GUJARAT TECHNOLOGICAL UNIVERSITY

English for Research Paper Writing
SUBJECT CODE: 3700001
SEMESTER: I/II

Type of course: Audit course

Prerequisite: -

Rationale: -

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE(E)	PA (M)	PA (V)	PA (I)	
2	0	0	0	50	0	0	0	50

Content

Sl. No.	Topic	Teaching Hours	Module Weightage (%)
1.	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	4	17
2.	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction	4	17
3.	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check	4	17
4.	key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature	4	17
5.	skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	4	16
6	useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	4	16

Reference Books:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

Course Outcome:

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

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title
4. Ensure the good quality of paper at very first-time submission

GUJARAT TECHNOLOGICAL UNIVERSITY

Disaster Management
SUBJECT CODE: 3700002
SEMESTER: I/II

Type of course: Audit course

Prerequisite: -

Rationale: -

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE(E)	PA (M)	PA (V)	PA (I)	
2	0	0	0	50	0	0	0	50

Content

Sl. No.	Topic	Teaching Hours	Module Weightage (%)
1.	**Introduction** Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	4	17
2.	**Repercussions Of Disasters And Hazards**: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts	4	17
3.	**Disaster Prone Areas In India** Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics	4	17
4.	**Disaster Preparedness And Management** Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness	4	17
5.	**Risk Assessment** Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.	4	16
6	**Disaster Mitigation**	4	16

	Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.		

Reference Books:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

Course Outcome:

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

1. learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response
2. critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations
4. critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

GUJARAT TECHNOLOGICAL UNIVERSITY
Master of Engineering
Subject Code - 3720001
Semester II
Subject Name: Mini Project with Seminar

Type of course: Core

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
0	0	4	2	0	0	0	100	100

Content:

A mini project requires comparatively less time than major projects. They are comparatively simpler and have shorter duration. Mini Project helps students to explore and strengthen the understanding of fundamentals through practical application of theoretical concepts. Mini Project can help them to boost their skills and widen their horizon of thinking. It will act like a beginners guide to undertake the major project/dissertation during the final year and will ensure preparedness of students to undertake major projects/dissertation. Students will be required to select the topic relevant to their specialization and that has value addition. Students will get an opportunity to work in actual industrial environment if they opt for internship. Based on the selected topic student will also prepare seminar report based on the literature survey

Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available. End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution. Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the departmental committee.

Course Outcomes: At the end of the course, the student will be able to:

1. Identify engineering problems reviewing available literature.
2. Study different techniques used to analyze complex systems.
3. Solve a live problem using software/analytical/computational tools and present solution by using his/her technique applying engineering principles.
4. Learn to write technical reports and develop skills to present and defend their work in front of technically qualified audience.

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3720801
FINITE ELEMENT ANALYSIS
SEMESTER: II

Type of course: Core Course

Prerequisite: Zeal to learn the Subject

Rationale: The subject aims to introduce numerical methods for solving governing equations of mechanical systems. The class of problems include 1D and 2D structural, thermal and fluid problems; beams and frames and 3D structural problems. Introduction to non-linear and dynamic problems is also included.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Topics	Teaching Hrs.
1	**Mathematical models for structural problems:** Equilibrium of continuum-Differential formulation, Energy Approach-Integral formulation, Principle of Virtual work - Variational formulation. Overview of approximate methods for the solution of the mathematical models: Rayleigh-Ritz methods, Methods of Weighted Residuals (Galerkin, Least-squares).	5
2	**Bars, Trusses and Beams** Relevance of finite element analysis in design, Modelling and discretization, Shape functions, elements and Degrees-of-Freedom, Strain – displacement relation, Local and Global equations, Applications of FEA. Iso-Sub-Super parametric formulations. 1D Elements Structural Problems: Linear and Quadratic elements, Elimination and Penalty Approach, Properties of global stiffness matrix. 1D thermal conduction and fluid flow problems. Formulation of Truss element, Plane truss. Beam: Element formulation, plane frames, various loading and boundary conditions.	15
3	**2D and 3D Elements:** Gauss Quadrature formula, Gauss Quadrature in two and three dimensions. Plate stress and plane strain matrices. Triangular (CST, LST) and Rectangular (Q4, Q8) Elements: Shape function, Jacobian matrix, strain-displacement matrix, stress-strain relationship matrix, force vector, Limitations of elements. Types of 3D elements and their comparison.	7
4	Plate and Shell Elements: Introduction, thin and thick plates: Kirchoff theory, Mindlin plate element, conforming and nonconforming elements, degenerated shell elements, reduced and selective integration, shear locking and hour glass phenomenon.	6

5	**Dynamic Problems:** Formulation of dynamic problems, consistent and lumped mass matrices Solution of eigenvalue problems: Transformation methods Jacobi method, Vector Iteration methods, subspace iteration method.	7
6	**Non-Linearity:** Introduction and types of non-linearity, Formulation for geometrical and material non-linearity.	2

Reference Books:

1. A First Course in the Finite Element Method, D Logan, Thompson Learning
2. Concepts and Applications of Finite Element Analysis, R D Cook, D S Malkus, M E Plesha, and R J Witt, Wiley.
3. Text book of Finite Element Analysis, Seshu P., PHI.
4. Finite Element Procedures, Bathe K. J., PHI.
5. Introduction to Finite Elements in Engineering, Chandrupatla T. R. and Belegunda A. D., PHI.
6. The Finite Element Method – A Practical Course, Liu G. R. and Quek S. S., Butterworth-Heinemann.
7. Finite element Method in Engineering, S S Rao, Elsevier.

Course Outcome:

Sr. No.	Course Outcome	Percentage weightage
CO-1	Students will be able to understand the concept of finite element method and develop algorithms for analysis of mechanical systems.	10%
CO-2	Students will be able to apply the knowledge of FEM for 1D stress analysis, modal analysis, heat transfer analysis and flow analysis.	30%
CO-3	Students will be able to formulate and solve problems of trusses, beams and frames, students will also be able to use commercial packages for complex problems.	30%
CO-4	Students will be able to develop 2-D FE formulations involving triangular, quadrilateral elements and higher order elements.	30%

List of Experiments: During practical sessions, various problems should from syllabus topics should be solved using FEA software. Wherever feasible, problems should also be solved with manual calculations.

1. Introduction to Finite Element Analysis software.
2. Solve 1D – Structural, thermal and fluid problems using FEA software.
3. Solve Plane truss problems, using FEA software. Include problems with symmetry.
4. Solve Beam problems with different boundary and loading conditions using FEA software.
5. Solve 2D problems using different element types in a FEA software. Also analyse effect of element formulation and number of elements.
6. Solve 3D problems using FEA software.
7. Solve plate and shell problems using FEA software.
8. Solve Dynamic problems using FEA software.

Major Equipment:

1. Computational facility and FEA solver.

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3720801

List of Open Source Software/learning website:

1. NPTEL courses
2. Scilab Software

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3720802
Semester –II
Subject Name: COMPUTER AIDED MANUFACTURING

Type of course: Core IV

Prerequisite: Zeal to learn the subject

Rationale: The manufacturing field has witnessed the development of major automation alternatives recently. CNC machines play a big role in manufacturing field. An attempt has been made to focus on CNC machine tools, related programming and their advanced features.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**CNC Machine Tools** **Introduction:**Concept of CNC and development of its technology, advantages, applications, classification of CNC Machine, axis designations, interpolators- linear, circular and helical interpolators.	4
	Hardware:CNC Machine building, structural details, CNC block diagram, guideways - friction and antifriction, recirculating ball screws, planetary roller screw, recirculating roller screw, types of indexing with numerical problems, automatic tool changers (ATC), automatic pallet changers (APC), timing gear belt design, types of control, CNC networking topologies and their protocols, concept of DNC	5
2	**System drives and control system:** **Spindle drives** - DC shunt motor, 3 phase AC induction motor & their comparison **Feed drives** - stepper motor, servo principle, DC & AC servomotors with numerical problems. **Control system**- Types of encoders, absolute and incremental optical encoders, synchro, synchro-resolver, gratings, moire fringe gratings, inductosyn, laser interferometer.	5
3	**Manual Part Programming for CNC:** Various controllers for CNC, Structure of a part program, G & M Codes, Types of programming, different compensations, Manual part	12

	programming using FANUC controllers: Canned cycles for lathe: G70, G71, G72, G73, G75, G76, G81; Canned cycles for Milling: G81, G82, G83, G73, G84,G74, Mirroring, Sub programming, Macros.	
4	**Feature Based Manufacturing:**Deficiencies of Geometric Models, Definition of Features, Types and Attributes of Features, Properties of Features and composite features; Taxonomies, Validation and Mapping of Features; Feature Creation, Automatic Feature recognition, Design by Features, Comparison of Feature Creation Techniques and Their Unification; Feature Based Part Creation, Feature Identification, Design by Feature, Tolerance Specification; Manufacturing Features, Level abstraction and Specification, Dimensionality, Completeness of Feature Model, Feature Relationships, Temporal Ordering, Product Families, Interactive Feature Identification, Design to Manufacturing Feature Mapping, Manufacturing Feature Recognition; Group Technology Coding, Feature based Planning: Process, Assembly, Inspection, Feature based Evaluation.	**12**
5	**Automated Part Programming:** Computer Assisted Part Programming, Automatic NC program generation from CAD models, Parametric Programming.	**4**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**20**	**20**	**20**	**20**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Parametric and feature based CAD/CAM, Shah J.J., Mäntylä M., 1995, John Wiley Sons Inc.
2. Mechatronics, HMT, McGraw Hill Education
3. James V. Valentino and Joseph Goldenberg, Introduction to Computer Numerical Control, 5\e, Prentice Hall, Englewood Cliff, New Jersey, 2012.
4. Yoram Koren, Computer control of Manufacturing Systems, McGraw Hill, 2006
5. T.K. Kundra, P.N.Rao, N.K. Tewari, Numerical Control and Computer Aided Manufacturing, Tata McGraw Hill Publishing Company Ltd.
6. David Gibbs and Thomas Crandall, CNC Machining and Programming: An Introduction, Industrial Press Inc., 2003

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand Computer Aided Manufacturing technology, through programming, setup, and operations of various Computer Numerical Control (CNC) machine	52

	tools	
CO-2	Prepare programmes of various CNC machine tools.	24
CO-3	To use feature based modelling for design for manufacture and manufacturing as well.	24

List of Experiments:

1. CNC machines hardware and their axis designations.
2. Manual part programming for CNC lathe without canned cycles
3. Manual part programming for CNC lathe for multipass turning and facing
4. Manual part programming for CNC lathe for undercutting, multi-pass threading and grooving
5. Manual part programming for profile milling with cutter radius compensation
6. Manual part programming for pocket milling with repeat count
7. Manual part programming for mirroring using sub program
8. Manual part program using macros.
9. Automatic part programming using high end CAD/CAM softwares

Equipment / Computational facility:

1. CNC Turning Centre
2. CNC Milling Centre
3. Manual Part programming software.
4. Computational facility.

List of Open Source Software/learning website: https://nptel.ac.in/

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3720814
Semester –II
Subject Name: COMPUTER AIDED PRODUCTION MANAGEMENT

Type of course: Core IV

Prerequisite: Zeal to learn the subject

Rationale: This course aims to provide an overview of production management, focusing on the computer aided tools applicable in managing automated production. It comprehends about the production systems, facility location and layout,production planning and control, Materials resource planning, scheduling, shop floor control, Simulation of Machine shop and modern approaches.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Fundamentals:** System concept, Hierarchical structure, System design, Decision makingprocedure, Manufacturing Systems, Factors affecting selection of Manufacturing Process, Modesof Production- Jobbing / Intermittent /Continuous/ Mass Production.	02
2	**Product / Process Planning and Design :** Facilities (Plant) Location - Facility location and layout – Factors considerations in Plant location- Comparative Study ofrural and urban sites – Methods of selection plant layout – objective of good layout – Principles – Types of layout. Computerized relative allocation of facility technique, automated layoutdesign program and computerized relationship layout planning for facilitylocation and layout.	12
3	**MRP :** Material Requirement – Terminology – typesofdemands – inputs to MRP- techniques of MRP – Lot sizing methods – benefits and drawbacks of MRP –Manufacturing Resources Planning (MRP –II).	04

4	**Job scheduling :** Scheduling – Policies – Types of scheduling – Forward and Backward Scheduling – Gantt Charts –Flow shop Scheduling – n jobs and 2 machines, n jobs and 3 machines – job shop Scheduling – 2 jobsand n machines – Line of Balance.	**06**
5	**Computer Aided Process Planning:** Generative and variant types, backwardand forward approach, feature based and CAD based CAPP.	**04**
6	**Shop Floor Control:** Database structures, hierarchical, network, Relationalconcepts,keys, relational operations, query languages; Shop Floor Data Collection Systems-Types of data, on-line and off-line data collection, Automatic data collection systems.	**06**
7	**Modern approaches in Manufacturing:** Cellular Manufacturing- Group Technology, Compositepart, Rank Order Clustering Technique, Hollier method for GT cell layouts; FlexibleManufacturing- Concept, principles, Lean manufacturing concept, principles.	**06**
8	**Simulation in Manufacturing system :** Major activities, purpose, simulation process, typesmethodology, simulation packages, process quality simulator, computer requirements trends, applications simulation of machine shop.	**04**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**10**	**30**	**20**	**20**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Production & operations management:Concepts, Models and Behaviour, Adam E.(Jr.), Ebert R J., PHI.
2. Production & operations management, Chary S N, McGraw-Hill.
3. Computer Aided Production Management,Mahapatra P B, PHI.
4. Manufacturing Processes, Kalpakjian, Pearson

5. Facility Layout & location – An analytical approach – Richard L. Francis, John A. white
6. Production & operations management, Nair G N, McGraw-Hill.
7. An Introduction to Computer Aided Production Management, Childe, S., Springer.

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand relevance and importance of the Different Production and operations management techniques and their applications.	25
CO-2	Capable to design, analyse and assess production planning and control systems, including those operating within distributed manufacturing environment.	25
CO-3	Be able to develop simulation of machine shop.	30
CO-4	Gain an overall understanding of computer aided production management.	2o

List of Experiments:

1. Salient features and facilities of ideal software.
2. Algorithm and program for sequencing / scheduling
3. Forecasting methods and program of any one.
4. Group technology
5. Computerized plant layout design
6. Computer aided process planning
7. Material requirement planning
8. Shop floor control

Equipment / Computational facility:
1.Computational Facility and programming software

List of Open Source Software/learning website: https://nptel.ac.in/

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3720815
Semester –II
Subject Name: COMPUTER INTEGRATED MANUFACTURING

Type of course: Core IV

Prerequisite: Zeal to learn the subject

Rationale: To address high end technologies used to automate manufacturing operations using computerized integration of product design, planning, production, distribution, and management.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Manufacturing Automation:** Automated Manufacturing Systems, Computerized Manufacturing Support Systems, Reasons for Automation, Automation Strategies-The USA Principle, Ten Strategies for Automation and Process Improvement, Automation Migration Strategy**.**	**2**
2	**Automated Flow lines:** System Configurations, Workpart Transfer Mechanisms, Storage Buffers, Control of Production Line, Analysis of Transfer Lines-Transfer Lines with No Internal Parts Storage, Transfer Lines with Internal Storage Buffers.	**4**
3	**Manual Assembly Lines:** Assembly Workstations, Work Transport Systems, Line Pacing, Coping With Product Variety, Analysis of Single Model Assembly Lines-Repositioning Losses, The Line Balancing Problem, Line Balancing Algorithms-Largest Candiate Rule, Kilbridge and Wester Method, Ranked Positional Weights Method.	**6**
4	**Automated Assembly Systems:** System Configurations, Parts Delivery at Workstations, Applications, Quantitative Analysis of Assembly Systems- Parts Delivery System at Workstations, Multi-station Assembly machines, Single Station Assembly Machines, Partial Automation.	**4**
5	**Automatic Material Handling and Storage systems:** Design Considerations in Material Handling, Material Transport Equipment-Industrial Trucks, Automated Guided Vehicles, Monorails and Other Rail-Guided Vehicles,	**4**

	Conveyors, Cranes and Hoists, Analysis of Vehicle Based Systems, Conveyor Analysis. Engineering Analysis of AS/RS and Carousel Systems.	
6	**Automated Inspection systems:** Overview of Automated Identification Methods, Bar Code Technology, Radio Frequency Identification, Other AIDC Technologies-Mangnetic Stripes, Optical Character Recognition, and Machine Vision.	**5**
7	**Computer Aided Process Planning:** Retrieval CAPP Systems, Generative CAPP Systems, Graph Based Approach, Attribute Adjacency Graph, Benefits of CAPP.	**4**
8	**Flexible Manufacturing Systems:** Types of flexibility, types of FMS, FMS components, FMS Components-Workstations, Material Handling and Storage Systems, Computer Control System, Human Recourses, FMS Applications and Benefits., Quantitative analysis of FMS, Sizing the FMS, System performance measure.	**5**
9	**Computer Integrated Manufacturing:** The Scope of CAD/CAM and CIM, Computerized elements of a CIM System, Components of CIM, Database for CIM, Planning , Scheduling and Analysis of CIM Systems.	**4**
10	**Rapid Prototyping** Introduction, Prototype design methods, prototype design tools, liquid, solid and powder based RP processes, STL format and STL file problems.	**4**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**10**	**30**	**20**	**20**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Automation, production Systems and Computer Integrated Manufacturing, Mikell P Groover, Prentice Hall, 2007.
2. System Approach to Computer Integrated Manufacturing, Nanua Singh, Wiley & Sons Inc., 1996.
3. Intelligent Manufacturing System, Andrew Kusiak, Prentice Hall Inc., 1992

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3720815

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Gain an overall understanding of automated systems integration.	20
CO-2	Be able to use and program programmable controllers, robots and CNC machines in an integrated system.	20
CO-3	Be able to develop interfaces necessary to integrate machines with a conveyor system and a host control system for a flexible manufacturing system.	30
CO-4	Demonstrate their understanding by producing a product through an integrated flexible manufacturing system and documenting the results	25
CO-5	Gain an overall understanding of automated systems integration.	15

List of Experiments:

1. Problems on automated flow lines
2. Problems on line balancing, Ranked Positional Weights Method etc. for manual assembly lines
3. Problems on automated assembly systems
4. Problems on quantitative analysis of FMS
5. Sizing problems on FMS
6. STL file format reading and use of related algorithm for its manipulation
7. Problems on scheduling for CIM
8. Demonstration / programming exercise on automated inspection system
9. Demonstration / programming exercise on Automated material handling system

Equipment / Computational facility:

1. AS/RS
2. AGV
3. Workstations.
4. Controlling software and hardware
5. Machine Vision System
6. Loading / Unloading Mechanisms.
7. RP Machine.

List of Open Source Software/learning website: https://nptel.ac.in/

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3720817
Noise and Vibrations Analysis
Semester II

Type of course: Engineering Science

Prerequisite: Zeal to learn the subject

Rationale: The course intends to provide intermediate level of knowledge of Mechanical Vibrations and foundations of noise. The course includes analysis of single and multi-degrees of freedom system, analysis of continuous system along with experimental methods

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Topics	Teaching Hrs.
1	**Fundamentals of Vibration:** Introduction to Single degree freedom systems, Duhamel's Integral, Impulse Response function, Virtual work, Lagrange's equation, Single degree freedom forced vibration with elastically coupled viscous dampers, Transient Vibration	06
2	**Two Degrees of Freedom System:** Free vibration of spring-coupled system, Mass coupled system, Vibration of two degree freedom system, Forced vibration of spring-coupled system, Mass coupled system,Nonlinear stiffness, Vibration Absorber, Vibration Isolation.	05
3	**Multi-Degrees Freedom System:** Normal mode of vibration, Flexibility Matrix and Stiffness matrix Eigenvalues and Eigenvectors,Orthogonal properties,Forced Vibration by Matrix inversion,Modal analysis, Modal damping in forced vibration,Matrix iteration, Using Lagrange's equation to derive equation of motion.	07
4	**Vibration of Continuous Systems:** Systems governed by wave equations, Vibration of strings, Vibration of rods,Euler Equation for Beams, Effect of Rotary inertia and shear deformation.	05
5	**Random Vibrations:** Description of random process, Correlation and power spectral density	03
6	**Experimental Methods in Vibration Analysis:** Vibration instruments, Vibration exciters Measuring Devices, Analysers, signal processing; modal parameter identification; vibration trouble-shooting and diagnosis; time-domain and frequency-domain vibration analysis.	06
7	**Noise:** Introduction Relation between vibration and noise pollution, vibration	03

	as noise sources, classification of analysis of machinery vibrations.	
8	**Noise Generated by Vibrating Structures and Control:** Elementary noise radiators; noise radiation by machine; noise source identification; sound intensity measurement; identification of noise source; noise radiation and transmission; design principles for noise reduction.	07

Reference Books:

1. Mechanical Vibrations, S. S.Rao, Pearson Eduction.
2. Mechanical Vibrations S.Graham Kelly and Shashidar K.Kudari, , McGraw-Hill Publishing
3. Engineering Vibration, Inman D J, Pearson Education.
4. Theory of Vibration with Applications Thomson W.T. CBS Publishers & Distributors / Prentice Hall of India
5. Introductory Course on Theory and Practice Mechanical Vibration Rao J.S., & Gupta, K. New Age International (P) Ltd.
6. Principles of Vibrations ControlA.K. Mallik, Affiliated East-West Press Pvt. Ltd.
7. Modal Testing: Theory and PracticeEwins D.JJohn Wiley.
8. Fundamentals of Noise and Vibration Analysis for EngineersNorton M P and Karczub D G Cambridge Press.

Course Outcome:

After learning the course

Sr. No.	Course Outcome	Percentage weightage
CO-1	Students will be able to understand fundamentals of modelling and analysis of mechanical systems.	30%
CO-2	Students will be able to conduct vibration analysis of continuous systems.	20%
CO-3	Students will be able to apply experimental methods for vibration measurement and control.	20%
CO-4	Students will be able to understand fundamentals of noise.	30%

List of Experiments:

Experiments should be designed considering following themes.

1. Study of SDOF forced vibration
2. Study of MDOF system.
3. Solution of SDOF and MDOF problems by MATLAB / SciLab
4. Vibration measurement using FFT analyser
5. Interpretation of FFT results i.e. finding problems like unbalance, misalignment, also finding damping coefficient
6. Study of vibrations of continuous system
7. Noise measurement

Major Equipment:

1. Universal Vibration experimental set up.

2. Accelerometer , Microphone, FFT analyzer.

List of Open Source Software/learning website:

1. **NPTEL courses**
2. **Scilab Software**

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3720820
MULTIBODY DYNAMICS
SEMESTER: II

Type of course: Program Elective

Prerequisite: Zeal to learn the subject

Rationale: This course reviews and reinforces the student's understanding Kinematics and Dynamics of multibody systems with immediate application to the dynamics of systems of rigid bodies. The course will place equal emphasis on gaining both an analytical understanding and insight/intuition on the subject.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Contents:

Sr. No	Topic	Lectures
1	**Basic concepts in 3-D rigid-body mechanics** Degrees-of-freedom;Rigid body vs flexible body; Spatial kinematics (3-D rotation transformations); Euler theorem, rotation parameterization, Rodriguez formula; Moments and products of inertia; Newton-Euler equations of motion; Lagrange Equation; Generalized forces.	**11**
2	**Inter-connected rigid bodies** Kinematic pairs (joints) with classification of constraints; holonomic and non-holonomic constraints; Springs, dampers, actuators and controllers with brief introduction of controls theory.	**6**
3	**Formulation of equations of motion for inter-connected bodies** Relative coordinates, generalized coordinates, Cartesian co-ordinates ; Lagrange' s equations and other approaches; Differential equations (ODE) and differential algebraic equations (DAE); Co-ordinate partitioning and Lagrange multipliers; Types of analyses (kinematic, static, quasi-static, kineto-static, dynamic and linear dynamic).	**11**
4	**Application of numerical methods** NR method, Jacobian, ODE integrators (Euler methods and Implicit methods); Stability, accuracy and Dahlquist's tradeoff criteria; Stiffness and damping - physical vs numerical; Lock-up, bifurcation and singularities.	**7**
5	**Flexible Multibody Systems** Dynamic analyses using classical approximation, FEM	**7**

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3720820

References Books:

1. Computational dynamics, Shabana A. A., John Wiley & Sons.
2. Dynamics of Multibody Systems, Roberson R. E., and Richard S., Springer-Verlag.
3. Dynamics of Multibody Systems, Shabana A. A., Cambridge University press.
4. Flexible Multibody Dynamics, Bauchau O. A., Vol. 176. Springer.
5. Dynamics and Balancing of Multibody Systems, Chaudhary H., and S K Saha. Springer.

Course Outcome:

After learning the course

Sr. No.	Course Outcome	Percentage weightage
CO-1	Students will be able to apply basic particle dynamics and 2-dimensional rigid body mechanics to 3-dimensional rigid bodies.	35%
CO-2	Students will be able to analyse interconnected bodies in a multi-body system.	35%
CO-3	Students will be able to use numerical methods for the analysis of multi-body system.	30%

List of Experiments:

1. Kinematics of a planar open-loop system using MATLAB/Scilab
2. Inverse dynamics of planar open-loop systems using MATLAB/Scilab
3. Forward dynamics of planar open-loop systems using MATLAB/Scilab
4. Kinematics of a planar closed-loop system using MATLAB/Scilab
5. Inverse dynamics of planar closed-loop systems using MATLAB/Scilab
6. Forward dynamics of planar closed-loop systems using MATLAB/Scilab
7. Kinematics of a spatial closed-loop system using MATLAB/Scilab
8. Inverse dynamics of spatial closed-loop systems using MATLAB/Scilab
9. Forward dynamics of spatial closed-loop systems using MATLAB/Scilab
10. Modellingand analysis of multibody systems using MBD software.

Major Equipment:

1. Computational facility and Matlab / Scilab.
2. Mechanism analysis software.

List of Open Source Software/learning website:

Scilab Software

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3720821
OPTIMIZATION TECHNIQUES
SEMESTER: II

Type of course: Program Elective

Prerequisite: Zeal to learn the subject

Rationale: This course deals with optimization techniques used in engineering.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Contents:

Sr. No	Topic	Hours
1	**Introduction to Optimization** Historical Development, Engineering applications of Optimization, Design vector and constraints, Constraint surface, Objective function, Classification of Optimization Problems	**04**
2	**Classical Optimization Techniques** Single variable optimization, Constrained and unconstrained multi-variable optimization, Direct substitution method, Lagrange's method of multipliers, Karush-Kuhn-Tucker conditions	**06**
3	**Linear Programming** Statement of an LP problem, Graphical Solution of an LP problem, Simplex method, Dual simplex method	**05**
4	**Non-linear Programming: One-dimensional minimization method** Unimodal function, Unrestricted search, Exhaustive search, Dichotomous search, Interval halving method, Fibonacci method, Golden section method, Direct root methods	**06**
5	**Non-linear Programming: Unconstrained Optimization Techniques** Direct Search Methods: Random search methods, Grid search method, Univariate method, Hookes and Jeeves' method, Powell's method Indirect Search Methods: Steepest descent method, Fletcher-Reeves method, Newton's method	**08**
6	**Non-linear Programming: Constrained Optimization Techniques** Direct Methods: Random search method, Sequential linear programming Indirect methods: Transformation techniques, Exterior penalty function method, Interior penalty function method	**08**
7	**Evolutionary Algorithms** An overview of evolutionary algorithms, Simulated annealing algorithm, Genetic algorithm, Particle swarm optimization	**06**

Reference Books:

1. Engineering Optimization Theory and Practice, S.S.Rao, New Age International (P) Ltd, Publishers
2. Kalyanmoy Deb Multi-objective optimization using evolutionary algorithms John Wiley Publications

3. Jasbir S. Arora Introduction to Optimum Design McGraw Hill Publication

Course Outcome:

After learning the course the

Sr. No.	Course Outcome	Percentage weightage
CO-1	Students will be able to understand basic theoretical principles for formulation of optimization models and its solution.	40%
CO-2	Students will be able to learn the unified and exact mathematical basis as well as the general principles of various soft computing techniques.	25%
CO-3	Students should be able to apply detailed theoretical and practical aspects of intelligent modelling, optimization and control of linear and non-linear systems.	35%

List of Experiments:

Computer programme (using Matlab / Scilab) for optimization techniques mentioned in syllabus like ..

1. Unrestricted Search methods
2. Golden Section Method
3. Fibonacci Method
4. Newton Methods
5. Quasi Newton and Secant methods
6. Univariate methods
7. Indirect search methods

Major Equipment:

1. Computational facility and Matlab / Scilab.

List of Open Source Software/learning website:

Scilab Software

GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3720823
Semester II
OIL HYDRAULICS AND PNEUMATICS

Type of course: Program Elective

Prerequisite: None

Rationale: A revolutionary change has taken place in the field of fluid power technology. An engineer in the field of design may require knowledge of power transmission; or in the field of operation and maintenance needs to know the power transmission system of machine tools, presses, equipment. An engineer should be well acquainted with various selection and manufacturing techniques, control, procedure and application of hydraulic/pneumatic components.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Contents	Teaching Hrs.
1	**Introduction:** Functional requirements of a power transmission, how these requirements can be fulfilled by various power transmission systems like mechanical, oil hydraulic, pneumatic, electrical or their combinations; Fundamentals of oil hydraulics and pneumatics, Control functions of oil hydraulic systems; Comparison between Mechanical, Oil Hydraulic, Pneumatic and Electrical power transmission systems; Advantages, disadvantages and Applications of Oil Hydraulic and Pneumatic power transmissions.	3
2	**Hydraulic Oils, Fluid Properties and Filter:** Types, Properties, functions of hydraulic Oils, ISOViscosity grades, Classification- Mineral based, Fire resistant& Biodegradable Oils, Filters, Contaminations, Filter rating, location of filter.	5
3	**Hydraulic Pumps, Valves and Actuators:** Classification of hydraulic pumps, Gear Pumps, Vane Pumps, Radial piston Pumps, Axial piston Pumps, Selection of Hydraulic Pumps, Direction control valves, Pressure control valves, Flow control valves, Non-return valves, Electro-Hydraulic Servo valves, Linear and Rotary Actuators, Hydrostatic Transmission Systems.	13
4	**Hydraulic system Accessories and Design of hydraulic circuits:** Reservoirs, Accumulators, Heating & cooling devices, Basic hydraulic circuits, Industrial hydraulic circuits, Power losses in flow control circuits.	7
5	**Introduction to Pneumatic systems, Air Compressor, Service Unit, pneumatic actuators and Pneumatic valves:** Basic Requirements for Pneumatic System, Applications, Types & Selection criteria for Air Compressors, Air receiver, FRL unit, Air filter, Pressure regulator and Lubricator, Types of Pneumatic Cylinders & Air motors, Cushion assembly, Pneumatic Direction control valves, Quick exhaust, Time delay, Shuttle and Twin pressure valves.	11
6	**Pneumatic circuits:** Basic pneumatic circuits, Conventional method, Cascade	2

	method.	
7	**Electro-Pneumatics and Electro Hydraulics :** Overview and applications, System components, Development of single and multiple Actuator Circuits.	**4**

Reference Books:

1. S R Majumdar, Oil Hydraulic Systems Tata McGraw-Hill
2. S R Majumdar Pneumatic Systems Tata McGraw-Hill
3. John Pippenger & Taylor Hicks Industrial Hydraulics McGraw-Hill
4. Anthony Esposito, Fluid Power,Prentice Hall
5. Andrew Parr, Hydraulics & Pneumatics , Jaico Publications

Course Outcome:

On completion of this course:

Sr. No.	Course Outcome	Percentage weightage
CO-1	Students will be able to understand basics of Hydraulic and Pneumatic systems and components used in these systems.	45%
CO-2	Students will be able to design Hydraulic and Pneumatic circuits for various applications.	45%
CO-3	Students will be able to understand fundaments of electro hydraulic and electro pneumatic systems.	10%

List of Experiments:

1. Introduction to graphical symbols as per DIN-ISO: 1219.
2. To understand working and construction of hydraulic components and basic circuits.
3. To understand working and construction of Pneumatic components and basic circuits. Construction of Basic hydraulic circuit.
4. Design of various hydraulic and electro hydraulic circuits used for automation purpose in industry.
5. Design of various pneumatic and electro pneumatic circuits used for automation purpose in industry.

Major Equipment:

1. A hydraulic trainer.
2. A pneumatic trainer.
3. PLC
4. Software like Automation Studio, where the simulation can be visualized.

List of Open Source Software/learning website:

1) Autosim Premium
2) Hydrosym
3) Scilab