VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

Scheme of instruction and examination (R-19 Revised)
M.E. (ADM) : FIRST SEMESTER 2019-20

M.E. (ADM) I-SEMESTER									
S. No	Course Code	Course Title	Scheme of Instruction Hours per week			Scheme of Examination			
			L	T	P	Duration in Hrs	Max. Marks SEE	Max. Marks CIE	Cr.
Theory									
1	PI19HS110EH	Skill Development Course -I: Communication Skills in English	1	-	-	1.5	40	30	1
	PI19AC110EH	Audit Course I – English for Research Paper writing	2	-	-	3	60	40	0
2	PI19PC110MA	Mathematical Methods for Engineers	3	-	-	3	60	40	3
3	PI19PC100ME	Metal Cutting and Forming	3	-	-	3	60	40	3
4	PI19PC110ME	Computer Integrated Design and manufacturing	3	-	-	3	60	40	3
5	PI19PE1XXME	Professional Elective -I	3	-	-	3	60	40	3
6	PI19PE1XXME	Professional Elective -II	3	-	-	3	60	40	3
7	PI19PE1XXME	Professional Elective -III	3	-	-	3	60	40	3
Labs									
8	PI19PC111ME	Computer Aided Modelling and Assembly Lab	-	-	3	-	-	50	1.5
9	PI19PC121ME	Advanced Manufacturing Lab	-	-	3	-	-	50	1.5
10	PI19PC118ME	Seminar	-	-	2	-	-	50	1
		Total	21	-	8		460	460	23
		Grand Total	29				920		
Left over hours allotted to Library / PDC / Proctorial Interaction /Academic Support / CC / RC / TC / CCA / ECA									

Scheme of instruction and examination (R-19 Revised)
M.E. (ADM) : SECOND SEMESTER 2019-20

M.E. (ADM) II-SEMESTER									
S. No	Course Code	Course Title	Scheme of Instruction Hours per week			Scheme of Examination			
			L	T	P	Duration in Hrs	Max. Marks SEE	Max. Marks CIE	Cr.
Theory									
1	PI19HS110EH	Skill Development Course-II: Soft Skills	1	-	-	1.5	40	30	1
	PI19AC210EH	Audit Course 2: Pedagogy Studies	2	-	-	3	60	40	0
2	PI19PC240ME	Research Methodology and IPR	2	-	-	3	60	40	2
3	PI19PC210ME	Design for Manufacture and Assembly	3	-	-	3	60	40	3
4	PI19PC220ME	Metallurgy of Metal Casting and Welding	3	-	-	3	60	40	3
5	PI19PC230ME	Computer Aided Mechanical Design and Analysis	3	-	-	3	60	40	3
6	PI19PE2X0ME	Professional Elective – IV	3	-	-	3	60	40	3
7	PI19PE2X4ME	Professional Elective – V	3	-	-	3	60	40	3
Labs									
8	PI19PC231ME	Vibration Analysis Lab	-	-	3	-	-	50	1.5
9	PI19PC241ME	Computer Aided Simulation Lab	-	-	3	-	-	50	1.5
10	PI19PW219ME	Mini Project	-	-	2	-	-	50	1
		Total	20	-	8		460	460	22
		Grand Total	28				920		
Left over hours allotted to Library / PDC / Proctorial Interaction /Academic Support / CC / RC / TC / CCA / ECA									

VASAVI COLLEGE OF ENGINEERING(Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

Scheme of instruction and examination (R-19 Revised)
M.E. (ADM) : THIRD SEMESTER 2019-20

M.E. (ADM) III-SEMESTER									
S. No	Course Code	Course Title	Scheme of Examination			Scheme of Examination			
			Hours per Week			Duration in Hrs	Maximum Marks		Credits
			L	T	P		SEE	CIE	
Theory									
1	PI19OE3XXXX	Open Elective	3	0	0	3	60	40	3
2	PI19PE3X5ME	Professional Elective – VI	3	0	0	3	60	40	3
LABS									
3	PI19PW319ME	Dissertation – Phase I / Internship	0	0	8	-	-	100	4
		Total	6	-	8		120	180	10
		Grand Total	14				300		10

Scheme of instruction and examination (R-19 Revised)
M.E. (ADM) : FOURTH SEMESTER 2019-20

M.E. (ADM) IV-SEMESTER									
S. No	Course Code	Course Title	Scheme of Instruction			Scheme of Examination			
			Hours per Week			Duration in Hrs	Maximum Marks		Credits
			L	T	P		SEE	CIE	
1	PI19PW419ME	Dissertation - Phase II / Internship	0	0	24	-	Viva-Voce (Grade)		12
		Total	0	0	24				12
		Grand Total	24						12

OE: Open Electives		
Sl. No.	**Course Code**	**Course Title**
1	PI19OE310XX	Business Analytics
2	PI19OE320XX	Industrial Safety
3	PI19OE330ME	Operations Research
4	PI19OE340XX	Cost Management of Engineering Projects
5	PI19OE350ME	Composite Materials
6	PI19OE360XX	Waste to Energy

AC: Audit Courses		
Sl. No.	**Course Code**	**Course Title**
1	PI19AC110EH	English for Research Paper Writing
2	PI19AC210EH	Pedagogy Studies
3	PI19ACX20XX	Disaster Management
4	PI19ACX30XX	Sanskrit for Technical Knowledge
5	PI19ACX40XX	Value Education
6	PI19ACX50XX	Constitution of India
7	PI19ACX70XX	Stress Management by Yoga
8	PI19ACX80XX	Personality Development through Life Enlightenment Skills

PE: Professional Electives		
Professional Elective-I (Design Group)		
1	PI19PE100ME	Mechanical Vibrations
2	PI19PE110ME	Advanced Kinematics
3	PI19PE120ME	Robotic Engineering
Professional Elective-II (Manufacturing Group)		
1	PI19PE130ME	Flexible Manufacturing systems
2	PI19PE140ME	Quality and Reliability Engineering
3	PI19PE150ME	An Introduction to Nano Science and Technology
Professional Elective-III (Analysis Group)		
1	PI19PE160ME	Finite Element Techniques
2	PI19PE170ME	Experimental Techniques and Data Analysis
3	PI19PE180ME	Fracture Mechanics
Professional Elective-IV (Design Group)		
1	PI19PE200ME	Theory of Elasticity and Plasticity
2	PI19PE210ME	Tribology in Design
3	PI19PE220ME	Mechanics of Composite materials
Professional Elective-V (Manufacturing Group)		
1	PI19PE230ME	Advanced Non Destructive Evaluation Techniques
2	PI19PE240ME	Additive Manufacturing
3	PI19PE250ME	Mechatronics
Professional Elective-VI (Analysis Group)		
1	PI19PE300ME	Optimization Techniques
2	PI19PE310ME	Advanced Finite Element Analysis
3	PI19PE320ME	Computational Fluid Dynamics

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

METAL CUTTING AND FORMING

SYLLABUS FOR M.E.I-SEMESTER

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: **PI19PC100ME**
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course are to: 1. Explain the principles of metal cutting 2. Discuss various shear angle relations 3. Discuss effects of temperature and forces in metal cutting 4. Describe various plastic deformation theories 5. Identify and differentiate various non conventional forming methods	On completion of the course, the student will be able to: 1. analyse various metal cutting processes. 2. formulate equations of temperature distribution and forces in metal cutting. 3. appreciate methods of improving cutting efficiency and economics. 4. evaluate different metal forming methods. 5. analyze various non conventional forming methods.

UNIT-I: TOOL MATERIALS

Tool material properties – HSS, Carbides, coated carbides, ceramic and CBN and diamonds, sialons, powder coatings – Relative advantages. Tool Geometry: Various methods of tool nomenclature and their inter relationship. Theoretical Determination of shear angle and cutting forces: Shear plane theory–Merchants models, Lee and Shofers model. Velocity relations. Estimation of shear angle experimentally. Metal cutting friction. Real area of contact-Rules of dry sliding, stress distribution of tool face-variation of co-efficient of tool face friction with the rake angle.

UNIT-II: DYNAMOMETRY

Theoretical and empirical estimation of force and power in turning, drilling, milling and grinding processes optimization in cutting forces – Dynamometer requirements – Force measurements – Electric transducers. Lathe, drilling and milling dynamometers. Cutting Temperatures: Shear Plane temperature – Average chip-tool interface temperature-interface temperature by dimensional analysis – Distribution of shear plane temperature-Measurement of temperature by radiation pyrometer – Moving thermo couple – Photo cell – Photographic method.

UNIT-III: TOOL WEAR, TOOL LIFE AND MACHINABILITY

Mechanism of tool wear – Adhesive, Abrasive, Diffusive and Chemical wear – Taylor‟s tool life equation. Cutting Fluids – Carbon tetrachloride – Direction of fluid application – Chip curl-economics of machining – Comparison of machinability of different metals. Recent development in metal cutting: Hot machining. Rotary machining – High speed machining, rapid proto typing.

UNIT-IV: PLASTIC DEFORMATION

Mechanism of plastic deformation, Factors affecting plastic deformation, Strain hardening behavior. Recovery, Recrystallization and grain growth. Variables affecting stress-strain curves, Ideal & Practical stress-strain curves. Cold working, warm working and hot working. Plasticity cycle. Plane stress & Plane strain condition. Rolling: Principle of rolling, process parameters. Estimation of rolling loads. Principles of roll pass design for various product shapes. Principles of ring rolling.

UNIT-V: UNCONVENTIONAL METHODS IN METAL FORMING

High energy rate forming. Merits and limitations of HERF Processes. Principle, merits, limitations and applications of pneumatic-mechanical systems. Explosive forming, electro-magnetic forming, electro-hydraulic forming and water hammer forming. Forming with rubber pads – Guerin, Marform & Wheelon forming techniques.

Learning Resources:

1. M.C. Shaw. Metal cutting principles – CBS Publications, New Delhi, 1992.
2. Bhattacharya, Metal cutting – Central book publishers, Calcutta – 1996.
3. Heinrich Makelt, Mechanical presses, Edward Arnold (Pvt) Ltd., London, 1968.
4. Bary. Donald.F and Reads. Edward A., Techniques of press working sheet metal, Prentice Hall Publ., 1974.
5. Kameschikov, Forming Practice, Mir Publishers, Moscow, 1970.
6. High Velocity Forming methods, ASTME, Michigan, 1968.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering
COMPUTER INTEGRATED DESIGN AND MANUFACTURING
SYLLABUS FOR M.E.I-SEMESTER

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: **PI19PC110ME**
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course are to: 1. understand the present trends of the product cycle. 2. learn the modern manufacturing methods and its programming part. 3. introduce the concepts of modern prototype manufacturing RPT 4. introduce the present shop floor control methods 5. Learn the network methods of the digital devices.	On completion of the course, the student will be able to: 1. understand the modern methods of design and manufacturing 2. Distinguish production planning and control methods in shop floor 3. Classify the different additive manufacturing methods 4. Describe the modern machining processes 5. Integrate the CAD/CAM operations

UNIT-I
Product Design and CAD/CAM in the Production Systems - Product development through CAD and CAE: Geometric modeling techniques using wireframe, surface and solid modeling-graphic standards, Advanced modeling for curves, surfaces, NURBS- Advanced assembly – assembly constraints – subassembly – modification - concepts of engineering analysis and optimization using CAE techniques.

UNIT-II
Advanced Manufacturing Technology – Design drafting interface, Graphic libraries, Computer aided manufacturing technologies using Numerical Control, CNC and DNC, process interface hardware, programming languages, direct digital control, supervisory compiler controls and optical control, adoptive control – Agile and lean manufacturing.

UNIT-III
Rapid proto typing: Various techniques & mathematical background. Automated inspection & RE-engineering techniques: Point cloud data acquisition & analysis.

UNIT-IV
Concepts of Production Planning, Material Requirement Planning, up to down planning and bottom up replanning – Master production scheduling, PPC, Material Handling Requirements, Technology Planning.

UNIT-V
Communication aspects in CIM – Issues in Implementation of Advanced Manufacturing Technology – configuration management, database systems, networking concepts, LAN, MAN, SQL, CIM Models, Economics of CIM.

Learning Resources:

1. MP Groover, "Automation, Production Systems and Computer Integrated Manufacturing", - Pearson Education, 2nd Edition, 2001.
2. Ibrahim Zeid, "CAD/CAM Theory and Practice", - Tata McGraw Hill, 1991.
3. FH Mitchell, "CIM Systems - An Introduction", - Prentice Hall, 1986.
4. Eric Teicholz & JN, "CIM Handbook", - McGraw Hill, 1986.
5. P.N. Rao, "CAD/CAM Principles and Applications", Tata McGraw Hill, 3rd Ed, 2010

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

RESEARCH METHODOLOGY & IPR

SYLLABUS FOR M.E.II-SEMESTER

L:T:P(Hrs/week):2:0:0	SEE Marks:60	Course Code: **PI19PC240ME**
Credits :02	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course are to: 1. Learn the research methodology and formulation. 2. Know the sources of literature, method for collection of research data and report writing. 3. Understand IPR laws and Acts.	On completion of the course, the student will be able to: 1. explain objectives of research and research process. 2. search the relevant literature and summarize information for formulating the research problem. 3. collect and organize the data for the preparation of research report. 4. explain different types of intellectual property rights and related laws. 5. understand the patent administration system.

Unit-I

Research Methodology: Meaning of research, Objectives and motivation of research, types of research, research approaches, significance of research, research methods versus methodology, criteria of good research, Research problem formulation.

Unit-II

Literature survey: Importance of literature survey, sources of information, Literature review: Need of Literature review, Plagiarism, research ethics, errors in research, Assessment of quality of journals.

Unit-III

Data collection & report preparation: Collection of primary data, secondary data, data organization, methods of data grouping, diagrammatic representation of data, graphic representation of data. Effective technical writing and how to write report, format of a research proposal, contents of a standard technical journal/conference paper, contents of dissertation.

Unit-IV

Introduction to Intellectual property law: Basics and types of intellectual property, international organizations, agencies and treaties.

Law of Trademarks: Purpose and functions of trademarks, types of Marks, acquisition of trade mark rights, protectable matter and trade mark registration process, Trade Mark Act.

Unit-V

Law of copyrights: Introduction, common law rights. Rights of reproduction, rights to display work publicly, other limitations of exclusive rights, copyright ownership issues, copy right registration and Berne convention.

Law of Patents: Administration of Indian patent system , Introduction, rights under patent law. Design patents, Plant patents. Patenting process. Patent ownership and transfer, new developments in IPR and international patent laws, Geographical Indications.

Learning Resources:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'.
2. C. R. Kothari-Research Methodology Methods and Techniques, Second revised edition, New Age International (P) limited Publishers, New Delhi.2013.
3. Ranjitkumar, Research methodology, A step-by-step Guide for Beginners, second Edition, Sage Publications India Pvt Ltd, New Delhi.2017.
4. Panneer Selvam, Research Methodology, Second Edition, PHI Learning Pvt Ltd, New Delhi.
5. Deborah E. Bouchoux -Intellectual Property, the law of trademarks, Copyrights, Patents and Trade Secrets. Fourth Edition, CENGAGE Learning India private Limited, New Delhi.2013.
6. P.Narayana, Intellectual property law, Third Edition, Eastern Law House, New Delhi.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

DESIGN FOR MANUFACTURE AND ASSEMBLY

SYLLABUS FOR M.E.II-SEMESTER

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: **PI19PC210ME**
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course are to: 1. Learn design principles, mechanical properties, geometrical tolerances and economic use of raw materials 2. design metallic components 3. design different casting processes 4. design non-metallic components and study ergonomical aspects 5. design assembled parts	On completion of the course, the student will be able to: 1. select materials for design 2. apply principles for manufacturability for metallic components 3. describe design considerations for castings 4. apply principles for manufacturability for non metallic components 5. assemble the designed parts.

Unit-I: INTRODUCTION

General design principles for manufacturability, Introduction to design for manufacturing concepts, mechanical behavior of materials. Materials and design, evolution of engineering materials and their properties. Materials selection charts, selection of engineering materials and their shape. Importance of product specification and standardization.

Economic Use of Raw Materials: Ferrous steel, hot rolled steel, cold finished steel, stainless steel, non ferrous materials aluminium, copper, brass, non metallic materials, plastics, rubber and composites.

Unit-II: METALLIC COMPONENTS DESIGN

Metal extrusion, metal stamping, fine blanking, spun metal parts, cold headed parts, extruded parts, rolled formed parts, specialized forming methods, turned parts, drilled parts, milled parts.

Unit-III: METALLIC COMPONENTS DESIGN

Planned and shaped parts, internal ground parts, center less ground, electrical discharged, electro chemical parts. Sand cast, die cast and investment cast.

Unit-IV: NON METALLIC COMPONENTS DESIGN

Thermosetting plastic, injection moulded and rotational moulded parts, blow moulded, ceramics. Thermoformed plastic parts, plastic welding, rubber parts, design for ergonomics, design for quality and reliability, design for X concepts.

Unit-V: DESIGN FOR ASSEMBLY

Design for assembly, design for reassembly, design for automated assembly, Assembled Parts Design: Welded parts, arc, resistance, brazed and soldered parts, gear box assembly, bearing assembly. Retention, bolted connection, screwed connections, press fitted connections, heat treated parts, product design requirements.

Case Studies: Identification of economical design and redesign for manufacture.

Learning Resources:

1. James G. Bralla, "*Hand book of product design for manufacturing*" McGraw Hill Co., 1999
2. K.G. Swift "*Knowledge based design for Manufacture*", Kogan page Limited, 1987.
3. Ashby. Materials selection in Mechanical Design fourth edition Elsevier, 2011
4. Boothroyd, Geoffrey, Peter Dewhurst, and Winston A. Knight. "Product Design for Manufacture and Assembly", 3rd edition, Fl: Standards media, 2010
5. Swift, K.G., and J.D. Booker. Manufacturing Process Selection Handbook, Butterworth-Heinemann, 2013.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

METALLURGY OF METAL CASTING AND WELDING

SYLLABUS FOR M.E.II-SEMESTER

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: **PI19PC220ME**
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course are to: 1. familiarize the concepts of Fe-Fe_3C equilibrium diagram. 2. impart knowledge about metallurgy of ferrous and no ferrous castings. 3. familiarize the concepts of various heat treatment processes. 4. study the welding aspects of various ferrous and non-ferrous alloys. 5. study about the defects in welding process.	On completion of the course, the student will be able to: 1. interpret metallurgy of casting for ferrous and non ferrous alloys and their heat treatment process. 2. distinguish various processes in Welding and related heat treatment processes. 3. demonstrate various aspects of welding of alloys of iron, aluminium, magnesium and titanium. 4. predictstresses in welding and their relief. 5. analyse the defects in welding processes

UNIT-I

Solidification of pure metals and alloys, phase diagrams.
Metallurgy of Steel and Cast Iron: Iron-Carbon constitutional equilibrium diagram, Solidification microstructure, effect of cooling rate, carbon content. Types of cast irons.

Solidification of Castings: solidification rate and directional solidification, microstructure of cast metals, shrinkage, gases in cast metals, degasification methods.

UNIT-II

Foundry Refractories, malleabilisation. Heat treatment of cast steel, cast iron, age hardening of castings.
Metallurgy of non-ferrous cast alloys: copper base alloys, Aluminium alloys, Magnesium alloys
Zinc based die casting alloys, Nickel chromium high temperature alloys.

UNIT-III

Welding metallurgy – Weld zone, Fusion boundary zone, Heat affected Zone. Heat treatment and related processes in Fusion welding – Annealing, Normalizing, Austempering, martempering stress relieving, Solution treatment.

UNIT-IV

Micro structural products in weldments – Schaeffer diagram, Delta Ferrite, Austenite, pearlite, Martensite. Effect of Alloying elements on weldments. Welding stresses – Residual stresses, effects, methods of relieving.

UNIT-V

Weldability aspects of low alloy steels, stainless steels, aluminium alloys, Magnesium and Titanium alloys.
Weld cracks – cold and hot cracks; Liquation cracks, Hydrogen Induced cracks, Lamellar cracks.

Learning Resources:

1. Taylor, Flemings & Wulff, "Foundry Engineering", N.Y,Wiley & Song Inc, 1993
2. Heine, Richard.W, and others, "Principles of metal casting", Tata McHill, New York, 1983.
3. Udin Funk & Wulff, "Welding for Engineers", N.Y.John Wiley,1954.
4. J.F. Lancaster, "Metallurgy of welding", London, George Allen & Unwio, 1999.
5. R.S. Parmar, "Welding Engineering & Technology", Delhi, Khanna Publishers, 2007.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

COMPUTER AIDED MECHANICAL DESIGN AND ANALYSIS

SYLLABUS FOR M.E.I-SEMESTER

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: **PI19PC230ME**
Credits :03	CIE Marks:40	Duration of SEE:03Hours

Course Objectives	Course Outcomes
The objectives of this course are to: 1. Explain the design procedure for pressure vessels 2. Discuss the plate bending theories and equations 3. Demonstrate the concept of fracture mechanics 4. Describe the Eigen value problems 5. Identify various methods to perform dynamic analysis	On completion of the course, the student will be able to: 1. analyse the pressure vessels 2. formulate the plate bending equations 3. interpret the behaviour of crack and crack propagation 4. formulate an Eigen value problem and develop its solution 5. apply various methods to obtain solutions in Dynamic analysis

UNIT-I

Design of pressure Vessels: Introduction and constructional features of pressure vessels, stresses in pressure vessels, shrink fit stresses in built up cylinders, autofrettage of thick cylinders, thermal stresses and their significance.

UNIT-II

Stresses in flat plates: Introduction, Bending of plate in one direction, Bending of plate in two perpendicular directions, Thermal stresses in plates, Bending of circular plates of constant thickness, Bending of uniformly loaded plates of constant thickness.

UNIT-III

Fracture Mechanics: Introduction, Modes of fracture failure Griffith Analysis, Energy release rate, Energy release rate of DCB specimen; Stress Intensity Factor: SIF‟s for edge and centre line crack, Fracture toughness, Elastic plastic analysis through J-integral method: Relevance and scope, Definition of J-integral, Path independence, stress strain relation, Strain Energy Release Rate Vs J-integral.

UNIT-IV

Eigen Value Problems: Properties of Eigen values and Eigen Vectors, Torsional, Longitudinal vibration, lateral vibration, Sturm sequence. Subspace iteration and Lanczo‟s method, Component mode synthesis, Eigen value problems applied to stepped beams and bars.

UNIT-V

Dynamic Analysis: Direct integration method, Central difference method, Wilson- method, Newmark method, Mode superposition, Single degree of freedom system response, Multi degree of freedom system response, Rayleigh damping, Condition for stability. (Note: The related algorithms and codes to be practiced by students)

Learning Resources:

1. John, V. Harvey, "Pressure Vessel Design: Nuclear and Chemical Applications", Affiliated East West Press Pvt. Ltd., 1969.
2. Prasanth Kumar, "Elements of Fracture Mechanics", Wheeler Publishing, New Delhi-1999.
3. V. Rammurti, "Computer Aided Mechanical Design and Analysis", Tata Mc Graw Hill-1992.
4. Bathe, J., " Finite Element Procedures", Prentice Hall of India-1996.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

PROFESSIONAL ELECTIVES
DESIGN GROUP

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

ADVANCED KINEMATICS (PROFESSIONAL ELECTIVE)

SYLLABUS FOR M.E.

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE510ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course are to: 1. study the graphical and analytical methods to perform kinematic analysis 2. assesnumber and dimensional synthesis of different linkages 3. learn D-H convention and transformations to do kinematic analysis of RGGR spatial mechanism 4. evaluate the cam and follower mechanism for different motion requirements and their design. 5. analyze the methods for kinematic analysis of Two degree of freedom Robot.	On completion of the course, the student will be able to: 1. perform kinematic analysis of complex mechanisms 2. demonstrate principles of kinematic synthesis 3. analyze spatial mechanism 4. design the cam profile for given required motion of the follower. 5. perform kinematic analysis for two degree of freedom Robot manipulator.

Unit-I: KINEMATIC ANALYSIS OF PLANE MECHANISM

Analytical method of kinematic analysis of four bar mechanisms. Acceleration analysis of complex mechanisms by auxiliary point method. Good man's indirect method.

Unit-II: KINEMATIC SYNTHESIS OF LINKAGES

Number synthesis, associated linkage or equivalent linkage concept, dimensional synthesis by analytical and graphical methods.

Unit-III

Kinematic analysis of four link RGGR spatial mechanism, D-H parameters, Transformations matrix method for position velocity and acceleration analysis of special mechanisms.

Unit-IV

Cams: Forces in rigid systems, Mathematical models, Response of a uniform - Motion undamped cam mechanism - Analytical method, Follower response by phase - Plane method - Position error, Jump, Crossover shock - Johnson's numerical analysis

Unit-V

Kinematic analysis of two-degree freedom of Robot, introduction to compliant mechanisms.

Learning Resources:

1. Amitabh Gosh and Ashok Kumar Mallik, 'Theory of Mechanisms and Machines', Affiliated East-West Press Pvt. Ltd., New Delhi, 1998.
2. Artur, G.Erdman and George.N.Sandor, 'Mechanism Design', Volume-I and -II, Prentice Hall of India, 1984.
3. Joseph Edward. Shigley and J.Joseph Uicker, 'Theory of Mechanisms and Machines', McGraw-Hill Company, 1995.
4. RL Norton 'Kinematics and Dynamics of Machines' by McGraw-Hill Company, 1st Ed., 2012.
5. Charles E Wilson "Kinematics and Dynamics of Machinery", Pearson, 3rd Edition .

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

MECHANICAL VIBRATIONS (PROFESSIONAL ELECTIVE)

SYLLABUS FOR M.E. (ADM)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE520ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

Course Objectives	Course Outcomes
The objectives of this course are to: 1. understand concept of vibrations in 2. multi degree and continuous system and perform modal analysis. 3. control vibrations of machines and to interpret non-linear and random vibrations.	On completion of the course, the student will be able to: 1. analyse the multi degree of freedom systems vibrations. 2. explain vibration behavior of continuous systems. 3. explain theoretical and experimental modal analysis. 4. apply various methods for vibration control. 5. interpret the concept of the Random and non-linear vibrations.

Unit-I

(A) Multi Degree Freedom System: Free Vibration equation of motion. Influence Coefficients i)Stiffness Coefficients. (ii) Flexibility Coefficients. Generalized co ordinates and Coordinate couplings. Lagrange's Equations. Eigen Values Eigen Vector problems. Modal Analysis of free andforced Vibrations of systems with and without damping.

(B) Study of Multi Degree Systems using Numerical Methods: (i) Holzer`s Method (ii)Methods of Matrix iterations (ii) Transfer Matrix Method.

Unit-II

Free Vibration of Continuous Systems: String, Bars, Shafts and Beams.

Energy methods: Rayleigh`s Method, Rayleigh-Ritz Method.

Unit-III

Modal parameter extraction methods: Introduction , Frequency response functions.

Preliminary checks of FRF Data , SDOF Modal Analysis : Peak-amplitude and Circle Fit Method.

Experimental modal analysis, Machine Condition Monitoring, fault diagnosis.

Unit-IV:

Vibration Control: Balancing of rotating machine, In-situ balancing of rotors, control of natural frequency. introduction of damping, vibration isolation & vibration absorbers.

Vibration Measurement: FFT analyzer, vibration exciters, signal analysis. Time domain & Frequency domain analysis of signals.

Unit-V

Random Vibrations: Expected values, Auto and Cross correlation function, Spectral density, response of linear systems, analysis of narrow band systems.

Non Linear Vibrations: Systems with non-linear elastic properties, free vibrations of system with non-linear elasticity and damping, phase-plane technique, Duffing's equation, jump phenomenon, Limit cycle, perturbation method.

Learning Resources:

1. W T Thomson, Marie Dillon Dahleh, Chandramouli Padmanabhan "Theory of Vibrations with Applications", 5th Edition, Pearson Education India, 2008.
2. Singiresu S. Rao, "Mechanical Vibrations", 5th Edition in SI Units, Prentice Hall, 2011.
3. Leonard Meirovitch, "Fundamentals of Vibration", Waveland Press, 2010.
4. J P Den Hartog, "Mechanical Vibrations", Courier Corporation, 2013.
5. Srinivasan, "Mechanical Vibration Analysis", Tata McGraw-Hill, 1982.
6. Nuno Manuel Mendes Maia et al," Theoretical and Experimental Modal Analysis", Wiley John & Sons, 1999.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

ADVANCED MECHANICS OF SOLIDS (PROFESSIONAL ELECTIVE)

SYLLABUS FOR M.E. (ADM)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE530ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course are to: 1. make the students understand the concepts of elasticity and equip them with the knowledge to independently handle the problems of elasticity. 2. enhance the competency level and develop the self confidence through quality assignments in theory of Elasticity. 3. inculcate the habit of researching and practicing in the field of elasticity.	On completion of the course, the student will be able to: 1. solve the problems of 3-D elasticity with confidence. 2. develop the problems of 2-D elasticity in Cartesian/Polar Coordinates. 3. apply Airy's stress function in 2-D problems of elasticity in Cartesian/Polar Coordinates. 4. relate various theories of torsion of prismatic bars of various cross sections and can solve the problems of torsion. 5. apply the theory of elasticity to practical problems of Structural engineering.

Unit-I

Definition and notation of stress. Components of stress and stain. Generalized Hooke's law. Stress and strain in three dimensions. Stress components on an oblique plane. Transformation of stress components under change of co-ordinate system.

Principal stresses and principal planes. Stress invariants. Mean and deviator stress. Strain energy per unit volume. Octahedral shear stress. Strain of a line element. Principle strains. Volume strain.

Unit-II: Two dimensional problems in elasticity

Plane stress and plane strain situations. Equilibrium equations. Compatibility equations. St. Venant's principle. Uniqueness of solution. Stress components in terms of Airy's stress functions. Applications to cantilever. Simply supported and fixed beams with sample loading.

Unit-III

Solutions of problems in polar co-ordinates. Equilibrium equations. Stress Strain Components. Compatibility equation. Applications using Airy's stress functions in polar co-ordinates for stress distributions symmetric about an axis. Effect of hole on stress distribution in a plate in tension. Stresses due to load at a point on a semi-infinite straight boundary. Stresses in a circular disc under diametrical loading

Unit -IV

Torsion – Torsion of various shapes of bars, Stress function method of solution applied to circular and elliptical bars. Prandtl's membrane analogy, Solution of torsion of rectangular bars by (i) Raleigh Ritz method and (ii) Finite difference method

Unit-V: Bending of curved beams

Winkler-Bach Formula, Elasticity solution for : pure bending of curved beams, curved cantilever under end loading

Learning Resources:

1. S. Timoshenko & N. Goodier, "Theory of Elasticity", Mc Graw Hill., 1951.
2. Valiappan, "Theory of Elasticity", Mc. Graw Hill, 2010.
3. L.S. Srinath, "Advanced Mechanics of Solids" Tata McGraw Hill, 2007.
4. Arthur P. Bores, Richard J, SCH midt "Advanced Mechanics of Materials", John Wiley, 2002.
5. Allen F Bower "Applied Mechanics of Solids", CRC Press, 2012.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

THEORY OF ELASTICITY AND PLASTICITY
(PROFESSIONAL ELECTIVE)
SYLLABUS FOR M.E. (ADM)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE540ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course are to: 1. enable the student to understand the basic concepts of stress 2. enable the student to understand the basic concepts of strain 3. interpret the stress strain relations and differential equations of equilibrium 4. understand the yeild criteria 5. describe the various flow processes for material deformation	On completion of the course, student will be able to : 1. understand the mathematical formulation for stress 2. understand the mathematical formulation for strain 3. apply the stress-strain relations for elastic behaviour to various materials 4. assess various yeild criteria and their application 5. analyse various plastic flow processes

Unit-I: BASIC CONCEPTS OF STRESS
Definition, State of stress at a point, stress tensor, invariants of stress tensor, principal stresses, stress ellipsoid, derivation for maximum shear stress and planes of maximum shear stress, octahedral shear stress, deviatoric and hydrostatic components of stress, invariance of deviatoric stress tensor, plane stress.

Unit-II: BASIC CONCEPTS OF STRAIN
Deformation tensor, strain tensor and rotation tensor; invariants of strain tensor, principle strains, derivation for maximum shear strain and planes of maximum shear strain, octahedral shear strain, deviatoric and hydrostatic components of strain tensor, invariance of deviatoric strain tensor, plane strain.

Unit-III: GENERALIZED HOOKE'S LAW
Stress-strain relationships for an isotropic body for three dimensional stress space for plane stress and plane strain conditions, differential equations of equilibrium, compatibility equations, material (D) matrix for Orthotropic Materials.

Unit-IV
True stress and true strain, von-Mise's and Tresca yield criteria, Haigh-Westergard stress space representation of von-Mise's and Tresca yield criteria, effective stress and effective strain, St. Venants theory of plastic flow, Prandtle –Reuss and Levy-Mise's constitutive equations of plastic flow, strain hardening theories, work of plastic deformation.

Unit-V: ANALYSIS METHODS
Slab method, slip line field method, uniform deformation energy method, upper and lower bound solutions. Application of slab method to forging, wire drawing, extrusion and rolling processes.

Learning Resources:

1. Timoshenko and Goodier,– '*Theory of Elasticity*', McGrawHill Publications 3rd Edition 2001.
2. LS Srinath "Advanced Mechanics of Solids", McGraw Hill Publications, 3rd Edition, 2009
3. George E Dieter, Mechanical Metallurgy, McGraw Hill Publications 3rd Ed., 1988
4. J. Chakrabarty, Theory of Plasticity, McGraw Hill Publications, 2nd Edition 1998.
5. Alexander Mendelson "Plasticity: Theory and Application", Krieger Publishing Company, 2nd ed, 1983

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

MECHANICS OF COMPOSITE MATERIALS (PROFESSIONAL ELECTIVE)

SYLLABUS FOR M.E. (ADM)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE550ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVE	COURSE OUTCOMES
The objective of this course are to: discuss the basic structure of composites, elastic constants and Hygro-thermal stresses. Identify stress-strain relations in composites, design with composites and demonstrate the basic equations of plate bending	On completion of the course, the student will be able to: 1. demonstrate knowledge of composites and their structure 2. predict the Elastic constants and Hygrothermal stresses 3. analyse the stress - strain relationship in composites 4. summarise and apply the Design procedure and the failure criteria. 5. formulate Plate bending equations for various Boundary conditions of composite plates.

Unit-I: INTRODUCTION

Fibres, Matrix materials, interfaces, polymer matrix composites, metal matrix composites, ceramic matrix composite, carbon fibre composites.

Unit-II:

Micromechanics of Composites: Mechanical Properties: Prediction of Elastic constant, micromechanical approach, Halpin-Tsai equations, Transverse stresses.

Thermal properties: Hygrothermal stresses, mechanics of load transfer from matrix to fibre.

Unit-III: MACRO-MECHANICS OF COMPOSITES

Elastic constants of a lamina, relations between engineering constants and reduced stiffness and compliances, variation of lamina properties with orientation, analysis of laminated composites, stresses and strains with orientation, inter-laminar stresses and edge effects. Simplified composite beam solutions. Bending of laminated beams.

Unit-IV:

Strength, fracture, fatigue and design: Tensile and compressive strength of unidirectional fibre composites, fracture modes in composites: Single and multiple fracture, de-bonding, fibre pullout and de-lamination failure, fatigue of liminate composites, Effect of variability of fibre strength.

Strength of an orthotropic lamina: Max stress theory, max strain criteria, maximum work (Tsai-Hill) criterion, quadratic interaction criteria. Designing with composite materials.

Unit-V: ANALYSIS OF PLATES AND STRESS

Plate equilibrium equations, Bending of composite plates, Levy and Navier solution for plates of composite material. Analysis of composite cylindrical shells under axially symmetric loads.

Learning Resources:

1. Jones, R.M., 'Mechanics of Composite Materials', Mc-Graw Hill Co., 1967.
2. Calcote, L.R., 'The Analysis of Laminated Composite Structures', Van Nostrand, 1969.
3. Whitney. I.M., Daniel, R.B. Pipes, 'Experimental Mechanics of Fibre Reinforced Composite Materials', Prentice Hall, 1984.
4. Hyer. M.W., 'Stress Analysis of Fibre-Reinforced Composite Materials', McGraw Hill Co., 1998.
5. Carl. T.Herakovich, 'Mechanics of Fibrous Composites', John Wiley Sons Inc., 1998.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

ROBOTIC ENGINEERING (PROFESSIONAL ELECTIVE)

SYLLABUS FOR M.E. (ADM)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE560ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course are to: 1. laws of robotics terms related with robotics, manipulator configurations, types of actuators, applications of robots. 2. kinematics of robotics and its homogenous transformation matrix. 3. inverse kinematics and jacobian with singularities and about bug algorithms, trajectory. 4. dynamics of a robotics and programming methods. 5. types of sensors including vision.	On completion of the course, the student will be able to: 1. understand basic concepts of industrial robotics and application of robotics with different manipulator configurations. 2. model the motion of robotic systems in terms of kinematics using Denavit-Hartenberg algorithm. 3. derive inverse kinematics and jacobian using forward kinematics, trajectory path planning and also sensor based motion planning. 4. evaluate dynamics using Largrange_Euler and Newton-Euler methods, controls and robotic programming. 5. identify the sensors used for displacement, velocity, acceleration, force and Machine vision

UNIT-I

Brief History, Types of robots, Overview of robot subsystems, resolution, repeatability and accuracy, Degrees of freedom of robots, Robot configurations and concept of workspace, Mechanisms and transmission, End effectors and Different types of grippers, vacuum and other methods of gripping. Pneumatic, hydraulic and electrical actuators, applications of robots, specifications of different industrial robots.

UNIT-II

Rotation matrices, Euler angle and RPY representation, Homogeneous transformation matrices, Denavit-Hartenberg notation, representation of absolute position and orientation in terms of joint parameters, direct kinematics.

UNIT-III

Inverse Kinematics, inverse orientation, inverse locations, Singularities, Jacobian, Trajectory Planning: joint interpolation, task space interpolation, executing user specified tasks, sensor based motion planning: The Bug Algorithm, The Tangent Bug Algorithm, The Incremental Voronoi Graph.

UNIT-IV

Static force analysis of RP type and RR type planar robots, Dynamic analysis using Lagrangean and Newton-Euler formulations of RR and RP type planar robots, , Independent joint control, PD and PID feedback, actuator models, nonlinearity of manipulator models, force feedback, hybrid control.

UNIT-V: SENSORS AND CONTROLLERS

Internal and external sensors, position, velocity and acceleration sensors, proximity sensors, force sensors, laser range finder. Robot vision: image processing fundamentals for robotic applications, image acquisition and preprocessing. Segmentation and region characterization object recognition by image matching and based on features

Learning Resources:

1. Nagrath and Mittal, "Robotics and Control", Tata McGraw-Hill, 2003.
2. Spong and Vidhyasagar, "Robot Dynamics and Control", John Wiley and sons, 2008.
3. Fu. K.S, Gonzalez, R.C., Lee, C.S.G, Robotics, control, sensing, Vision and Intelligence, McGraw Hill International, 1987
4. Steve LaValle, "Planning Algorithms", Cambridge Univ. Press, New York, 2006.
5. Howie Choset, Kevin Lynch, Seth Hutchinson, George Kantor, Wolfram Burgard, Lydia Kavraki and Sebastian Thurn, "Principles of Robot Motion: Theory, Algorithms, and Implementations", Prentice Hall of India, 2005.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering
GEAR DESIGN AND ENGINEERING (PROFESSIONAL ELECTIVE)
SYLLABUS FOR M.E. (ADM)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE570ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objective of this course is to: 1. understand the principles of gear tooth action, gear manufacturing process, gear tooth failure modes, stresses developed in them and selection of a right kind of gear for the given application. 2. understand the design considerations and methodology involved in design of various types of gears 3. understand the different gear trains (simple, compound and epicyclic) 4. understand the different parameters involved in gear design optimization	On completion of the course the student will be able to: 1. calculate strength of gear tooth under dynamic considerations 2. interpret the type of gear teeth failure from the failed specimen. 3. design a gear shaft with different types of gears (spur, helical, worm and bevel). 4. design a gear box for an automobile and gear trains from the propeller shaft of airplane for auxiliary systems. 5. design compact gear trains using optimization techniques.

UNIT-I
Introduction, Principles of gear tooth action, Generation of Cycloid and Involute gears, Involutometry, gear manufacturing process and Inspection, gear tooth failure modes, stresses, selection of right kind of gears.
Spur Gears: Tooth loads, Principles of Geometry, Design considerations and methodology, Complete design of spur gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load. Design of gear shaft and bearings.
UNIT-II
Helical Gears: Tooth loads, Principles of Geometry, Design considerations and methodology, complete design of helical gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load. Design of gear shaft and bearings.
Gear Failures: Analysis of gear tooth failures, Nomenclature of gear tooth wear and failure, tooth - breakage, pitting, scoring, wear, overloading, gear-casing problems, lubrication failures.
UNIT-III: WORM GEARS
Tooth loads, Principles of Geometry, Design considerations and methodology, Complete design of worm gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load. Heat dissipation consideration. Design of gear shaft and bearings.
UNIT-IV: BEVEL GEARS
Tooth loads, Principles of Geometry, Design considerations and methodology, Complete design of bevel gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load. Design of gear shaft and bearings.
UNIT-V
Gear Trains: Simple, compound and epicyclic gear trains, Ray diagrams, Design of a gear box of an automobile, Design of gear trains from the propeller shafts of airplanes for auxiliary systems.
Optimal Gear Design: Optimization of gear design parameters. Weight Minimization, Constraints
in gear train design-space, interference, strength, dynamic considerations, rigidity etc. Compact design of gear trains, multi objective optimization of gear trains. Application of Traditional and non-traditional optimization techniques.
Note: PSG Design Data book is allowed.
Learning Resources:

1. W Dudley, "Handbook of Practical Gear Design", CRC Press LLC, 2002.
2. Gitin M Maitra, "Handbook of Gear Design", Tata McGraw-Hill, 2nd Edition, 2003.
3. H. E Merritt, "Gear Engineering", Wheeler Publication, 3rd Indian Edition, 1992.
4. Joseph E Shigley, Charles R Mischke, "Mechanical Engineering Design", Tata McGraw Hill, 6th Edition, 2003.
5. Robert C Juvinall, Kurt M Marshek, "Fundamentals of Machine Component Design", John Wiley & Sons, 3rd Edition, 2000.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

DESIGN OF PRESSURE VESSELS AND PIPING
(PROFESSIONAL ELECTIVE
SYLLABUS FOR M.E. (ADM)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE580ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objective of this course is to: 1. understand the stresses in pressure vessels. 2. Perform stress analysis for cylinder components 3. design supports for various cylinder configurations. 4. interpret the buckling phenomenon in cylinders 5. identify the components of piping layout	On completion of the course, the student will be able to: 1. identify and estimate the stresses in a Pressure vessel 2. analyze the stresses in cylinder components 3. estimate the supporting column and allied component stresses. 4. calculate the buckling load and stresses 5. familiarize with piping layout and stresses

Unit-I: INTRODUCTION
stresses in pressure vessels, determination of radial stress hoop stress and longitudinal stress, shrink fit stresses in built up cylinders, autofrettage of thick cylinders, thermal stresses and their significance, methods for determining stresses – Terminology and Ligament Efficiency – Applications.

Unit-II: STRESSES IN PRESSURE VESSELS
Introduction – Stresses in a circular ring, cylinder – Membrane stress Analysis of Vessel Shell components – Cylindrical shells, spherical Heads, conical heads – Thermal Stresses – Discontinuity stresses in pressure vessels.

Unit-III: DESIGN OF VESSELS
Design of tall cylindrical self supporting process columns –Supports for short, vertical and horizontal vessels – stress concentration – at a variable Thickness transition section in a cylindrical vessel, about a circular hole, elliptical openings. Theory of Reinforcement – pressure vessel Design. Introduction to ASME pressure vessel codes

Unit-I: BUCKLING OF VESSELS
Buckling phenomenon – Elastic Buckling of circular ring and cylinders under external pressure – collapse of thick walled cylinders or tubes under external pressure – Effect of supports on Elastic Buckling of Cylinders – Buckling under combined External pressure and axial loading.

Unit-V
Piping Introduction – Flow diagram – piping layout and piping stress Analysis.

Learning Resources:

1. John F. Harvey, Theory and Design of Pressure Vessels, CBS Publishers and Distributors, 1987.
2. Henry H. Bedner, "Pressure Vessels, Design Hand Book, CBS publishers and Distributors, 1987.
3. Stanley, M. Wales, "Chemical process equipment, selection and Design. Buterworths series in Chemical Engineering, 1988.
4. William. J., Bees, "Approximate Methods in the Design and Analysis of Pressure Vessels and Piping", Pre ASME Pressure Vessels and Piping Conference, 1997.
5. Sam Kannapan, "Introduction to Pipe Stress Analysis". John Wiley and Sons, 1985.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

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2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

TRIBOLOGY IN DESIGN (PROFESSIONAL ELECTIVE)

SYLLABUS FOR M.E. (ADM)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE590ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course are to: 1. study the theories of friction and wear 2. design, hydro static, hydro dynamic and elasto hydro dynamic lubricated bearings.	On completion of the course, the student will be able to: 1. apply theories of friction and wear to various practical situations by analysing the physics of the process. 2. understand the various surface measurement techniques and effect of surface texture on Tribological behavior of a surface. 3. select materials and lubricants to suggest a tribological solution to a particular situation. 4. design a hydrodynamic bearing using various bearing charts. 5. understand the recent developments in the field and understand modern research material.

Unit-I

Friction, theories of friction, Friction control, Surface texture and measurement, genesis of friction, instabilities and stick-slip motion.

Unit-II

Wear, types of wear, theories of wear, wear prevention.
Tribological properties of bearing materials and lubricants.

Unit-III

Lubrication, Reynolds's equation and its limitations, idealized bearings, infinitely long plane pivoted and fixed show sliders, infinitely long and infinitely short (narrow) journal bearings, lightly loaded infinitely long journal bearing (Petroff's solution), Finite Bearings, Design of hydrodynamic journal bearings

Unit-IV

Hydrostatic, squeeze film Circular and rectangular flat plates, variable and alternating loads, piston pin lubrications, application to journal bearings.

Unit-V

Elasto-hydrodynamic lubrication – pressure viscosity term in Reynolds's equation, Hertz' theory, Ertel-Grubin equation, lubrication of spheres, gear teeth and rolling element bearings, Air lubricated bearings, Tilting pad bearings,

Learning Resources:

1. Cameron, "Basic Lubrication Theory", Ellis Horwood Ltd, 1981.
2. Principles in Tribology, Edited by J. Halling, 1975.
3. Fundamentals of Fluid Film Lubrication – B. J. Hamrock, McGraw Hill International,1994.
4. D.D. Fuller, "Theory and Practice of Lubrication for Engineers", John Wiley and Sons, 1984.
5. "Fundamentals of Friction and wear of Materials" American Society of Metals.
6. Introduction to Tribology of Bearings –B. C. Majumdar, A. H. Wheeler &co. pvt. ltd 1985.
7. T.A. Stolarski, "Tribology in Machine Design".

The break-up of CIE: Internal Tests+ Assignments + Quizzes

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3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

PROFESSIONAL ELECTIVES
MANUFACTURING GROUP

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

FLEXIBLE MANUFACTURING SYSTEMS

(PROFESSIONAL ELECTIVE)

SYLLABUS FOR M.E. (ADM)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE514ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course are to: 1. set up schemes for machine and accessory layouts for effective manufacture under CIM 2. have a thorough knowledge in part family identification using group technology 3. analyze mathematically the manufacturing situations so as to prevent bottlenecks in manufacture under CIM 4. be in a position to choose the most appropriate material handling scheme of relevance in CIM operations 5. plan for hardware and software for the various computational resources and electronic devices used in FMS	On completion of the course, the student will be able to: 1. interpret meaning, importance and utility of various layouts 2. Specify equipment for FMS operations after detailed study through group technology, process planning and technology planning 3. Plan for FMS operations and its schemes using JIT etc. 4. distinguish material handling requirements for traditional manufacture and those needed in FMS environment 5. Specify thehardware and software requirements and integrate different subsystems

Unit-I: EVOLUTION OF MANUFACTURING SYSTEMS

FMS definition and description, General FMS considerations, Manufacturing cells, Cellular versus Flexible Manufacturing. Systems Planning: Objective, introduction planning, preparation guidelines, the project team, supplier selection, system description and sizing, facility preparation planning, FMS layouts. Human resources: staff considerations, team work, communication and involvement, the supervisors role, personnel selection, job classifications, employee training.

Unit-II: MANUFACTURING'S DRIVING FORCE

Definition, description and characteristics. Just in-time manufacturing, definition and description, benefits and relationship to FMS, implementation cornerstones, quality and quantity application principles. Single manufacture Cell – design scheduling of jobs on single manufacturing cells. Group Technology: Concepts, classification and coding, benefits and relationship to FMS, design of group technology using rank order clustering technique.

Unit-III: FMS DESIGN – Using Bottleneck, Extended bottleneck models, Processing and Quality Assurance

Turning centres, Machining centre, construction and operations performed, axes, programming, and format information, work-holding and work-changing equipment, automated features and capabilities, cleaning and deburring – station types and operation description, importance to automated manufacturing, coordinate measuring machines, types, construction and general function, operation cycle description, importance to flexible cells and systems.

Unit-IV: AUTOMATED MOVEMENT AND STORAGE SYSTEMS

AGVs, Robots, automated storage and retrieval systems, storage space design, queuing carousels and automatic work changers, coolant and chip Disposal and recovery systems, auxiliary support equipment, cutting tools and tool Management – introduction, getting control of cutting tools, Tool Management, tool strategies, data transfer, tool monitoring and fault detection, guidelines, work holding considerations, General fixturing, Modular fixturing. FMS and the relationship with workstations – Manual, automated and transfer lines design aspects.

Unit-V: FMS

Computer Hardware, Software, Communications networks and Nanotechnology – general functions, and manufacturing usages, hardware configuration, programmable logic controllers, cell controllers, communications networks. FMS implementation.

Learning Resources:

1. William Luggen, "Flexible Manufacturing Systems", Prentice-Hall, Newjersy, 1991.
2. Parrish, D.J., "Flexible Manufacturing", - Butter Worths – Heinemann, Oxford, 1993.
3. Groover, M.P., "Automation, Production Systems and CI", - Prentice Hall India, 1989.
4. Kusiak, A., "Intelligent Manufacturing Systems", - Prentice Hall, 1990.
5. Ranky, P.G., "Design and Operation of FMS", - IFS Publishers, UK, 1988.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering
ADVANCED NON-DESTRUCTIVE EVALUATION TECHNIQUES (PROFESSIONAL ELECTIVE)
SYLLABUS FOR M.E. (ADM)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE524ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course are to: 1. study the importance of various non-destructive testing method. 2. study different methods to find the surface and subsurface defects in the components 3. study different methods of finding surface, internal defects and properties of the components. 4. study computer aided inspection processes to find defects in components used in medical field 5. study inspection method using light source.	On completion of the course, the student will be able to: 1. understand the importance and practical applications of various non-destructive methods in industry 2. evaluate the surface and sub surface defects of the components produced in industry. 3. apply the methods for inspecting surface, internal defects and to find mechanical properties of the components. 4. select appropriate computer aided method of inspection of the components depending upon applications 5. apply appropriate methods based on light as source of inspection.

Unit-I
Types of defects and characteristics, Quantification aspects relevant for NDE including fracture aspects and stress intensity factors - NDT overview – quality assurance–visual inspection–comparative features of conventional Non destructive Testing and Evaluation Methods including Optical, Radiography, Ultrasonic Testing, Dye penetrate testing, Eddy current testing etc.

Unit-II
Leak testing – liquid penetrant testing – penetrant used – equipment – penetration, emulsification, solvent removal. Eddy current testing – material conductivity – coil impedance–coils and instruments–testing in non-ferromagnetic conducting materials and Ferro magnetic materials – skin effect – frequency used – inspection probes – phase analysis.

Unit-III
Radiography–sources of radiation–shadow formation, enlargement and distortion – recording media – exposures, markers.
Infrared and thermal testing – imaging systems – detectors – analysis methods.
Ultrasonic testing – generation of ultrasound – methodologies – transducers and equipment used – flaw detection - sensitivity and calibration.
Magnetic particle testing–magnetization methods–continuous and residual methods – sensitivity – demagnetization.

Unit-IV
Computer aided image processing methods for radiography and ultrasonic's, tomography in these areas.
Optical techniques of nondestructive evaluation: Principles of Photo elasticity, holographic Interferometry and Laser speckle techniques; use of fibre optics, non-invasive techniques in medical field and NDT.

Unit-V
Machine Vision-system components, Sensors, specifications for resolution & range.
Grid and Moire NDT, acoustic, shearography, Principles of Microwave, acoustic emission techniques.

Learning Resources:

1. Barry Hull, 'Non-Destructive Testing' –Vernon John, ELBS/ Macmillan, 1988.
2. Baldev Raj, T.JayaKumar, M.Thavansimuthee, 'Practical Non-Destructive Testing', - Narosa Publishing House, New Delhi, 1997.
3. Journals: British Journal of NDT, Materials Evaluation, ISNDT Journal.
4. ASM Handbook: Non-Destructive Evaluation and Quality Control, ASM International, Vol. 17, 1989.
5. Ravi Prakash, Non-Destructive Testing Techniques, New Age Science, 2009.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERABAD – 500 031
Department of Mechanical Engineering
ADDITIVE MANUFACTURING (PROFESSIONAL ELECTIVE)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE534ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course are to: 1. understand the importance of RPT 2. Apply various liquid and solid based RPT Systems 3. Apply various powder based RPT systems and rapid tooling 4. Recognize various STL formats and slicing methods and tessellation 5. Application of RPT in Engineering, Jewelry and Bio medical etc.	On completion of the course the student will be able to: 1. understand the developments of RPT and its terminology, Advantages and limitations of RPT 2. understand mechanism involved in stereo lithography apparatus system, and terminated object manufacturing, fused deposition modeling and their applications. 3. understand mechanism in selective laser interims and its application. Understand the importance of Rapid tooling 4. recognize various types of file format and slicing methods in RP and various software available to convert 3D models. 5. apply RPT in various fields like Engineering, Jewelry, medical and Bio – Medical Engineering

Unit-I: INTRODUCTION

Prototyping fundamentals, Historical development, fundamentals of Rapid Prototyping, Advantages and Limitations of Rapid Prototyping, Commonly used terms, classification of RP process, Rapid prototyping process chain: Fundamental Automated processes, process chain.

Unit-II

Liquid based rapid prototyping systems: Stereo lithography apparatus (SLA): Models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies. Solid ground curing (SGC): Models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

Solid based rapid prototyping systems: Laminated object manufacturing (LOM): Models and specifications, process, working principle, applications, advantages and disadvantages, case studies. Fused deposition modeling (FDM): Models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

Unit-III

Powder Based Rapid Prototyping Systems: Selective laser sintering (SLS): Models and specifications, process, working principle, applications, advantages and disadvantages, case studies. Three dimensional printing (3DP): Models and specification, process, working principle, applications, advantages and disadvantages, case studies.

Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs Rt, Need for RT. Rapid Tooling Classification: Indirect Rapid Tooling Methods: Spray Metal Deposition, RTV Epoxy Tools, Ceramic tools, investment casting, spin casting, die csting, sand casting, 3D Keltool process. Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP

Unit-IV

Rapid Prototyping Data Formats: STL Format, STL File Problems, Consequence of Building Valid and invalid tressellated models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats.

Rapid Prototyping Software's: Features of various RP software's like Magics, Mimics, Solid View, view expert, 3 D view, velocity 2, Rhino, STL view 3 data expert and 3 D doctor

Unit-V

RP Applications: Application – Material Relationship, application in design, application in engineering, Analysis and planning, aerospace industry, automatic industry, Jewelry industry, coin industry, GIS application, Arts and Architecture.

RP Medical and Bioengineering Application: Planning and simulation of complex surgery, customized implant and prosthesis, design and production of medical devices, forensic science and anthropology, visualization of biomolecules.

Learning Resources:

1. Chua C.K., Leong K.F. and LIM C.S Rapid prototyping: Principles an Applications, World Scientific publications, 3rd Ed., 2010
2. D.T. Pham and S.S. Dimov, "Rapid Manufacturing", Springer, 2001
3. Terry Wohlers, " Wholers Report 2000", Wohlers Associates, 2000
4. Paul F. Jacobs, " Rapid Prototyping and Manufacturing"–, ASME Press, 1996
5. Ian Gibson, Davin Rosen, Brent Stucker "Additive Manufacturing Technologies, Springer, 2nd ed, 2014

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

AN INTRODUCTION TO NANO SCIENCE AND TECHNOLOGY (PROFESSIONAL ELECTIVE)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE544ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course are to: 1. understand basic fundamentals of nanotechnology 2. identify and classify nano materials 3. explain synthesis and processing of nano powders 4. explain nano, micro fabrication techniques	On completion of the course, the student will be able to: 1. understand basic fundamentals of nanotechnology and differentiate it from nano science 2. classify nano materials and identify their applications 3. explain various synthesis and processing steps for nano materials 4. describe and use nano, micro fabrication techniques

Unit-I: INTRODUCTION

Evolution of science and technology, Introduction to Nanotechnology, Nanotechnology – Definition – Difference between Nanoscience and Nanotechnology, Feynman predictions on Nanotechnology, Moores law, Role of Bottom up and top down approaches in nanotechnology, challenges in Nanotechnology.

Unit-II: NANO MATERIALS

History of materials, Nanomaterials – Definition, Classification of Nanostructured materials, cause of interest in nanomaterials, some present and future applications of nanomaterials.

Unit-III: SYNTHESIS AND PROCESSING OF NANO POWDERS

Processes for producing ultrafine powders – mechanical milling, wet chemical synthesis, gas condensation process, chemical vapour condensation, laser ablation.

Design and Synthesis of self assembled nano structured materials.

Unit-IV

Special nanomaterials, characterization and tools: Carbon nanotubes, nano composites

Carbon fullerenes: An overview of preparation, properties applications.

Electron Microscopy Techniques: Scanning Electron Microscopy, Transmission Electron Microscopy, Scanning Probe Microscopy – X ray methods.

Unit-V

Nanoelectronics: Introduction to micro, nano fabrication: Optical lithography, Electron beam lithography, Atomic lithography, Molecular beam epitaxy.

MEMS: Introduction, Principles, Types of MEMS:- Mechanical, Thermal, Magnetic MEMS; Fabrication of MEMS.

Learning Resources:

1. Dieter Vollath, Nanomaterials: An Introduction to Synthesis, Properties and Applications, Second Edition, Wiley, 2013
2. Guozhong Cao, Ying Wang, Nanostructures and Nanomaterials: Synthesis, Properties, and Applications, World Scientific, 2011
3. Nitaigour P. Mahalik, Micromanufacturing and Nanotechnology, Springer Science & Business Media, 2006.
4. Mark A. Ratner, Daniel Ratner, Nanotechnology: A Gentle Introduction to the Next Big Idea, Prentice Hall Professional, 2003
5. A.S Edelstein, R.C Cammaratra, Nanomaterials: Synthesis, Properties and Applications, Second Edition, CRC Press, 1998.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

QUALITY AND RELIABILITY ENGINEERING

(PROFESSIONAL ELECTIVE)

SYLLABUS FOR M.E. (ADM)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE554ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course are to: 1. understand the process capability and control charts 2. Analysis the importance of tolerance design 3. Relate QFD and house of quality and its use in product design 4. Apply various techniques to improve reliability systems 5. Selective maintainability and availability of equipment	On completion of the course, the students will be able to: 1. understand importance of quality applications of various control charts and acceptance sampling in quality engineering 2. estimate the loss function, and consequence of tolerance design for a product and checking of online quality control 3. prepare a house of quality for a product and QFD matrix, importance of ISO and quality circles. 4. analyze Various methods to estimate system reliability and how to improve it. Usage of weibull distribution in quality control and reliability 5. identify the best way of maintenance of an equipment, How to increase the availability and economics of reliability engineering.

Unit-I

Quality value and engineering – Quality systems – quality engineering in product design and production process – system design – parameter design – tolerance design quality costs – quality improvement.
Statistical Process Control-x, R, P, C charts, process capability. Acceptance Sampling by variables and attributes, Design of Sampling Plans, Single, Double, Sequential plans.

Unit-II

Loss Function, Tolerance Design – N Type, L Type, S Type; determination of tolerance for these types, nonlinear tolerances. Online Quality Control – Variable Characteristics, Attribute Characteristics, Parameter Design.

Unit-III

Quality function deployment – House of Quality, QFD Matrix, Total Quality Management Concepts. Quality Information Systems; Quality Circles, Introduction to ISO 9000 Standards.

Unit-IV

Reliability – Evaluation of design by tests - Hazard Models; Linear, Releigh, Weibull. Failure Data Analysis System, Reliability, Reliability of series, Parallel Standey Systems; reliability prediction and system effectiveness, reliability prediction based on weibull distribution, Reliability improvement.

Unit-V

Maintainability, Availability, Economics of Reliability Engineering; Replacement of items, Maintenance Costing and Budgeting, Reliability Testing – Burn in testing by binomial, exponential models, Accelerated life testing.

Learning Resources:

1. G Taguchi, '*Quality Engineering in Production Systems*', - McGraw Hill, 1989.
2. W.A. Taylor, '*Optimization & Variation Reduction in Quality*', Tata McGraw Hill, 1991, 1st Edition.
3. Philipposs, '*Taguchi Techniques for Quality Engineering*', McGraw Hill, 1996, 2nd Edition.
4. E.Bala Guruswamy, '*Reliability Engineering*', Tata McGraw Hill, 1994.
5. LS Srinath, '*Reliability Engineering*', Affiliated East West Pvt. Ltd., 1991, 3rd Edition.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

VALUE ENGINEERING (PROFESSIONAL ELECTIVE))

SYLLABUS FOR M.E. (ADM)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE564ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

Course Objectives	Course Outcomes
The objectives of this course are to: 1. Know the basic concepts of value engineering 2. Learn different types of manufacturing processes with respect to time, cost etc. 3. Use critical path of function for quick analysis 4. Improve the quality of the product by choosing proper design and manufacturing method. 5. Select alternate and best possible method. 6. Enhance the value of the existing product.	On completion of the course, the students will be able to: 1. understand the manufacturing methods to be implemented. 2. identify the materials needed to meet the required mechanical properties. 3. assess and conclude best possible method for problem solving . 4. demonstrate improvement in productivity using value analysis techniques. 5. develop a product which is functionally sound.

Unit-I

Basic concepts of Value Engineering – Function, Value, Value analysis, Value of job plan, Study of Engineering materials specially latest materials with respect to their mechanical properties, Cost and availability. Study of wide range of manufacturing processes based on the factors – productivity time, cost, surface finish, tolerance etc. Mechanical properties of products based on manufacturing processes.

Unit-II

Information phase, Functional phase, Creation – phase, Evaluation phase, Recommendation phase. DARSIRI method.

Fast diagramming: Critical path of function, how, why and when logic, supporing and all time functions, Ground rule for FAST diagram.

Unit-III

Productivity, improvement by Value Engineering and Value analysis – Selection of Engineering Products of different applications and studying each one of them about design, types of stresses induced, manufacturing method.

Unit-IV

Results acceleration – Basic steps, valuation of Value Engineering, Problem setting, Problem solving case studies alternative methods and best possible method.

Unit-V

Work study and Value Engineering Methods: Case studies in work study and Value Engineering methods – product Design implementation using Value Engineering.

Developing any one product (important in functional aspect) which actually adds Value to Existing product in use.

Learning Resources:

1. L.D. Miles, 'Techniques of Value Analysis and Engineering', McGraw Hill, 1961
2. A.E. Mudge, 'Value Engineering A Systematic Approach', McGraw Hill, 1971.
3. Greve J.W. and Wilson, 'Value Engineering in Manufacturing', Prentice Hall, Englewood Cliffs, 1967.
4. SS Iyer, 'Value Engineering', New Age International Pvt. Ltd.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

MECHATRONICS (PROFESSIONAL ELECTIVE)

SYLLABUS FOR M.E. (ADM)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE574ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

Course Objectives	Course Outcomes
The objectives of this course are to: 1. Understand key elements of Mechatronics system, representation into block diagram 2. understand concept of transfer function, reduction and analysis 3. understand principles of sensors, its characteristics, interfacing with DAQ microcontroller 4. understand the concept of PLC system and its ladder programming, and significance of PLC systems in industrial application 5. understand the system modeling and analysis in time domain and frequency domain	On completion of the course, the students will be able to: 1. Identification of key elements of mechatronics system and its representation in terms of block diagram 2. Understand the concept of signal processing and use of interfacing systems such as ADC, DAC, digital I/O 3. Interface the Sensors, Actuators using appropriate DAQ micro-controller 4. study time and Frequency domain analysis of system model (for control application) 5. Develop PLC ladder programming and implementation of real life system

Unit-I

Introduction to Sensors & Actuators: Introduction to Mechatronics, **Measurement characteristics:** Static and Dynamic Sensors: Position Sensors: - Potentiometer, LVDT, Encoders; Proximity sensors:- Optical, Inductive, Capacitive; **Motion Sensors:** Variable Reluctance; Temperature Sensor: RTD, Thermocouples; **Force / Pressure Sensors:** Strain gauges; Flow sensors: - Electromagnetic Actuators: Stepper motor, Servo motor, Solenoids

Unit-II: BLOCK DIAGRAM REPRESENTATION

Open and Closed loop control system, identification of key elements of mechatronics systems and represent into block diagram (Electro-Mechanical Systems), Concept of transfer function, Block diagram reduction principles, Applications of mechatronics systems:- Household, Automotive, Shop floor (industrial).

Unit-III: DATA ACQUISITION & MICROCONTROLLER SYSTEM

Interfacing of Sensors / Actuators to DAQ system, Bit width, Sampling theorem, Aliasing, Sample and hold circuit, Sampling frequency, ADC (Successive Approximation), DAC (R-2R), Current and Voltage Amplifier.

Unit-IV: PLC Programming

Introduction, Architecture, Ladder Logic programming for different types of logic gates, Latching, Timers, Counter, Practical Examples of Ladder Programming, Introduction to SCADA system

Unit-V

Modelling and Analysis of Mechatronics System: System modeling (Mechanical, Thermal and Fluid), Stability Analysis via identification of poles and zeros, Time Domain Analysis of System and estimation of Transient characteristics: % Overshoot, damping factor, damping frequency, Rise time, Frequency Domain Analysis of System and Estimation of frequency domain parameters such as Natural Frequency, Damping Frequency and Damping Factor

Learning Resources:

1. K.P. Ramchandran, G.K. Vijyaraghavan, M.S. Balasundaram, Mechatronics: Integrated Mechanical Electronic Systems, Willey Publication, 2008
2. Bolton, Mechatronics - A Multidisciplinary approach, 4th Edition, Prentice Hall, 2009
3. Alciatore &Histand, Introduction to Mechatronics and Measurement system, 4th Edition, Mc-Graw Hill publication, 2011.
4. Bishop (Editor), Mechatronics – An Introduction, CRC Press, 2006.
5. Mahalik, Mechatronics – Principles, concepts and applications, Tata Mc-Graw Hill publication, New Delhi.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

MECHANICAL BEHAVIOUR OF ENGINEERING MATERIALS (PROFESSIONAL ELECTIVE)

SYLLABUS FOR M.E. (ADM)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE584ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course are to: 1. assess the elastic behavior of materials 2. identify various crystal defects in materials 3. develop viscoelastic and viscoplastic models of the materials 4. analyze causes for creep and fracture of materials 5. illustrate the fatigue loading and failure of materials	On completion of the course, the student will be able to: 1. correlate microscopic and macroscopic material behaviors 2. explain causes and mechanism of plastic deformation of materials 3. estimate the responses of viscoelastic and viscoplastic response of the materials 4. assess creep and fracture behavior of materials 5. estimate the fatigue behavior of materials and design for safety against fatigue.

Unit I

Overview: Different responses of material to loading, material properties, macroscopic experiments and its relevance, physical mechanisms controlling the behavior.

Elasticity: Atomic structure and bonding, Atomic interaction, physical origin of elastic modulus, Generalized Hooke's law, Anisotropic linear elasticity of crystals, orientation dependence of elastic modulus.

Unit II: PLASTICITY

Theoretical shear strength of crystals, Point, line and volume defects, edge and screw dislocations, Burgers circuit and Burgers vector, force between dislocations, movement and interactions of dislocations, slip planes, twinning, strengthening mechanisms, work hardening, grain boundary strengthening and solid solution strengthening, true stress-strain curve, necking phenomenon, yield criteria, rheological models, plastic stress-strain relationships.

Unit III: VISCOELASTICITY AND VISCOPLASTICITY

Responses of viscoelastic materials under different loading, creep and relaxation, Maxwell and Kelvin models, Three parameter solid and four parameter fluid, generalized Maxwell's and generalized Kelvin's models

Unit IV: CREEP AND FRACTURE

primary, secondary and tertiary creep, creep mechanisms, dislocation creep, diffusion creep and grain boundary creep. Mechanisms, creep laws, Analysis and Applications in Design, Brittle, ductile and fatigue fracture, fracture surfaces, Griffith's theory, modes of fracture, energy release rate, stress intensity factor, crack tip plasticity, J-integral and Crack Tip Opening Displacement

Unit V: FATIGUE

Cyclic loads, constant amplitude and variable amplitude loads, cycle counting techniques, infinite life, safe-life, fail-safe, damage-tolerant design philosophies, Low cycle and high cycle fatigue, Stress-Life approach, Strain-Life approach, and Fracture mechanics approach, Cumulative damage theories. Mechanical Characterization of Materials: Mechanical testing for material Characterization, Measurement techniques in experimental solid mechanics, Non destructive testing.

Learning Resources:

1. Norman E. Dowling, Mechanical behavior of materials : Engineering Methods for Deformation, Fracture and Fatigue, Prentice Hall
2. Marc Meyers and Krishnan K. Chawla, Mechanical behavior of materials, Cambridge University Press
3. William F. Hosford, Mechanical behavior of materials, Cambridge University Press
4. Thomas H. Courtney, Mechanical behavior of materials, Overseas Press
5. Joachim Roesler, Harald Harders, and Martin Baeker, Mechanical Behavior of Engineering Materials, Springer.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

PROFESSIONAL ELECTIVES

ANALYSIS GROUP

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

FINITE ELEMENT TECHNIQUES (PROFESSIONAL ELECTIVE)

SYLLABUS FOR M.E. (ADM)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE515ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course are to: analyze the Mechanical Engineering problems by using Finite Element Method.	On completion of the course, the student will be able to: 1. formulate F.E. Models using 1-d bar element and compute the deflections and stresses . 2. formulate 1-d F.E. Model for truss, beam and frame members and compute the deflections and stresses. 3. formulate F.E. Model for two dimensional problems and compute the deflections and stresses. 4. formulate 1-d and 2-d F.E. Models for heat transfer problems and compute the temperature distribution. 5. formulate 1-d F.E. Models for eigen value problems and compute the natural frequencies and mode shapes.

UNIT-I: INTRODUCTION

Finite Element Method of solving field problems. Stress and Equilibrium. Boundary conditions. Strain-Displacement relations. Stress-strain relations. One Dimensional Bar Element: Finite element modeling. Local, natural and global coordinates and shape functions. Potential Energy approach : Assembly of Global stiffness matrix and load vector. Finite element equations, treatment of boundary conditions. Quadratic shape functions.

UNIT-II: ANALYSIS OF TRUSSES , BEAMS AND FRAMES

Analysis of plane truss. Analysis of Beams: Element stiffness matrix for two noded, two degrees of freedom per node for beam element. Analysis of frames with two translations and a rotational degree of freedom at each node.

UNIT-III

Finite element modeling of two dimensional stress analysis problems with constant strain triangles and treatment of boundary conditions. Two dimensional four noded isoparametric elements and numerical integration. Finite element modeling of Axisymmentric solids subjected to axisymmetric loading with triangular elements. Convergence requirements and geometric isotropy.

UNIT-IV: STEADY STATE HEAT TRANSFER ANALYSIS

One dimensional analysis of a fin and two dimensional conduction analysis of thin plate.
Analysis of a uniform shaft subjected to torsion using Finite Element Analysis.

UNIT-V: DYNAMIC ANALYSIS

Formulation of finite element modeling of Eigen value problem for a stepped bar and beam. Evaluation of Eigen values and Eigen vectors.
1-d Finite Element formulation of an incompressible fluid. Potential flow problems.
Introduction to finite element formulation of three dimensional structural problems.
Introduction to Finite Element analysis software.

Learning Resources:

1. Tirupathi R. Chandrupatla and Ashok D. Belegundu, "Introduction to Finite Elements in Engineering",4th edition, Pearson Education, 2011.
2. Singiresu S.Rao , " The Finite Element Method in Engineering",4th edition, Elsevier Science & Technology Books,2004
3. Larry J. Segerlind , " Applied Finite Element Analysis" , 2nd edition, Wiley India ,2010
4. J.N. Reddy, "An Introduction to the Finite Element Method", 3rd edition , McGraw-Hill Education, 2005
5. K J Bathe, " Finite element procedures", 1st edition, Prentice Hall, 1996.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering
OPTIMIZATION TECHNIQUES (PROFESSIONAL ELECTIVE)
SYLLABUS FOR M.E. (ADM)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE525ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

Course Objectives	Course Outcomes
The objectives of this course are to: 1. Understand linear programming & transportation & sensitivity analysis 2. Compute non L.P and unconstrained optimization. 3. Compute the non L.P.P and constrained optimization. 4. Apply principle of optimality in dynamic programming and integer programming 5. Apply CPM & PERT for project scheduling and control.	On completion of the course, the Students will be able to: 1. explain simplex, dual simplex and revised simplex & sensitivity analysis and transportation and their applications for shop floor problems. 2. apply of non LPP like unconstrained method univariate method, steepest descent conjugate gradient, quasi Newton method. 3. apply Lagrange multiplier, Kuhn-Tucker conditions, Beal's method penalty, Function for constrained optimization problems. 4. describe the importance of dynamic principles and its applications like Cargo loading, product scheduling and forecasting. Integer programming like branch and bound and Gromery's cutting plane method. 5. apply the project management techniques like CPM & PERT

Unit-I: LINEAR PROGRAMMING
Statement of Optimization Problem, Linear Programming: Simplex method, revised simplex method, sensitivity analysis and transportation problems.
Unit-II:
Non Linear Programming unconstrained optimization: Nonlinear programming approach, convergence and scaling of design variables;
Unconstrained optimization direct search methods: Random Search, Univariate, Pattern search, Powell Method, Hook – Jeeves algorithm ;.
Non linear unconstrained optimisation indirect Search methods: Steepest Descent, Conjugate Gradient, Newton, Quasi Newton.
Unit-III: Non Linear Programming constrained optimization
Nonlinear programming constrained optimization direct methods: Lagrange multipliers, Kuhn-Tucker conditions, Beal's method, indirect method: Penalty function and applications
Unit-IV
Dynamic Programming:
Introduction to dynamic programming; Concept of sub optimization and the principle of optimality; Linear and continuous dynamic programming with applications; Introduction to integer programming; Cutting plane method; Branch and bound method; Introduction to genetic algorithms, particle swarm optimization.
Unit-V: Project scheduling: PERT-CPM, Probability and cost consideration in project scheduling; Crashing analysis, Resource allocation, Resource levelling.
Learning Resources:

1. Rao, S.S., 'Engineering Optimization Theory and Practice', New Age Int. Pub., 3rd Ed., 1996
2. Deb, K., "Optimization for Engineering Design", Prentice Hall of India, 1995.
3. Haug, E.J. and Arora, J.S., 'Applied optimal design' Wiley Inter Science Publication, NY, 1979
4. Douglas J. Willde, 'Globally optimal design' Jhon Wiley & Sons, New York, 1978
5. S.D. Sharma, 'Operations Research', Khanna Publications, 2001
6. David Goldberg, Genetic Algorithms, pearson publications, 2006

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

ADVANCED FINITE ELEMENT ANALYSIS
((PROFESSIONAL ELECTIVE)
SYLLABUS FOR M.E. (ADM)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE535ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course is to: 1. understand basic theory of plates and shells 2. interpret the concept of non-linearity 3. familiarize with the numerical methods in dynamic analysis 4. understand fluid flow and heat transfer analysis 5. familiarize with adaptive meshing and error estimates	On completion of the course, the Students will be able to: 1. identify the FE formulations for plates and shells 2. formulate the non-linear problems. 3. calculate dynamic characteristics using numerical methods 4. formulate the fluid flow and heat transfer analysis. 5. estimate the errors and convergence rates

Unit-I: BENDING OF PLATES AND SHELLS
Review of Elasticity Equations – Bending of Plates and Shells – Finite Element Formulation of Plate and Shell Elements - Conforming and Non Conforming Elements – C0 and C1 Continuity Elements –Degenerated shell elements- Application and Examples.

Unit-II: NON-LINEAR PROBLEMS
Introduction – Iterative Techniques – Material non-linearity – Elasto Plasticity – Plasticity – Visco Plasticity – Geometric Non linearity – large displacement Formulation –Solution procedure- Application in Metal Forming Process and Contact Problems.

Unit-III: DYNAMIC PROBLEM
Direct Formulation – Free, Transient and Forced Response – Solution Procedures – Eigen solution-Subspace Iterative Technique – Response analysis-Houbolt, Wilson, Newmark – Methods – Explicit &Implict Methods-Lanchzos, Reduced method for large size system equations.

Unit-IV: FLUID MECHANICS AND HEAT TRANSFER
Governing Equations of Fluid Mechanics – Solid structure interaction - Inviscid and Incompressible Flow – Potential Formulations – Slow Non-Newtonian Flow – Metal and Polymer Forming – Navier Stokes Equation – Steady and Transient Solution.

Unit-V: ERROR ESTIMATES AND ADAPTIVE REFINEMENT
Error norms and Convergence rates – h-refinement with adaptivity – Adaptive refinement.

Learning Resources:

1. Zienkiewicz, O.C. and Taylor, R.L., "The Finite Element Method", Fourth Edition, Volumes 1 & 2, McGraw Hill International Edition, Physics Services, 1991.
2. Cook R.D., "Concepts and Applications of Finite Element Analysis",John Wiley and Sons Inc., Newyork, 1989.
3. Bathe K.J., "Finite Element Procedures in Engineering Analysis", Prentice Hall, 1990
4. S.S.Rao, "Mechanical Vibrations" Addison-Wesley publishing co. 1998
5. V. Rammurti "computer aided mechanical design and analysis" Tata Mc-Grawhill 1992

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: 1 Hour 30 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERABAD – 500 031
Department of Mechanical Engineering
EXPERIMENTAL TECHNIQUES AND DATA ANALYSIS ((PROFESSIONAL ELECTIVE)
SYLLABUS FOR M.E. (ADM)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE545ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course are to: 1. understanding measurement of force, temperature, flow measurement 2. applying the above techniques in experimental setup. 3. recognise micro-structure & surface measurement techniques 4. design various experiments and validate using testing method. 5. introduce Taguchi method and conclude quality loss function	On completion of the course, the Students will be able to: 1. estimating force using strain gauges, transducers and strain by photoelasticity, holography, interferometer. 2. estimating temperature by electrical resistance, pyrometers thermo couples, biometalic etc and flow measurement by laser dopler, hot wire anemometer, ultrasonic, shadow graphs. 3. recognise various microstructure of metals and alloys under different working conditions. Measurement of surface finish. 4. describe various hypothesis using t-, F & chi-square test, selection of process parameters and factorial design for experiments, ANOVA to estimate contribution of each parameter. 5. Applying orthogonally array for experimental design and optimization of response function, estimating loss function and its applications.

Unit-I

Measurement of cutting forces

Strain gauge and piezoelectric transducers and their characteristics. Dynamometer construction, Bridge circuits. Instrumentation and calibration. Displacement and Strain measurements by photoelasticity, Holography, interferometer, Moir techniques, strain gauge rosettes.

Unit-II

Temperature Measurement: Circuits and instrumentation for different transducers viz., bimetallic, expanding fluid, electrical resistance, thermister, thermocouples, pyrometers.

Flow Measurement: Transducers for flow measurements of Non-compressible fluids, Obstruction and drag methods. Vortex shredding flow meters. Ultrasonic, Laser Dopler and Hotwire anemometer. Flow visualization techniques, Shadow graphs, Schilieren photography. Interferometer.

Unit-III

Metallurgical Studies: Optical and electron microscopy, X-ray diffraction, Bragg's Law and its application for studying crystal structure and residual stresses. Electron spectroscopy, electron microprobe.

Surface Measurement: Micro hardness, roughness, accuracy of dimensions and forms. 3-D Co-ordinate measuring machines.

Unit-IV

Experiment design & data analysis: Statistical methods, Randomised block design, Latin and orthogonal squares, factorial design. Replication and randomization.

Data Analysis: Deterministic and random data, uncertainty analysis, test of significance: Chi-square, student's 't' test. Regression modeling, direct and interaction effects. ANOVA, F-test. Time Series analysis, Autocorrelation and autoregressive modeling.

Unit-V: TAGUCHI METHODS

Experimental design and planning with Orthogonal arrays and linear graphs. Additive cause-effect model, Optimization of response level. Identification of Design and noise factors. Performance evaluation and Optimization by signal to noise ratios. Concepts of loss function and its application.

Learning Resources:

1. Jack Philip Holman, Experimental Methods for Engineers, 7th edition, McGraw-Hill, 2001
2. V. C. Venkatesh, H. Chandrasekaran, Experimental Techniques in Metal Cutting, Eastern economy edition, Prentice-Hall of India, 1987
3. George E. P. Box, Gwilym M. Jenkins, Gregory C. Reinsel, Greta M. Ljung, Time Series Analysis: Forecasting and Control, 5th Edition, John Wiley & Sons, 2015
4. Richard C. Dove, Paul H. Adams, Experimental stress analysis and motion measurement: theory, instruments and circuits, techniques, C. E. Merrill Books, 1964
5. Bagchi Tapan P, Taguchi Methods Explained: Practical Steps to Robust Design, Prentice-Hall (India), 1993.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

FRACTURE MECHANICS (PROFESSIONAL ELECTIVE)

SYLLABUS FOR M.E. (ADM)

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19PE555ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course are to: 1. study different types of fractures 2. study the stress field of elastic crack and its solution. 3. study about the crack growth and crack arrest 4. study about the elastic-plastic fracture mechanics 5. study about the application of fracture mechanics	On completion of the course, the student will be able to: 1. understand the crack and its effect on the service. 2. solve the elastic crack problems 3. analyse factors effecting crack growth and its arrest 4. solve crack problems using FEM 5. derive relationship between fracture design and selection of materials.

Unit-I: INTRODUCTION
Crack in a Structure – Griffth Criterion – Cleavage fracture – Ductile fracture – Fatigue Cracking. Service failure analysis.

Unit-II: ELASTIC CRACK
Elastic Crack tip stress field – Solution to crack problems. Effect of finite size stress intensity factor – Special cases – Irwin plastic zone correction. Actual shape of plastic zone – Plane stress – Plane strain.

Unit-III
Energy Principle: Energy release rate – Criterion for crack growth – Crack resistance curve – Principles of crack arrest – Crack arrest in practice.

Fatigue Crack Growth: Fatigue crack growth test, stress intensity factor, factors affecting stress intensity factor – Variable amplitude service loading, retardation model.

Unit-IV: ELASTIC PLASTIC FRACTURE MECHANICS
Elastic plastic fracture concept – Crack tip opening displacement – J-integral technique; Determination of J- using FEM.

Unit-V
Application of Fracture Mechanics: Fracture design – Selection of materials – fatigue crack growth rate curve – Stress intensity factor range – Use of crack growth law.

Learning Resources:

1. David Broek – Elementary Engineering Fracture Mechanics: Sifth off an Noordhoff Internal Publishers – 1978.
2. John M. Barson and Stanely T. Rolfe: Fracture and Fatigue Control in Structures – Prentice Hall, Inc. USA 1987.
3. Jean Cemative and Jean Louis Chboche Mechanics of Solid Materials, Cambridge University Press, Cambridge, 1987.
4. Prashant Kumar, "Elements of Fracture Mechanics", Wheeler Publications, 1999.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: **1 Hour 30 Minutes**

LABORATORY COURSES

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

COMPUTER AIDED MODELLING AND ASSEMBLY LAB

SYLLABUS FOR M.E. (ADM) I-SEMESTER

L:T:P(Hrs./week):0:0:3	SEE Marks: 0	Course Code: PI19PC111ME
Credits :1.5	CIE Marks:50	Duration of SEE: ---

Course Objectives	Course Outcomes
The objectives of this course are to: 1. practice 2D and 3D modelling 2. design and assemble the parts to create mechanical products.	On completion of the course, the Students will be able to: 1. aware the geometric entities and edit for developing 2D drawings. 2. practice the geometric entities to create 3D model. 3. develop assembly of mechanical products by using assembly constraints.

List of Experiments

1. To draw 2D sketches using basic geometric entities.
2. To draw 2D sketches using different line types with dimensions and text.
3. To draw 2D sketches using dimensions and geometric constraints.
4. To draw 2D sketches using mirror, pattern operations.
5. To model components in 3D using linear Extrusion and Boolean operations.
6. To model components in 3D using datum planes and feature instance operations.
7. To model components in 3D using revolve and Boolean operations.
8. To model typical 3-D components (gear, hexagonal headed bolt and Nut, Helical spring.)
9. To develop simple Assembly using 3D part models with the application of Assembly constraints.
10. To model 3D part models of Journal bearing and developing the assembly of it.
11. To model 3D part models of Universal coupling and developing the assembly of it.
12. To model 3D part models of Journal bearing and developing the assembly of it.
13. To model 3D part models of Flange coupling and developing the assembly of it.
14. To model 3D part models of Connecting rod and developing the assembly of it.

No. of Internal Tests:	01	Max. Marks for Internal Test:	12
Marks for assessment of each experiment			18
Duration of Internal Test: **3 Hours**			

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

ADVANCED MANUFACTURING LAB

SYLLABUS FOR M.E. (ADM) I-SEMESTER

L:T:P(Hrs./week):0:0:3	SEE Marks: 0	Course Code: PI19PC121ME
Credits :1.5	CIE Marks:50	Duration of SEE: ---

Course Objectives	Course Outcomes
The objectives of this course are to: 1. understands the CNC programming. 2. utilize advanced manufacturing technology like additive manufacturing and EDM.	On completion of the course, the Students will be able to: 1. develop the part program for operating CNC lathe and CNC mill for machining. 2. Manufacture the components using 3D printer. 3. Study the characteristics of EDM machining. 4. performance evaluation of drilling operation & Lathe tool dynamometer.

List of Experiments

1. Manual part program on CNC lathe for Plain turning.
2. Manual part program on CNC lathe for Step turning.
3. Manual part program on CNC lathe for Taper turning.
4. Manual part program on CNC Mill for linear and circular interpolation.
5. Manual part program on CNC Mill for Contouring operation.
6. Manual part program on CNC Mill for Pocketing operation.
7. Development of CNC code using CAM software for turning and milling.
8. Additive manufacturing of simple components using 3D printer.
9. Additive manufacturing of complex components using 3D printer.
10. Generation of characteristic curves on an EDM machine.
11. Study of drilling characteristics using drill tool dynamometer.
12. Feed Force measurement using Lathe tool dynamometer.
13. Normal force measurement using lathe tool dynamometer.
14. Demonstration on Plastic injection moulding machine

No. of Internal Tests:	01	Max. Marks for Internal Test:	12
Marks for assessment of each experiment			18
Duration of Internal Test: **3 Hours**			

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERABAD – 500 031
Department of Mechanical Engineering

VIBRATION ANALYSIS LAB
SYLLABUS FOR M.E. (ADM) II-SEMESTER

L:T:P(Hrs./week):0:0:3	SEE Marks: 0	Course Code: PI19PC231ME
Credits :1.5	CIE Marks:50	Duration of SEE: ---

COURSE OBJECTIVES	COURSE OUTCOMES
The objectives of this course are to: 1. understand motion characteristics in rotating mass system. 2. Analyze the damped, undamped vibration system. 3. understand vibration response characteristics and stability of dynamic systems. 4. data acquisition and analysis of the vibration signals.	On completion of the course, the Students will be able to: 1. evaluate the static and dynamic balancing of masses. 2. analyze the response of dynamic systems under dynamic loading. 3. analyze the spring mass system with and without damping. 4. Analyze the vibration data through data acquisition system. 5. analysis of mechanical systems using simulation software.

List of Experiments

1. To find the static and dynamic balancing masses in a rotating mass system.
2. To determine the vibration characteristics for the damped and un damped Longitudinal Vibrations of spring mass system.
3. To determine the vibration characteristics for the damped and un damped Torsional Vibrations of single rotor system.
4. Determination of Critical Speed of the given shaft with the given end conditions. (Whirling of Shafts)
5. To determine the vibration characteristics for the Free Vibrations of Beams.
6. To determine the vibration characteristics for the Forced vibrations of Beams.
7. To analyze a 1- DOF system subjected to un damped and damped Free Vibrations using MATLAB
8. To analyze a 1- DOF system subjected to un damped and damped Forced Vibrations using MATLAB
9. To analyze a Multi DOF system subjected to un damped and damped Free Vibrations using MATLAB
10. To analyze a Multi DOF system subjected to un damped and damped Forced Vibrations using MATLAB
11. To analyze a 1- DOF free and forced vibration systems using SIMULINK
12. To analyze a Multi -DOF free and forced vibration systems using SIMULINK
13. Vibration Analysis of spring mass system and it's data acquisition using Lab VIEW Software
14. Vibration Analysis of beams and it's data acquisition using Lab VIEW Software

From the above experiments, each student should perform at least 12 (Twelve) experiments.

No. of Internal Tests:	01	Max. Marks for Internal Test:	12
Marks for assessment of each experiment			18
Duration of Internal Test: **3 Hours**			

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

COMPUTER AIDED SIMULATION LAB

SYLLABUS FOR M.E. (ADM) II-SEMESTER

L:T:P(Hrs./week):0:0:3	SEE Marks: 0	Course Code: PI19PC241ME
Credits :1.5	CIE Marks:50	Duration of SEE: ---

COURSE OBJECTIVES	COURSE OUT COMES
The objectives of this course are to: 1. understand the CAE software applicability for analyzing structural problems. 2. analyze non linear behaviour of structural members. 3. kinematic analysis of mechanical systems.	*On completion of the course, the student will be able to:* 1. select appropriate finite element for solving structural problems. 2. analyze non linear behaviour of mechanical components and metal forming operation. 3. analysis of mechanisms like 4 bar mechanism, spring damper and projectile motion.

List of Experiments

1. Introduction to FEA software - Analysis using 1-d bar elements.
2. Analysis if Trusses.
3. Analysis of Beams.
4. Analysis of Plane stress.
5. Analysis of Plane strain.
6. Modal and Harmonic Analysis of Beams.
7. Transient Analysis of Beams.
8. Non Linear small displacement analysis of a Beam.
9. Non linear large displacement analysis of a Hose Clamp.
10. Plastic deformation Analysis in metal forming operation.
11. Analysis of a 4 bar mechanism using simulation software.
12. Analysis of Spring damper.
13. Analysis of projectile motion using multi body dynamics software.
14. Analysis of simple mechanisms using multi body dynamics software.
15. Non linear analysis of spring damper system.

Note: The above experiments are to be conducted using all the available softwares in the Department. From the above experiments, each student should perform at least 12 (Twelve) experiments.

No. of Internal Tests:	01	Max. Marks for Internal Test:	12
Marks for assessment of each experiment			18
Duration of Internal Test: **3 Hours**			

OPEN ELECTIVE

COURSES

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

ADVANCED OPERATIONS RESEARCH (OPEN ELECTIVE)

SYLLABUS FOR M.E. III SEMESTER

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19OE330ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVE	COURSE OUT COMES
The objective of this course is to: understand Linear & non-linear programming, transportation modelling , CPM & PERT for project scheduling and control, replacement, game theory and sequencing	On completion of the course, the student will be able to: 1. understand simplex, dual simplex, Sensitivity and transportation and their applications for shop floor problems. 2. understand the importance of Sensitivity analysis and various advanced LPP techniques 3. apply the techniques like CPM and PERT for project management. 4. apply various replacement techniques to find optimum replacement time period for equipment. 5. identify the best strategy to win the game and optimum sequence for minimum elapsed time.

Unit-I: OPERATIONS RESEARCH-AN OVERVIEW

Meaning and Origin of Operations research, Introduction to Linear programming problems (LPP) -Formulation of LPP- Solution to LPP by Graphical method and simplex method.

Unit-II: ADVANCED TOPICS IN LINEAR PROGRAMMING

Dual simplex method, special cases in LPP, Duality in LPP, Differences between primal and dual, shadow prices, sensitivity analysis. Non linear programming Khun Tucker conditions.

Unit-III

Transportation Model: Definition of the transportation model-matrix of Transportation model-Formulation and solution of transportation models- Methods for calculating Initial basic feasible solution, optimal solution by Stepping stone method and MODI method.

Assignment Problem: Hungarian method of assignment problem, maximization in assignment problem, unbalanced problem, problems with restrictions, travelling salesman problems.

Unit-IV: PROJECT SCHEDULING

Introduction to network analysis, Rules to draw network diagram, Fulkerson rule for numbering events, Critical path method, Summarisation of CPM calculations. PERT, Estimation of probability and its corresponding duration in PERT, Crashing of project and finding of optimal project duration in crashing.

Unit-V

Replacement models: Introduction, replacement of items that deteriorate ignoring change in money value, replacement of items that deteriorate considering change in money value with time, replacement of items that fail suddenly – individual replacement policy, group replacement policy.

Game theory: Introduction, 2 person zero sum games, maximi– minima principle, principle of dominance, solution for mixed strategy problems graphical method for 2 x n and m x 2 games

Sequencing models: introduction, general assumptions, processing to jobs through 2 machines, processing 'n' jobs through m machines processing 2 jobs through m machines.

Learning Resources:

1. S. D.Sharma, "Operations Research", 10th edition, Newage India Pvt Ltd, New Delhi
2. Hamady.A.Taha An Introduction to Operations Research, "8th edition, TMH
3. Prem Kumar Gupta and Dr. DS Hira, "Operations Research ", S.Chand & Company Pvt. Ltd., 2014.
4. R. Paneerselvam, "Operations Research", PHI Learning Pvt Ltd., 2009.
5. NVS Raju, "Optimization methods for Engineers ", PHI Learning Pvt. Ltd. ., 2014
6. Col D.S. Cheema, "Operations Research", University science press, 2nd edition, India

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: 1 Hour 30 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

INTRODUCTION TO COMPOSITE MATERIALS (OPEN ELECTIVE)

SYLLABUS FOR M.E. III SEMESTER

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: PI19OE330ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVE	COURSE OUT COMES
The objective of this course is to: discuss the basic structure of composites, elastic constants and Hygro-thermal stresses. Identify stress-strain relations in composites, design with composites.	On completion of the course, the student will be able to: 1. demonstrate knowledge of composites and their structure 2. predict the Elastic constants and Hygrothermal stresses 3. analyse the stress - strain relationship in composites 4. summarise apply the Design procedure and the failure criteria. 5. apply the Design procedure and the failure criteria..

Unit-I: INTRODUCTION

Fibres, Matrix materials, interfaces, polymer matrix composites, metal matrix composites, ceramic matrix composite, carbon fibre composites.

Unit-II: MICROMECHANICS OF COMPOSITES

Mechanical Properties: Prediction of Elastic constant, micromechanical approach, Halpin-Tsai equations, Transverse stresses.

Thermal properties: Hygrothermal stresses, mechanics of load transfer from matrix to fibre.

Unit-III: MACRO-MECHANICS OF COMPOSITES

Elastic constants of a lamina, relations between engineering constants and reduced stiffness and compliances, variation of lamina properties with orientation, analysis of laminated composites, stresses and strains with orientation, inter-laminar stresses and edge effects. Simplified composite beam solutions. Bending of laminated beams.

Unit-IV: STRENGTH, FRACTURE, FATIGUE AND DESIGN

Tensile and compressive strength of unidirectional fibre composites, fracture modes in composites: Single and multiple fracture, de-bonding, fibre pullout and de-lamination failure, fatigue of liminate composites, Effect of variability of fibre strength.

Unit-V

Strength of an orthotropic lamina: Max stress theory, max strain criteria, maximum work (Tsai-Hill) criterion, quadratic interaction criteria. Designing with composite materials.

Learning Resources:

1. Jones, R.M., 'Mechanics of Composite Materials', Mc-Graw Hill Co., 1967.
2. Calcote, L.R., 'The Analysis of Laminated Composite Structures', Van Nostrand, 1969.
3. Whitney. I.M., Daniel, R.B. Pipes, 'Experimental Mechanics of Fibre Reinforced Composite Materials', Prentice Hall, 1984.
4. Hyer. M.W., 'Stress Analysis of Fibre-Reinforced Composite Materials', McGraw Hill Co., 1998.
5. Carl. T.Herakovich, 'Mechanics of Fibrous Composites', John Wiley Sons Inc., 1998.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: 1 Hour 30 Minutes

SEMINARS

&

DISSERTATION

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

SEMINAR

SYLLABUS FOR M.E. (ADM) I-SEMESTER

L:T:P(Hrs./week):0:0:2	SEE Marks: 0	Course Code: PI19PC118ME
Credits : 1	CIE Marks:50	Duration of SEE: ---

COURSE OBJECTIVE	COURSE OUTCOMES
The objective of this course is to: prepare the student for a systematic and independent study of state of the art topics in a broad area of his / her specialization	On completion of the course, the students will be able to: 1. write a suitable abstract 2. write a seminar report 3. present and deliver a seminar

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to following aspects of seminar presentations.

- Selection of Topics from published Journals / Conference Proceedings in the areas of Design, Manufacturing and Analysis.
- Report to be prepared showing literature survey, organisation of material, preparation of PPT and displaying technical writing skills.
- Must display the presentation skills

Each student is required to

1. Submit a one page synopsis of the seminar talk.
2. Give a 20 minutes presentation through OHP, PC, Slide projector followed by a 10 minutes discussions
3. Submit a report on the seminar topic with literature survey

Seminars are to be scheduled from the 3rd week to the last week of the semester and any change in schedule should be discouraged.

The CIE marks will be awarded to the students by at least 2 faculty members on the basis of an oral and a written presentation as well as their involvement in the discussions.

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

MINI PROJECT

SYLLABUS FOR M.E. (ADM) II-SEMESTER

L:T:P(Hrs./week):0:0:2	SEE Marks: 0	Course Code: PI19PW219ME
Credits : 1	CIE Marks:50	Duration of SEE: ---

COURSE OBJECTIVE	COURSE OUTCOMES
The objective of this course is to: enable the student to take up investigative study in the field of design, analysis and manufacturing engineering.	On completion of the course, the student will be able to: 1. Choose appropriate problem in design, analysis and manufacturing areas. 2. Plan the activities for carrying out the work in teams. 3. Develop the capability to conduct investigations on the chosen problem using the mechanical engineering tools. 4. present the work carried out for evaluation.

The mini project can be assigned on individual basis or in a group consisting of maximum 2 students/ batch.

The students are required to identify the topic of their interest and collect data / literature in core areas of design, analysis and manufacturing engineering. The students need to identify a problem and work in that area in consultation with the project guide. The output may be in terms of a small prototype or conducting investigations through experiments or evaluate theoretically using modern tools of mechanical engineering using modelling and analysis tools.

The students are required to submit a project report containing the abstract and the summary of the work in terms of plots or fabricated models and submit for evaluation.

The students are required to give a oral presentation/ demo of prototype before the departmental committee for evaluation.

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

DISSERTATION - PHASE I

SYLLABUS FOR M.E. (ADM) III-SEMESTER

L:T:P(Hrs./week):0:0:8	SEE Marks: 0	Course Code: PI19PW319ME
Credits : 4	CIE Marks: 100	Duration of SEE: ---

COURSE OBJECTIVE	COURSE OUTCOMES
The objective of this course is to: start with a suitable Dissertation work in consultation with the supervisor in the areas of his/her specialization either in the Institute or Industry.	On completion of the course, the students will be able to: 1. apply and Solve the problems in the relevant field of specialization from the knowledge gained from theoretical and practical courses pursued during the course. 2. develop the capability to conduct investigations on the chosen problem. 3. develop flair for R&D work.

- A research project topic may be selected either from published lists or from the creative ideas of the students themselves in consultation with their project supervisor.
- To improve the student research and development activities.

The CIE marks will be awarded to the students by at least 2 faculty members and the supervisor on the basis of an oral presentation and submission of a progress report.

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

DISSERTATION - PHASE II
SYLLABUS FOR M.E. (ADM) IV-SEMESTER

L:T:P(Hrs./week):0:0:24	SEE Marks: 0	Course Code: PI19PW419ME
Credits : 12	CIE Marks: 100	Duration of SEE: ---

COURSE OBJECTIVE	COURSE OUTCOMES
The objective of this course is to: complete the Dissertation work in line with the chosen field in the areas of his/her specialization.	On completion of the course, the students will be able to: 1. Prepare a thesis with all the findings in the chosen area. 2. Present a seminar with all the results during the Viva-voce examination.

The final assessment involves presentation of the dissertation work by the student and the award of the grade by an expert of relevant specialization.