observe the working of all components
- Dismantle & Assemble the Automotive Engine, Gear Box, Clutch, brakes
- Prepare the posters of automobile chassis & display
- Visit nearby automobile showrooms/ service station
- Prepare a comparison statement of different automobiles using specification provided by respective manufacturers
- Visit auto expo

Semester V

DESIGN LAB			
Course Code	**21MEL55**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0-0-2*-0	SEE Marks	50
Credits	01	Exam Hours	03

**** Additional one hour may be considered for instructions if required.***

Course objectives:

The students will be able

- To understand the concepts of natural frequency, logarithmic decrement, damping and damping ratio.
- To understand the techniques of balancing of rotating masses and influence of gyroscopic couple.
- To verify the concept of the critical speed of a rotating shaft.
- To illustrate the concept of stress concentration using Photo elasticity.
- To appreciate the equilibrium speed, sensitiveness, power and effort of a Governor.
- To illustrate the principles of pressure development in an oil film of a hydrodynamic journal bearing.
- To visualize different mechanisms and cam motions

Modern computing techniques are preferred to be used wherever possible.

Sl.NO	Experiments
1	Determination of natural frequency, logarithmic decrement, damping ratio and damping coefficient in a single degree of freedom vibrating systems (longitudinal and torsional)
2	Balancing of rotating masses
3	Determination of critical speed of a rotating shaft
4	Determination of equilibrium speed, sensitiveness, power and effort of Porter/Proell /Hartnel Governor.
5	Determination of Pressure distribution in Journal bearing
6	Study the principle of working of a Gyroscope and demonstrate the Effect of gyroscopic Couple on plane disc
7	Study of different types of cams, types of followers and typical follower motions. Obtain cam profile for any two types of follower motions and types of follower
8	
9	Determination of Fringe constant of Photo-elastic material using. a) Circular disc subjected to diametral compression. b) Pure bending specimen (four-point bending).
	Demonstration Experiments (For CIE)
10	**Demonstration and study of operation of different Mechanisms and their Inversions:** Slider crank chain, Double slider crank chain and its inversions, Quick return motion mechanisms- Peaucellier's mechanism. Geneva wheel mechanism, Ratchet and Pawl mechanism, toggle mechanism, pantograph, Ackerman steering gear mechanism.
11	
12	Demonstration of stress concentration using Photo-elasticity for simple components like plate with a hole under tension or bending, circular disk with circular hole under compression,

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Compute the natural frequency of the free and forced vibration of single degree freedom systems, critical speed of shafts.
- Carry out balancing of rotating masses and gyroscope phenomenon.
- Analyse the governor characteristics.
- Determine stresses in disk, beams and plates using photo elastic bench.
- Determination of Pressure distribution in Journal bearing
- Analyse the stress and strains using strain gauges in compression and bending test
- To realize different mechanisms and cam motions

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination(SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8^{th} week of the semester and the second test shall be conducted after the 14^{th} week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners

jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

1. Theory of Machines, Rattan S.S , Tata McGraw-Hill Publishing Company, 2014
2. Experimental Stress analysis, M. M. Frotch, McGraw-Hill

BASICS OF MATLAB			
Course Code	**21ME581**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2*:0	SEE Marks	50
Credits	01	Exam Hours	02

**** Additional one hour may be considered for instructions, if required***

Course objectives:

1. To know about fundamentals of MATLAB tool.
2. To provide an overview to program curve fitting & solve Linear and Nonlinear Equations.
3. To understand the concept and importance of Fourier transforms.
4. To gain knowledge about MATLAB Simulink & solve Electrical engineering problems.

Sl.NO	Experiments
1 2	**Introduction to MATLAB Programming:** Basics of MATLAB Programming, array operations in MATLAB, loops and execution of control, working with files: Scripts and functions**,** plotting and programming output, examples.
3 4	**Numerical Methods and their applications: Curve Fitting: Straight line fit, Polynomial fit.**
5 6	**Numerical Integration and Differentiation:** Trapezoidal method, Simpson method.
7 8	**Linear and Nonlinear Equations:** Eigen values, Eigen vectors, Solution of linear algebraic equations using Gauss Elimination and LU decomposition, Solution of nonlinear equation in single variable using Gauss-Siedal and Newton-Raphson method.
9 10	**Ordinary Differential Equations:** Introduction to ODE's, Euler's method, second order RungaKutta method, MATLAB ode45 algorithm in single variable and multivariables. **Transforms:** Discrete Fourier Transforms,
11 12 13	Application of MATLAB to analyse problems in basic engineering mechanics, mechanical vibrations, control system, statistics and dynamics of different circuits. **MATLAB Simulink:** Introduction to MATLAB Simulink, Simulink libraries, development of basic models in Simscape Power Systems

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Able to implement loops, branching, control instruction and functions in MATLAB programming environment.
- Able to program curve fitting, numerical differentiation and integration, solution of linear equations in MATLAB and solve electrical engineering problems.
- Able to understand implementation of ODE using ode 45 and execute Solutions of nonlinear equations and DFT in MATLAB.
- Able to simulate MATLAB Simulink examples

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination(SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8^{th} week of the semester and the second test shall be conducted after the 14^{th} week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

Text Books:

1. Agam Kumar Tyagi, "**MATLAB and Simulink for Engineers**", OXFORD Higher Education.
2. Dr. Shailendra Jain, "**Modeling& Simulation using MATLAB – Simulink**", Wiley – India.

Reference Books:

1. Won Y.Tang, Wemun Cao, Tae-Sang Ching and John Morris, "**Applied Numerical Methods Using MATLAB**", A John Wiley & Sons.
2. Steven T. Karris, "**Introduction to Simulink with Engineering Applications**", Orchard Publications.

Semester 05

DIGITAL MARKETING			
Course Code	21ME582	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:2:0:0	SEE Marks	50
Total Hours of Pedagogy	30	Total Marks	100
Credits	01	Exam Hours	01

Course objectives:

- To provide with the knowledge about business advantages of the digital marketing and its importance for marketing success;
- To develop a digital marketing plan;
- To make SWOT analysis;
- To define a target group;
- To get introduced to various digital channels, their advantages and ways of integration;
- To integrate different digital media and create marketing content;
- To optimize a Website and SEO optimization;
- To create Google AdWords campaigns; social media planning;
- To get basic knowledge of Google Analytics for measuring effects of digital marketing and getting insight of future trends that will affect the future development of the digital marketing.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

15. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
16. Chalk and Talk method for Problem Solving.
17. Adopt flipped classroom teaching method.
18. Adopt collaborative (Group Learning) learning in the class.
19. Adopt Problem Based Learning (PBL), which fosters students' analytical skills and develops thinking skills such as evaluating, generalizing, and analysing information.

Module-1	
Introduction to the Course and Work plan, Introduction of the digital marketing, Digital vs. Real Marketing, Digital Marketing Channels Creating initial digital marketing plan, Content management, SWOT analysis, Target group analysis, Web design, Optimization of Web sites, MS Expression Web	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk

Module-2	
SEO Optimization, Writing the SEO content Google AdWords- creating accounts, Google AdWords- types Introduction to CRM, CRM platform, CRM models	
Teaching-Learning Process	. 1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk

Module-3	
Introduction to Web analytics, Web analytics – levels, Introduction of Social Media Marketing Creating a Facebook page, Visual identity of a Facebook page, Types of publications Business opportunities and Instagram options, Optimization of Instagram profiles, Integrating Instagram with a Web Site and other social networks, keeping up with posts	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk

Module-4

Business tools on LinkedIn,Creating campaigns on LinkedIn, Analyzing visitation on LinkedIn Creating business accounts on YouTube, YouTube Advertising, YouTube Analytics Facebook Ads, Creating Facebook Ads, Ads Visibility	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk
Module-5	
E-mail marketing, E-mail marketing plan, E-mail marketing campaign analysis, Keeping up with conversions Digital Marketing Budgeting- resource planning, cost estimating, cost budgeting, cost control	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

- toidentifytheimportance of the digital marketing for marketing success,
- to manage customer relationships across all digital channels and build better customer relationships,
- to create a digital marketing plan, starting from the SWOT analysis and defining a target group, then identifying digital channels, their advantages and limitations,
- to perceive ways of the integration taking into consideration the available budget.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of **20 Marks (duration 01 hour**)

13. First test at the end of 5th week of the semester
14. Second test at the end of the 10th week of the semester
15. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

9. First assignment at the end of 4th week of the semester
10. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be **scaled down to 50 marks**

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books

1. Ryan, D. (2014). Understanding Digital Marketing
2. Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited
3. The Beginner's Guide to Digital Marketing (2015). Digital Marketer
4. Pulizzi,J.(2014) Epic Content Marketing, Mc-graw Hill Education.

Web links and Video Lectures (e-Resources):

- .

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

DefineaTargetGroup;CreatingWebSites;WritingtheSEOcontent;SEOOptimizacija;GoogleAdWords;CRM Platform; Social Media Marketing Plan; Making a Facebook page; Budgeting; Final presentation.

Semester

VFX: VISUAL EFFECTS			
Course Code	21ME583	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:2:0:0	SEE Marks	50
Total Hours of Pedagogy	30	Total Marks	100
Credits	01	Exam Hours	01

Course objectives:

To expose the students to the following:

1. To learn the Basics of compositing using layer based compositing software.
2. To understand the tools and techniques of compositing.
3. To practice the categories in compositing process.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

20. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
21. Chalk and Talk method for Problem Solving.
22. Adopt flipped classroom teaching method.
23. Adopt collaborative (Group Learning) learning in the class.
24. Adopt Problem Based Learning (PBL), which fosters students' analytical skills and develops thinking skills such as evaluating, generalizing, and analysing information.

Module-1	
Visual Effects: Set Up Your VFX Content Development Workstation, The Foundation of Raster for VFX: Pixels, Color, and Alpha; The Foundation of Motion for VFX: Frames and Codecs; The Foundation of Audio for VFX: MIDI, Wave, and Sample.	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk

Module-2	
The Foundation of 2D Vector for VFX: Point, Path, and SVG; The Foundation of 3D Vector for VFX: Models and OpenGL; Professional VFX Software: Black magic Design Fusion; VFX Pipeline Composition: Using the Flow Node Editor.	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk

Module-3	
VFX Pipeline Animation: Using the Timeline Editor; VFX Pipeline Motion Control: Using the Spline Editor; VFX Pipeline Pixel Isolation: Animated Polyline Masking; VFX Pipeline Automated Masking: Matte Generators.	
Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk

Module-4	
VFX Pipeline Pixel Tracking: Using Motion Tracking; VFX Pipeline 3D Production: Compositing 3D Assets; VFX Pipeline 3D Rendering: Shader, Material, and Texture; VFX Pipeline 3D Modeling: 3D Text-Title Creation.	
Teaching-Learning	1. Power-point Presentation, 2. Video demonstration or Simulations,

Process	3. Chalk and Talk

Module-5
VFX Pipeline 3D Animation: 3D Text-Titling Modifiers; Advanced VFX Pipeline Effects: 3D Particle Systems; Advanced VFX Pipeline Physics: 3D Particle Physics; Advanced Interactive VFX: i3D Content Publishing.

Teaching-Learning Process	1. Power-point Presentation, 2. Video demonstration or Simulations, 3. Chalk and Talk

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

- Gain good understanding about compositing process.
- Identify major applications of compositing process used in industry.
- Develop a visual effects pipeline.
- Demonstrate an in-depth knowledge of grading and VFX principles, practice and system capabilities.
- Create customized tools through software or scripting to allow for more creative application of visual effects techniques.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester
- Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be **scaled down to 50 marks**

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books

1. Karen E. Goulekas Visual effects in a digital world

2. Wallace Jackson Vfx fundamentals: visual special effects using fusion 8.0

3. Martin Watt and Erwin Coumans [Digital] Visual Effects and Compositing

Web links and Video Lectures (e-Resources):

1. http://chrisoatley.com/upcoming2015/
2. https://thewaltdisneycompany.com/employee-profile-spotlight-on-a-visualdevelopment-artist-2/
3. http://www.artofvfx.com/escape-plan-chris-wells-vfx-supervisor-hydraulx/
4. http://conceptartworld.com/artists/interview-with-visual-development-artistlandis-fields/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning •