Estd. 1962
NAAC 'A' Grade
MHRD-NIRF- 28th Rank

SHIVAJI UNIVERISTY, KOLHAPUR-416 004. MAHARASHTRA
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दुरध्वनी (ईपीएबीएक्स) २६०९००० (अभ्यास मंडळे विभाग– २६०९०९४)
फॅक्स : ००९१-०२३१-२६९१५३३ व २६९२३३३.e-mail:bos@unishivaji.ac.in

SU/BOS/Sci. & Tech/10399 **Date: 24/09/2018**

To,

The Principal/ Director,
All affiliated Engineering Colleges/ Institute,
Shivaji University, Kolhapur.

Subject : Regarding Guidelines, structure, of CBCS M. Tech. Program and syllabus of Part - I&II M. Tech. Program under Faculty of Science and Technology.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the University Authorities have accepted and granted approval to Guidelines, structure of CBCS M. Tech. Program and syllabus of Part - I&II M. Tech. Program to following branches under Faculty of Science and Technology:

M.Tech Part I & II (CBCS) (Branch)

1.	Civil Engineering	**2.**	Chemcial Engineering
3.	Mechanical (Heat power Engineering)	**4.**	Electronics Engineering
5.	Mechanical (Design Engineering)	**6.**	Computer Science and Engineering
7.	Mechnical (CAD/CAM/CAE)	**8.**	Electronics and Telecommunication
9.	Mechanical (Machine Design)		

The revised syllabi shall be implemented from the academic year 2018-19 (i.e. from July 2018) onwards. A soft copy containing CBCS Guidelines, structure, and syllabus of Part - I&II M. Tech. is enclosed herewith. The syllabus is also made available on university website www.unishivaji.ac.in.

Further, it is hereby informed that the question papers on the pre-revised syllabi shall be set for the examination to be held in October/November 2018 and April/May 2019. These chances are available for repeater students, if any.

You are therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,

Dy. Registrar

Encl-: as above.

Copy to-

1) I/c Dean, Faculty of Science & Technology
2) Director, Examination and Evaluation
3) The Chairman, respective BOS / Co-ordinating Committee

} For information

4) O.E. 4 Section
5) Appointment Section
6) Eligibility Section
7) Meeting Section

} For information & necessary action

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M. Tech.

MECHANICAL (MACHINE DESIGN)

(CBCS)

Part I & II

Syllabus to be implementd from 2018-19

FIRST YEAR M. Tech. MECHANICAL (MACHINE DESIGN) – CBCS PATTERN

SEMESTER - I

Sr. No	Course (Subject Title)	TEACHING SCHEME									EXAMINATION SCHEME												
		THEORY			TUTORIAL			PRACTICAL			THEORY					PRACTICAL					TERM WORK		
		Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Hours	Mode	Marks	Total Marks	Min	Hours	Mode	Marks	Total Marks	Min	Hours	Max	Min
1	MEMD101	3	3	3	1	1	1	-	-	-		CIE ESE	30 70	100	40	As per BOS Guidelines	-	-		-	1	25	10
2	MEMD 102	3	3	3	-	-	-	-	-	-		CIE ESE	30 70	100	40		-	-		-	-	-	-
3	MEMD 103	3	3	3	-	-	-	-	-	-		CIE ESE	30 70	100	40		-	-		-	-	-	-
4	MEMD 104 (E-I)	3	3	3	-	-	-	-	-	-		CIE ESE	30 70	100	40		-	-		-	-	-	-
5	MEMD 105 (E-II)	3	3	3	-	-	-	-	-	-		CIE ESE	30 70	100	40		-	-		-	-	-	-
6	MEMD 106	-	-	-	-	-	-	2	2	2							CIE ESE	25 25	50	20	-	-	-
7	MEMD 107	-	-	-	-	-	-	1	2	2							CIE ESE	25 25	50	20	-	-	-
8	MEMD 108	-	-	-	-	-	-	1	1	1							-	-	-	-	1	25	10
	TOTAL	**15**	**15**	**15**	**1**	**1**	**1**	**4**	**5**	**5**				**500**				**100**				**50**	

		SEMESTER –II																						
1	MEMD 201	3	3	3		1	1	1		-	-	-		CIE ESE	30 70	100	40	As per BOS Guidelines	-	-		-	1	25	10
2	MEMD 202	3	3	3		-	-	-		-	-	-		CIE ESE	30 70	100	40		-	-		-	-	-	-
3	MEMD 203	3	3	3		-	-	-		-	-	-		CIE ESE	30 70	100	40		-	-		-	-	-	-
4	MEMD 204 (E-III)	3	3	3		-	-	-		-	-	-		CIE ESE	30 70	100	40		-	-		-	-	-	-
5	MEMD 205 (E-IV)	3	3	3		-	-	-		-	-	-		CIE ESE	30 70	100	40		-	-		-	-	-	-
6	MEMD 206	-	-	-		-	-	-		2	2	2							CIE ESE	25 25	50	20	-	-	-
7	MEMD 207	-	-	-		-	-	-		1	1	1								-	-	-	1	25	10
8	MEMD 208	-	-	-		-	-	-		1	-	-							CIE ESE	25 25	50	20	-	-	-
	TOTAL	**15**	**15**	**15**		**1**	**1**	**1**		**4**	**3**	**3**				**500**				**100**					
	TOTAL	**30**	**30**	**30**		**2**	**2**	**2**		**8**	**8**	**8**				**1000**				**200**				**100**	

CIE- Continuous Internal Evaluation

ESE – End Semester Examination

• Candidate contact hours per week : 30 Hours (Minimum)	• Total Marks for M. Tech. Sem I& II: **1300**
• Theory/Tutorial Duration : 60 Minutes and Practical Duration : 120 Minutes	• Total Credits for M. Tech. Sem I & II : **40**
• In theory examination there will be a passing based on separate head of passing for examination of CIE and ESE.	
• There shall be separate passing for theory and practical (term work) courses.	

SECOND YEAR M. Tech. MECHANICAL (MACHINE DESIGN)–CBCS PATTERN

Sr. No	Course (Subject Title)	TEACHING SCHEME									EXAMINATION SCHEME												
		THEORY			TUTORIAL			PRACTICAL			THEORY					PRACTICAL				TERM WORK		
		Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Hours	Mode	Marks	Total Marks	Min	Hours	Mode	Max	Min	Hours	Max	Min
SEMESTER –III																							
1	MEMD301	-	-	-	-	-	-	2	-	-		CIE ESE	- -	-	-	As per BOS Guidelines	-	-	-	-	50	20
2	MEMD 302	-	-	-	-	-	-	2	5	5		CIE ESE	- -	-	-		-	-	-	-	50	20
3	MEMD 303	-	-	-	-	-	-	8	5	5		- -	- -	- -	- -		CIE ESE	50 50	20 20	-	-	-
	TOTAL	-	-	-	-	-	-	**12**	**5**	**5**							-	**100**	40	-	**100**	40
SEMESTER –IV																							
1	MEMD 401	-	-	-	-	-	-	8	5	5		CIE ESE	- -	-	-	As per BOS Guidelines	ESE	50	20	-	50	20
2	MEMD 402	-	-	-	-	-	-	8	**5**	**5**		CIE ESE	- -	-	-		ESE	100	40	-	-	-
	TOTAL	-	-	-	-	-	-	16	**5**	**5**		-	-	-	-		-	**150**		-	**50**	**20**
	TOTAL	-	-	-	-	-	-	**28**	**10**	**10**	-	-	-	-	-		-	**250**	-	-	**150**	-

CIE- Continuous Internal Evaluation
ESE – End Semester Examination

- Total Marks for M. Tech. Sem III & IV :**400**
- Total Credits for M. Tech. Sem III & IV :**28**
- In theory examination there will be a passing based on separate head of passing for examination of CIE and ESE.
- There shall be separate passing for theory and practical (term work) courses.

Note :

*For seminar I and Seminar II, work load will be for two students

*** Open elective:- Students can take any subject from other PG discipline being conducted in the same Institute and with the consent of their Guide/PG Faculty.

For Dissertation Phase, Work load will be for 6 Students.

COURSE CODE AND DEFINITION

Semester I

Sr. No	Code No.	Subject	Credits
1.	MEMD101	Solids Mechanics	4
2.	MEMD102	Mathematical Modeling and Design Optimization	3
3.	MEMD103	Vibrations Engineering	3
4.	MEMD104(E-I)	Elective – I	3
5.	MEMD105(E-II)	Elective-II	3
6.	MEMD106	Design Engineering Lab	2
7.	MEMD107	Computer Aided Analysis Lab-I	1
8.	MEMD108	*Seminar – I	1
		Total	20

Sr. No	Elective-I	Elective-II
1	Tribology	Vibration Control and Condition Monitoring
2	Process Equipment Design	Product Design and Development
3	Finite Element Analysis	Material Handling Equipment Design
4	Mechatronics	Robotics

Semester II

Sr. No	Code No.	Subject	Credits
1.	MEMD201	Mechanics of Machinery	4
2.	MEMD202	Advanced Machine Design	3
3.	MEMD203	Advanced Materials	3

4.	MEMD204 (E-I)	Elective-III	3
5.	MEMD205 (E-II)	Elective-IV	3
6.	MEMD206	Computer Aided Analysis Lab-II	2
7.	MEMD207	*Seminar – II	1
8.	MEMD208	Comprehensive Viva	1
		Total	20

Sr. No	Elective-III	Elective-IV
1	Experimental Stress Analysis	Noise and Vibration Harshness (NVH)
2	Composite Materials	Vehicle Dynamics
3	Advanced Machine Tool Design	Engineering Fracture Mechanics
4	** Open Elective	Reliability Engineering

Open Elective:-

1) Artificial Intelligence and Neural Network
2) Bio Medical Engineering
3) Hybrid Vehicles

Semester III

Sr. No	Code No.	Subject	Credits
1.	MEMD 301	Seminar-III	2
2.	MEMD 302	One Course from Moodle/Swayam	2
3.	MEMD 303	#Dissertation Phase-I	8
		Total	**12**

Semester IV

Sr. No	Code No.	Subject	Credits
1.	MEMD 401	#Dissertation Phase-II	8
2.	MEMD 402	#Dissertation Phase-III	8
		Total	**16**

Note :

*For seminar I and Seminar II, work load will be for two students.

#For Dissertation Phase I,Dissertation phase II and Dissertation Phase III work load will be for 6 students.

M.Tech. Mechanical (Machine Design) Part – I (Semester – I)

SolidsMechanics

TeachingScheme:
Lectures : 3 Hoursperweek
Tutorial : 1 Hourperweek

ExaminationScheme:
CIE : 30 Marks ESE :70 Marks
Term work : 25
Credit : 4

Course Objectives:

1. To provide students with sound basic concept in solid mechanics.
2. To acquire knowledge of solid mechanics for designing in Technical profession.
3. To train the students with good design engineering concept required for safe and efficient design, construction, installation, inspection and testing of structural part of mechanical system.

Course Outcomes:

On successful completion of the course the student should be able to

1. Solve the problems related to the theory of elasticity.
2. Analyze two dimensional problems in rectangular as well as polar co-ordinates.
3. Find shear center for various cross section.
4. Determine membrane stresses in shell and storage vessel.
5. Interrupt torsion of bars with various cross section.
6. Solve problem based on contact stresses.

1. Plane stress and plane strain: Differential equations of equilibrium, Boundary conditions,Compatibility,StressfunctionsandBiharmonicequation.Twodimensional problems in Rectangular coordinates, Applications to polynomials in rectangular coordinates, Saint-Venant'sprinciple.
2. Twodimensionalproblemsinpolarcoordinates:Generalequationsinpolarcoordinates, Pure bending of curved bars, Strain components in polar coordinates, Rotating discs, stresses in a circulardiscs.
3. Shear center: Shear stress, distribution and shear centre for thin walled open sections. BendingofBeams,Energymethods,Introductiontoelasticstability,Plasticity.
4. Torsion:Torsionofbarswithellipticalsquareandrectangularcrosssection,Membrane analogy,Hydrodynamicalanalogy,Torsionofhollowandthintubes.
5. Membranestressesinshellandstoragevessels,Shellsandvesselsofuniformstrength.
6. Contact stresses: Problem of determining contact stresses, Assumption Expressions for principal stresses,Examples.

Term Work:

10 to 12 study experiments/tutorials based on above topics.

Reference Books:

1. S.TimoshenkoandJ.W.Goodier"TheoryofElasticity"MGHbookcoLtd.
2. J.P.DenHartog,"Advancedstrengthofmaterials"MGHbookcoLtd.
3. F.B.Seety&Smith"Advancedmechanicsofmaterials"JohnWiley&Sons.
4. Irving H. Shames & James M. Pitarresi, "Introduction to Solid Mechanics", 3rd ed, PHI,

pub.
5. Boresi A.P. and Sidebottom O.M., “Advanced Mechanics of Materials”, John Wiley, 1993.
6. Chakrabarty,“TheoryofPlasticity”,McGraw-HillBookCompany,NewYork1990.
7. PopovE.P.,“EngineeringMechanicsofSolids”,2ndEd.,PrenticeHallIndia,1998.
8. Crandall S.H., Dahl N.C. and Lardner T.J., “An Introduction to the Mechanics of Solids”, 2nd Ed., McGraw-Hill,1978.
9. NashW.,“StrengthofMaterials”,Schaum’soutlineseries,McGrawHill.
10. Timoshenko.S.andYoungD.H.–“ElementsofstrengthmaterialsVol.IandVol.II”.T. Van Nostrand Co-Inc Princeton-N.J.1990.
11. “Statics and Mechanics of Materials: An Integrated Approach”, Riley Sturges and Morris. Wiley, 2ndEdition.
12. Sadhu Singh – Theory of Elasticity, KhannaPublisher

M.Tech. Mechanical (Machine Design) Part – I (Semester – I)

Mathematical Modeling and DesignOptimization

TeachingScheme:
Lectures : 3 Hoursperweek

ExaminationScheme:
CIE : 30 Marks ESE :70 Marks
Credit : 3

Course Objectives:

1. To gain a working knowledge of core techniques behind mathematical modeling
2. To develop a basic ability to quantify certain phenomena associated with the physical sciences and come up with practical suggestions
3. To apply Optimization Methods to Machine Design Engineering Problems
4. To appreciate the effect of optimization on design quality

Course Outcomes:

On successful completion of the course the student should be able to

1. Understand and apply types of models to real life situations
2. Know and use basic techniques such as simulation, solution of linear and nonlinear equations etc.
3. Use conservation equations to construct mathematical models of a range of phenomena
4. Formulate optimization problem, know given optimization techniques, apply correct technique to solve specific problem and draw meaningful inferences

Section I: Mathematical Modeling

1.Research Modeling andSimulation:

The Reality, the experiment and the model, Concept of modeling,Models as Approximations,Types of Modeling, Need and Classification of mathematical modeling, Use of Analogy, Data consideration and Testing of Models, Modeling of dynamic systems with differential equations, Simulation of data in the form of mathematical equations, Linear-Non-linear equations, Determining the Unknowns of Equations using Least Square Criterion, Process of Simulation, Steps and Features of Simulation Experiments and their Validation.

Section II: Design Optimization

2. a. Classical OptimizationTechniques:

Single-variable and Multi-variable Optimization, Hessian Matrix, Saddle Point, Lagrange Multipliers Method and Kuhn-Tucker Conditions.

b. Single-variable OptimizationTechniques:

LinearandNon-Linearbehavior,UnrestrictedSearch,Solutionusing GraphicalMethod andNumericalMethods,Interval-halvingMethod,Golden-sectionMethod,Newton Method, SecantMethod

c. Multi-variable OptimizationTechniques:

Non-linear Equations, Steepest Descent Method,Conjugate Gradient Method, Davids on- Fletcher-Powell Method

3. TaguchiMethod:
Introduction, Loss Function and Signal –to-noise ratios, Control Factors and Noise Factors, Orthogonal Design, Design of Experiments, Steps in carrying out experiment, Analysis of variances etc.

Term Work:
The Student is expected to understand and study the basic components of the research process so that they should carry out the term work so that it will help/lead to finalize research project.

Four Assignments based on the Syllabus which includes
Data Collection, data Processing, data Simulation
Modeling and simulation of Design problem
Optimum Design of Mechanical system using Numerical/Graphical techniques.
Case studies to be solved by using EXCEL sheet of following nature.
CaseI:ForBetterSurfaceFinish(Considerthreeparameters(factors))
a. Hardness b. Speed c. Feed
Case II: For Better Tool Life (Consider three parameters (factors))
a. Linear Velocity b. Depth of Cut c. Feed

Case III: For Optimum Cutting Force during Turning Operation (Consider three parameters (factors)) a. Speed b. Depth of cut c. feed

Students are to design the experiment based on similar problems given as above.

Text Books:

1. WilkinsonK.P.L.Bhandarkar,FormulationofHypothesis,HimalayaPublishingHouse
2. Ranjit Kumar, (2006), Research Methodology – A Step-By-Step Guide for Beginners, (Pearson Education, Delhi) ISBN :81-317-0496-3
3. C.R. Kothari, “Research Methodology”, Wiley EasternPublication.
4. Dr S.S. Rao,”Optimization Theory and Applications”, Wiley Eastern Ltd., New Age International, New Delhi, 2nd Edition,1994.
5. AdlerandGranovky,”OptimizationofEngineeringExperiments”,MeerPublications

Reference Books:

1. Trochim, William M.K. (2003), 2/e, Research Methods, (Biztantra, Dreamtech Press, New Delhi), ISBN :81-7722-372-0
2. Montgomery Douglas C., & Tunger, George C. (2007). 3/e, Applied Statistics & Probability for Engineers, (WileyIndia).
3. Ross P.J., “Taguchi Techniques for Quality Engineering”, TMH,2005.
4. JeffWu,“Experiments:Planning,AnalysisandParameterDesign”,JohnWiley,2000.
5. FoxR.L.,“OptimizationMethodsforEngineeringDesign”,AddisonWesley,1971.

M.Tech. Mechanical (Machine Design) Part – I (Semester – I)

Vibration Engineering

TeachingScheme:	ExaminationScheme:
Lectures : 3 Hoursperweek	CIE : 30 Marks ESE :70 Marks
	Credit : 3

Course Objectives:

1. To understand the fundamentals of Vibration Theory
2. To acquire complete knowledge of analysis of Two degree freedom system, Multi degree freedom system and Vibration of Continuous Systems
3. To make students understand and learn about the Experimental Methods in Vibration Analysis
4. To acquire knowledge of Analytical Dynamic Analysis, Non-Linear Vibrations and Random Vibrations

Course Outcomes:

After the completion of course students will be able to

1. Knowledge of fundamentals of Vibrations
2. Considerably more in-depth knowledge of the major subject and ability to solve problems on Two degree freedom system, Multi degree freedom system
3. Knowledge of Experimental Methods in Vibration Analysis
4. Deeper knowledge of Dynamic Analysis.
5. Knowledge of Non-Linear Vibrations and Random Vibrations.

1. Fundamentals of Vibration: Review of Single and Two degree freedom systems subjectedtoForcedandMotionExcitation.Responsetoarbitraryperiodicandaperiodic excitations,Impulseresponse-Transientvibration-Laplacetransformationformulation. Fourier transforms- definition, Relation to transfer functions, First order systems, applications. Basic Concepts like Passive, Semi-active and Active Parameters.
2. Two Degree Freedom System: Optimum design of single, two degree of freedom systems, Vibration Absorber and Vibrationisolators.
3. Multi Degree Freedom System : Normal mode of vibration - Flexibility matrix and stiffnessmatrix-EigenvalueandEigenvector–Orthogonalproperties-Modalmatrix - Modal analysis - Forced vibration by matrix inversion - Modal damping in forced vibration - Numerical methods of determining natural frequencies.
4. Vibration of Continuous Systems: Systems governed by wave equations - Vibration of strings - Vibration of rods - Euler's equation for beams - Effect of Rotary inertia and shear deformation - Vibration ofplates.
5. Experimental Methods in Vibration Analysis: Vibration instruments - Vibration exciters,Measuring Devices - Analysis - Vibration Tests - Free and Forced Vibration tests. Collection of FRF, Experimental modal analysis methods, Examples of vibration tests - Industrial casestudies.
6. Analytical Dynamic Analysis: Dynamic analysis - Equation of motions - Mass matrices-Freevibrationanalysis-NaturalfrequenciesofLongitudinal-Transverseand torsional vibrations - Introduction to transient fieldproblem.
7. Validation of Analytical Models: Preliminary check, Correlation of analytical model with experimental model, Model updating-fundamentals.

8. Non-Linear Vibrations: Introduction, Sources of nonlinearity, Qualitative analysis of nonlinear systems, Phase plane, Conservative systems, Stability of equilibrium, Limit cycles-van der pol oscillator, Perturbation method, Chaos, Method of iteration, Self-excited oscillations, Lindstedt'sMethod.

9. Random Vibrations: Random phenomena, Time averaging and expected value, Frequencyresponsefunction,Probabilitydistribution,Correlation,Powerspectrumand power spectral density, Fourier transforms, FT's andresponse.

Term Work:

Following Experiments/Assignments Comprise the laboratory Practice:-

1. Application of sensors and related instrumentation for time domain and frequency domain.
2. Twoassignmentsonmeasurementofdynamictestdataofmachineelements.
3. Modaltestingandanalysisfornaturalfrequenciesandmodeshapesforstructures.
4. Random vibration and measurement of vehicles on testtrack.
5. Two assignments on dynamic analysis using FEA software like Nastran, Hyperworks etc.
6. OneAssignmentonmodeldatacorrelationforanyonemodelusedinSr.No.2and3.
7. MinimiumTWOassignmentsonsolvingvibrationproblemsusingMATLAB.
8. Soundintensitymeasurementininteriorofvehicleforsourcelocationforharshness.

Text Books:

1. ThomsonW.T.,"TheoryofVibrationwithApplications"CBSPublishersand Distributors, New Delhi ,1990
2. DenHartogJ.P.,"MechanicalVibrations",DoverPublications,1990.
3. RaoS.S.,"MechanicalVibrations",AddisonWesleyLongman,1995.
4. MechanicalVibrations-S.GrahamKelly,Schaum'sOutlines,TataMcGrawHill,2007
5. ElementsofVibrationAnalysis,LenordMeirovitch,Mc,GrawHillLtd,2004

Reference Books:

1. RaoJ.S.&GuptaK.,"Ind.CourseonTheoryandPracticeMechanicalVibration",New Age International (P) Ltd.,1984.
2. D.J. Ewins, Modal Testing: Theory and Practice, Research Press Ltd, Letch worth (Herefordshire, England)(1984).
3. M.I. Friswell & J.E. Mottershead, Finite Element Model Updating in Structural Dynamics(SolidMechanics&ItsApplications.)KluwerAcademicPublishers(1995)
4. Vibration:FundamentalandPractice,ClarenceW.deSilva,CRCPressLLC,2000.
5. FundamentalsofMechanicalVibration.-S.GrahamKelly.2ndeditionMcGrawHill.

M.Tech. Mechanical (Machine Design) Part – I (Semester – I)

Elective I- Tribology

TeachingScheme:
Lectures : 3 Hoursperweek

ExaminationScheme:
CIE : 30 Marks ESE :70 Marks
Credit : 3

Course Objectives:

1. To acquire basic understanding of Tribology.
2. To acquire complete knowledge of friction and wear.
3. To make students understand and learn about Bearings, Lubrication and Lubricants
4. To acquire knowledge of lubrication systems.

Course Outcomes:

After the completion of course students will be able to

1. Knowledge of design for Tribology.
2. Considerably more in-depth knowledge of the major subject and friction and wear
3. Deeper Knowledge of Bearings, Lubrication.
4. knowledge of Hydrostatic (externally-pressurized) & Elasto-Hydrodynamic Lubrication
5. Knowledge of Rheodynamic (static) Lubrication

1.Introduction:

Introduction to Tribology-General Tribology considerations in the design of gears, Cams, Reciprocating components, etc. Engine Tribology basics- Tribology aspects of engine components such as bearings, piston assembly, valve train and drive train components etc.

2.Friction andwear:

Nature of metal surfaces- surface properties- surface parameters and measurements, Friction-sliding friction-rolling friction characteristics of common metals and nonmetals-frictionunderextremeenvironments,Enginefriction-Lossesandenginedesignparameters, Economic role of wear-type of wear-wear mechanism-factors affecting wear-selection of materials for different wear situations-measurement of wear-tribometers and Tribometry, Enginewear-mechanisms,Wearresistancematerialandcoatingsandfailuremodeanalysis.

3.Bearings, lubrication andLubricants:

TheoryofhydrodynamiclubricationGeneralizedReynoldsEquation-Sliderbearings-Fixed and pivoted shoe bearings-Hydrodynamic journal bearings-short and finite bearing-Thrust bearings-SinteredBearing-NonCircularbearingsandmultisidesurfacebearings. Lubrication-typeoflubricants-PropertiesandTesting–ServiceClassificationoflubricants-Lubrication of tribological components-Lubrication systems-Lubricant monitoring,SOAP, Ferrographyandotherrapidtestingmethodsforlubricantscontamination.

4.Hydrostatic (externally-pressurized) & Elasto-Hydrodynamic lubrication:

Hydrostatic bearing-basic concepts, bearing pad coefficient, Restrictors-Capillary, Orifice and flow control valve-bearing characteristic number and performancecoefficients-Flat,

Conical and Spherical pad thrust bearing-Multirecess journal and thrust bearings-Air and gaaslubricatedbearings,LubricationofBallandrollerbearings,camsandgears,Selection and life estimation, Fatigue anddiagnostics.

5.Rheodynamic (static)lubrication:

Non-Newtonian fluids, characteristics, Thixotopic, materials and Bingham solids, Grease lubrication and stability, Tribology of components in extreme environments like vacuum, pressure, temperature; tribomonitoring and special applications, Tribology matching and selection, Tribometry, Tribo-testing and standards

Term-Work:

Minimum TEN assignments based on the above topics.

Reference Books:

1. Bowden F.P. & Tabor D., “Friction and Lubrication of solids”, Oxford University Press.,1986.
2. ErnestRabinoweiez:“FrictionandWearofmaterials”InterscicencePublishers,1995.
3. Neale M.J., Tribology-: Hand Book", Butterworth,1995.
4. FullerD.D.:“TheoryandpracticeofLubricationforengineers”,JohnWileysons,1984.
5. Gross W. A.: “Gas film lubrication”, Wiley,1980.

M.Tech. Mechanical (Machine Design) Part – I (Semester – I)

Elective I-Process Equipment Design

TeachingScheme:	ExaminationScheme:
Lectures : 3 Hoursperweek	CIE : 30 Marks ESE :70 Marks
	Credit : 3

Course Objectives:

1. To prepare students to acquire the basic of process equipment design.
2. To acquire complete knowledge of design procedure for commonly used process equipment.
3. To understand the piping design.
4. To acquire knowledge of process control, planning, inspection and irrection of process equipment.

Course Outcomes:

After the completion of course students will be able to

1. Knowledge of basic process equipment design.
2. Developing ability to design pressure vessel and their parts.
3. Knowledge of piping design and process equipment design.
4. Knowledge of application of CAD for process equipment design.

1. Process DesignParameters:

Basic concepts in process design, Block diagrams for flow of processes,Material flow balance, Design pressures -–temperatures, Design stresses, factory of safety, Minimum shell thickness and corrosion allowance, Weld joints efficiency, Design loading, Stress concentration and thermal stresses, Failure criteria, Optimization technique such as Lagrange's multiplier and golden section method, Cost and profitability estimation. Introduction to design codes like IS-2825, ASME-SECT, EIGHT-DIV-II TEMA.API-650, BS-1500 & 1515.

2. DesignofCylindricalandSphericalVessels:

Thin and thick walled cylinder analysis, Design of end closers, Local stresses due to discontinuity or change of shape of vessel, Vessel opening compensation, Design of standard and non-standard flanges, Design of vessels and pipes under external pressure, Design of supports for process vessels.

3. DesignofTallVesselsandLargeStorageTanks:

Determinationofequivalentstressundercombinedloadingsincludingseismicandwind loads,Applicationofittoverticalequipmentlikedistillationcolumn.

4. DesignofThickWalledHighPressureVessels:

Designbyvarioustheoriesoffailure,Constructionofthesevesselswithhighstrengthsteel and other specialmethods.

5. Process Equipment Design:

Storage vessels, Reaction vessels, Agitators and Mixers, Heat exchangers, Filters and Driers, Centrifuges, Code practices, selection and specification procedures used in design, Selection of pumps, compressors, electrical equipments and auxiliary services, safety, etc.

6. Process Piping Design:

Flowdiagramsandpipeworksymbols,Designoflayoutofwater,steamandcompressedair pipes work, Pipe fitting, Linings and flanged connections. Types of valves used on pipe line,Fabrication of pipe lines, Expansion joints and pipesupports.

7. Planning,manufacture,inspectionanderectionofprocessequipment:

Planning,manufacture,inspectionanderectionofprocessequipmentlikePressurevessels, chimneys,ducting,heatexchangers,pulverizingequipment,etc.Protectivecoatings,Lining ofvessels.

8. Process Control:

Fundamentalsofprocessmeasurementsandcontrolmoderncontroldevicesandother controls of major unit operation andprocesses.

9. ApplicationsofCADtoProcessEquipmentDesign:

Term Work:

Followingassignments/experimentscomprisethelaboratorypractice:-

1. Designandoptimizationoftallvesselsandlargetanks.
2. Design of Heat exchangers used inindustries.
3. Designofcrystallizers.
4. Designanddevelopmentofequipmentusefultoprocessindustriessuchas Sugar, Cement andChemical
5. Preparing flow diagrams of processes, piping layout,etc.
6. Report based on visit to industries such as Sugar, Cement andChemical

Reference Books:

1. Process Equipment Design : By Dr. M.V. Joshi,Mc-Millan.
2. Process Equipment Design : By Browell and Young, JohnWiley.
3. PlantDesignandEconomics:MaxandTimasulausKalus–McGrawHill.
4. IndustrialInstrumentationservicingHandBook:CannelGrady&McGrawHill.
5. HandbookofInstrumentationandControl:KellenHeward,McGrawHill.
6. Chemical Engineering Handbook : Perry John, McGrawHill.
7. Chemical Equipment Design : B.C.Bhattacharya.
8. Industrial Pipe Work : D.N.W. Kentish, McGrawHill.
9. ChemicalEngineering:J.M.Coulson,Richardson,SinnottVol.VII,Maxwell, McMillan.
10. Pressure Vessel Design Hand Book : H.Bedna.
11. Dryden'soutlinesofChemicalTechnologyforthe2:ByRoaM.Gopala&Sitting M., East West Press Pvt. Ltd., NewDelhi.
12. AppliedProcessDesignforChemicalandPetrochemical,Vol.I,IIandIII:ByE.E. Ludwig, Gulf Publication Co.,Houston.
13. ChemicalProcessControl:AnIntroductiontoTheoryandPractice:By Stephanopoulos G., Prentice Hall of India, NewDelhi.
14. ChemicalProcessEquipmentSelectionandDesign:ByStanleyM.Walas, Butterworth- Heinemann Series in ChemicalEngineering.
15. ProcessSystemAnalysisandControl:ByD.R.Coughanowr,McGrawHill,New York.
16. EngineeringOptimization:TheoryandPractice:ByRaoS.S.,NewAgePublishing Co., NewDelhi.

17. OptimizationofChemicalProcesses:ByEdgarT.F.,HimmelblauD.M.,McGraw Hill Book Co., NewYork.
18. Control Devices, Vol. I and II :Liptak
19. Analysis,synthesisanddesignofChemicalProcesses:RichardTurton,RichardC. Bailie, Wallace B. Whiting, Josheph A. Shaewitz, Prentice Hall Int. Series in Physical and ChemicalScience.
20. TheoryandDesignofPressureVessels",byHarvey,secondedition,CBSpublishers anddistributors

M.Tech. Mechanical (Machine Design) Part – I (Semester – I)
Elective I - Finite Element Analysis

TeachingScheme:	ExaminationScheme:
Lectures : 3 Hoursperweek	CIE : 30 Marks ESE :70 Marks
	Credit : 3

Course Objectives:

1. To explain variational and energy principles.
2. To introduce the basics of finite element formulation.
3. To formulate one-dimensional and two-dimensional elements.
4. To analyze one-dimensional and two-dimensional applications in solid mechanics and heat transfer.
5. To explain numerical integration.
6. To introduce isoparametric elements.
7. To utilise commercial finite element analysis software.

Course Outcomes:

Having successfully completed this course, the student will be able to:

1. Identify the concepts of idealization and discretisation,
2. Defining boundary conditions,
3. Formulate element and global stiffness matrices,
4. Evaluate results of finite element analysis,
5. Identify sources of computational errors of finite element analysis,
6. Identify sources of physical errors of finite element analysis.
7. Understand limitations and scope applicability of finite element analysis.
8. Implement the methodology of finite element analysis,
9. Interpret numerical results of finite element analysis,
10. Use commercial finite element analysis software.

1. Introduction to Finite Element Method : Engineering Analysis, History, Advantages, Classification, Basic steps, Convergence criteria, Role of finite element analysis in computer-aided design, Mathematical Preliminaries, Differential equations formulations, Variational formulations, Weighted residualmethods.

2. One-Dimensional Elements-Analysis of Bars and Trusses: Basic Equations and PotentialEnergyFunctional,1-DBarElement,Trusses,Admissibledisplacementfunction, Strain matrix, Stress recovery, Element equations, Stiffness matrix, Consistent nodal force vector: Body force, Initial strain, Assembly Procedure, Boundary and Constraint Conditions, Single point constraint, Multi-point constraint, 2-D Bar Element, Shape Functions for Higher Order Elements.

3. Two-Dimensional Elements-Analysis of Plane Elasticity Problems: Three-Noded Triangular Element (TRIA 3), Four-Noded Quadrilateral Element (QUAD 4),Shape functions for Higher Order Elements (TRIA 6, QUAD 8).

4. Axi-symmetric Solid Elements-Analysis of Bodies of Revolution under axi-symmetric loading: Axisymmetric Triangular and Quadrilateral Ring Elements. Shape functions for Higher OrderElements.

5. Three-Dimensional Elements-Applications to Solid Mechanics Problems: Basic Equations and Potential Energy Functional, Four-Noded Tetrahedral Element (TET 4), Eight-Noded Hexahedral Element (HEXA 8), Tetrahedral elements, Hexahedralelements: Serendipity family, Hexahedral elements: Lagrange family, Shape functions for Higher Order Elements

6. Beam Elements-Analysis of Beams and Frames: 1–D Beam Element, 2–D Beam Element Problems, Plate bending and shellelements.

7. Heat Transfer - Fluid Flow: Steady state heat transfer, 1 D heat conduction governing equation, Boundary conditions, One dimensional element, Functional approach for heat conduction,Galerkinapproachforheatconduction,Heatfluxboundarycondition,1Dheat transferinthinfins.Basicdifferentialequationforfluidflowinpipes,aroundsolidbodies, porous media.

8. Dynamic Considerations: Formulation for point mass and distributed masses, Consistent element mass matrix of one dimensional bar element, truss element, axisymmetric triangular element, quadrilatateral element, beam element. Lumped mass matrix, Evaluation of Eigen values and Eigen vectors, Applications to bars, stepped bars, andbeams.IntroductiontoFESoftwarePackages,Algorithmicapproachfordevelopingthe code by theindividuals

9. Non-linear Analysis - Sources and types of non-linearity, Incremental approach to solution of nonlinear problems, Iterative solution methodologies, Considerations for simulation of non-linearproblems.

Term Work:

Tutorials should be given based on the below mentioned topics.

1. 1D & 2D structuralanalysis.
2. Analysis of planetrusses
3. Stress Analysis ofBracket.
4. Stress Analysis of with circularhole.
5. 1D and 2D heat transferproblems.
6. Computation of shapefunction.
7. Analysis of 2-D transient heat flow inplate
8. Computerprogrammesfor3Dstructuralanalysis
9. FiniteElementAnalysisofFluidFlowProblems.
10. Formulationandsolutionofdynamicproblemsusingcomputerprogrammes.

Text Books:

1. Rao S. S. “Finite Elements Method in Engineering”- 4th Edition, Elsevier,2006
2. J.N.Reddy,“FiniteElementMethod”-McGraw-HillInternationalEdition.
3. Bathe K. J. Finite Elements Procedures, PHI. Cook R. D., et al. “Concepts and ApplicationofFiniteElementsAnalysis”-4thEdition,Wiley&Sons,2003.
4. ChandrupatlaT.R.,“FiniteElementsinengineering”-2ndEditions,PHI,2007.2.

Reference Books:

1. Frank L. Stasa,” Applied finite Element Analysis for Engineers”, CBS International Edition,1985.
2. Zeinkovich, “The Finite Element Method for Solid and Structural Mechanics, 6th Ed., Elsevier2007.

M.Tech. Mechanical (Machine Design) Part – I (Semester – I)
Elective I- Mechatronics

TeachingScheme:
Lectures : 3 Hoursperweek

ExaminationScheme:
CIE : 30 Marks ESE :70 Marks
Credit : 3

Course Objectives:

1. To provide knowledge on electrical circuits, signal conditioning
2. To make familiar about control system and power electronics in designing Mechatronics system

Course Outcomes:

On successful completion of the course, the student will be able to,

1. Describe Mechatronic systems and overview of control systems & actuators.
2. Differentiate between various sensors, transducers and actuators and their applications.
3. Relate various signal conditioning units, amplifiers, logic gates and their role in programmable logic controllers

1. Introduction
   What is Mechatronics Systems, Measurement Systems, Control Systems, Microprocessor- based controllers, The Mechatronics Approach.

2. Sensors &transducers
   Sensors and Transducers, Performance Terminology, (Displacement, Position &ProximitySensors),(Velocity&Motion,Force,FluidPressure,Liquid Flow,LiquidLevel,Temperature&LightSensors),SelectionofSensors.

3. Electronicfundamentals
   Signal Conditioning Process, Operational Amplifier, Digital Logic, Logic Gates,BooleanAlgebra,DataAcquisitionSystems,MeasurementSystems, Testing andCalibration.

4. Actuators
   Mechanical Actuation Systems, Hydraulic & Pneumatic Actuation Systems, Electrical Actuation Systems, A.C. Motor, D.C. Motor, Stepper Motor.

5. System modelling &control
   Mathematical Models, Engineering Systems, Electromechanical & Hydraulic-Mechanical Systems, Modeling Dynamic Systems, Transfer Functions, IntroductiontoMATLAB&SIMULINK,ControlModes,PIDController.

6. Microprocessor &computer
   Computer and Interfacing, Microcomputer Structure, Microcontrollers, Application of Microcontrollers, PLC.

7. Design &mechatronics
   Designing, Possible Design Solutions, Case Studies of Mechatronic Systems.

Term Work:

Minimum Ten assignments based on above topics.

Text Books:

1. Mechatronics, W. Bolton, Pearson EducationAsia
2. Mechatronics, Dan Necsulescu, Pearson EducationAsia
3. Mechatronics,HMT
4. Measurement Systems, E.O. Doeblin, McGrawHill
5. Automatic Control Systems, B.C. Kuo, Ogata,PHI

Reference Books:

1. MechatronicsSystemDesignbyDevdasShettyandRichardA.Kolk,P.W.S. Publishing Company, 2001.
2. MechatronicsbyW.Bolton,PearsonEducation,Asia,II-Edition,2001.
3. AnalyticalRoboticsandMechatronics,WolframStadler&McGrawHill
4. Mechatronics,AMT
5. Introduction to Digital Computer Electronics, A.P. Mahind &TMH
6. UnderstandingElectromechanicalEngineering;AnIntroductiontoMechatronics-Lawrence J KPHI

M.Tech. Mechanical (Machine Design) Part – I (Semester – I)
Elective II-Vibration Control and Condition Monitoring

TeachingScheme:	ExaminationScheme:
Lectures : 3 Hoursperweek	CIE : 30 Marks ESE :70 Marks
	Credit : 3

Course Objectives:

1. To understand fundamental of vibrations.
2. To acquire complete knowledge of analysis of multidegree freedom system.
3. To understand the experimental methods in vibration analysis.
4. To acquire knowledge of non-linear and random vibration.
5. To understand condition monitoring techniques.

Course Outcomes:

On successful completion of the course the student should be able to

1. Knowledge of fundamentals of vibrations.
2. Various methods used to control vibrations.
3. Understand various technique of condition monitoring and fault diagnosis.
4. Know various methods of maintaince and signature analysis.
5. Understanding of dynamic balancing technique.

1. Introduction - Review of Fundamentals of Single Degree Freedom Systems – Two DegreeFreedomSystems,MultiDegreeFreedomSystem,continuoussystem,Determination ofNaturalfrequenciesandmodeshapes,NumericalmethodsinVibrationAnalysis.
2. Vibration Control – Reduction of Vibration at the Source – Control of Vibration – by Structuraldesign–MaterialSelection–Localizedadditions–Artificialdamping–Resilient isolation, Vibration isolation, Vibration absorbers, Active vibration control – review of smart materials – types and characteristics – smartstructures.
3. Selecting methods of condition monitoring – Machine condition monitoring and diagnosis Vibration severity criteria – Machine maintenance techniques – Machine condition monitoring techniques – Vibration monitoring techniques – Instrumentation systems – Choiceof monitoringparameter.
4. Predictive Maintenance and Signature Analysis – Observational and estimation techniques, Online techniques specially dealing with instrumentation system, Offline techniquelikevisualinspection,nondestructivetestinganddestructivetestingformaterials, fluids and generalmechanical and electrical components, Predicitive analyais of potential failures and end of useful life. Diagnostic maintenance, Applications to specific industrial machinery and plants.
5. Dynamic balancing and alignment of machinery: Dynamic Balancing of Rotors, Field Balancinginoneplane,twoplanes,andinseveralPlanes,MachineryAlignment,"Rough" Alignment Methods, the Face – Peripheral Dial Indicator Method, Reverse Indicator Method,Shaft-to-coupling spoolmethod.

Term Work:

Minimum Ten assignments based on above topics.

Text Books:

1. Singiresu S.Rao, “Mechanical Vibrations”, Addison-WesleyPublishing Company,1995.
2. J.O.DenHartog,“MechanicalVibrations”,McGrawHill,Newyork,1985.
3. R.A.Collacott, “Vibration monitoring and diagnosis”, Wiley,1979.

Reference Books:

1. R.A.Collacott,“MechanicalFaultdiagnosisandconditionmonitoring”,Wiley,1977.
2. Firstcourseon“Conditionmonitoringintheprocessindustries”,Manchester,edited by M.J.Neale,Nov.1979.
3. Newman, “Management of Industrial Maintenance”, Butterworth,1978.
4. “ConditionMonitoringmanual”,NationalProductivityCouncil,NewDelhi.
5. “Terotechnology”, Institute of mechanical Engineers,1975.
6. RaoJ.S.,“VibratoryConditionMonitoringofMachines”,CRCPress,2000.
7. “Hand Book of Condition Monitoring”,Els

M.Tech. Mechanical (Machine Design) Part – I (Semester – I)
Elective II-Product Design and Development

TeachingScheme:
Lectures : 3 Hoursperweek

ExaminationScheme:
CIE : 30 Marks ESE :70 Marks
Credit : 3

Course Objectives:

1. To teach Techniques in Design and development of innovative products in modern Industry to achieve the long-term success and survive in intensively competitive global market.
2. To know integrated approach to management of product design and development to create better quality products with enhanced capabilities, at attractive prices with compressed time.

Course Outcomes:

After the completion of course students will be able to

1. Identify and analyze the product design and development processes in manufacturing industry.
2. Define the components and their functions of product design and development processes and their relationships from concept to customer over whole product lifecycle.
3. Analyze, estimate and apply the methodologies for Industrial product design, development with Economic considerations.
4. Undertake a methodical approach to the management of product development and value engineering to full fill customer needs.

1. Introduction to product design: Approach industrial product based on idea generation andinnovativeness(andinventiveness)tomeettheneedsofthedevelopingsociety,Design and development process of industrial products, Various steps such as creative process involvedinideaofmarketing,TheDesigner-hisrole,mythandreality,theindustrialdesign organization,Basicdesignconsiderations,RoleofAestheticsinproductdesign,Functional design practice. Use of modeling technique, prototype designs, conceptual (conceptional) design.

2. Design for Production: Producibility Requirements in the design of machine components, Forging design, Pressed component design, Casting design for economical molding, eliminating defects and features to aid handling, Design for machining ease,The role of process Engineer, Ease of location and Clamping, Some additional aspects of production design, Design of powder metallurgical parts.

3.a) Industrial Product Design: General design situations, sailing specifications, requirementsandratings,theirimportanceinthedesign.,Studyofmarketrequirementsand manufacturingaspectsofindustrialdesigns.Aspectsofergonomicdesignofmachinetools,

testingequipments,instruments,automobiles,processequipmentsetc.Conventionofstyle, form and color of industrialdesign.

b) Design of Consumer Product: Design concepts of consumer products, Specification requirementsandratingoftheirimportanceindesign,functionsanduse,standardandlegal requirements,body/dimensions.ErgonomicConsiderations,interpretationofinformation, conversions for style, forms,colors.

4.Economics Considerations: Selection of material, Design for production,Use of standardization,Valueanalysisandcostreduction,Maintenanceaspectsofproductdesign. Economic Factors Influencing Design: Product value, Design for safety, Reliability and Environmentalconsiderations,Manufacturingoperationsinrelationtodesign,Economic analysis, Profit and competitiveness, Break even analysis, Economics of a new product design (Samuel Eilon Model).

5.Value Engineering and Product Design: Introduction, Historical perspective, Value, Natureandmeasurementofvalue,Maximumvalue,Normaldegreeofvalue,Importanceof value,ThevalueAnalysisJobPlan,Creativity,Stepstoproblemsolvingandvalueanalysis, Value Engg. Idea generation check list, Cost reduction, Materials and process selectionin value engineering.

6.Design Organization : Organization structure, Designers position, Drawing office procedure, Standardization, Record keeping, Legal product of designpatents.

Term Work:

Minimum Ten assignments based on above topics.

Text Books:

1. ProductDesignandDevelopmentbyKailTUlrichandStevenDEppinger
2. Product Design and Development by AK Chitale andGupta
3. Design of Systems and Devices by Middendorf MarcelDekker
4. Problemsofproductdesignanddevelopment–HearnBuck,PergamonPress.

Reference Books:

1. Industrialdesignforengineers–W.H.Mayall,LondonIliflebooks,Ltd.
2. Industrialdesignsinengineering–CharlesH.Flurscheimdesigncouncil.
3. Thegenerationofideafornewproducts–Trevorsowecy,Koganpage
4. The science of Engineering design – Percy II,Hill
5. Engineeringdesignconceptualstage–M.J.French,HeinmanEducationBooks.
6. Material of Inension – EziaManzim.

M.Tech. Mechanical (Machine Design) Part – I (Semester – I)
Elective II- Material Handling Equipment Design

TeachingScheme:
Lectures : 3 Hoursperweek

ExaminationScheme:
CIE : 30 Marks ESE :70 Marks
Credit : 3

Course Objectives:

1. To gain a working knowledge of various equipment used for material handling and storage
2. To understand the role of storage and handling equipment in manufacturing
3. To be able to design as simple equipment as possible and to plan for minimum manufacturing lead time and bottlenecks
4. To study in detail computerization of handling and storage to extract maximum benefits from them
5. To study safety aspects and regulations and if necessary create new ones for specific situations

Course Outcomes:

On successful completion of the course the student should be able to

1. Know all commonly used material handling equipment. Understand the significance of material handling equipment.
2. Know how to select the correct MH equipment for specific task
3. Plan and design commonly used MH equipment such as crane, hoist, conveyors etc.
4. Understand equipment for storing and select correct storage system
5. Understand role and need of automation of transfer and storage system
6. Understand and follow safety concerns and regulations

1. Elements of Material HandlingSystem:
   Importance, Terminology, Objectives and benefits of better Material Handling, Principles and features of Material Handling System, Interrelationships between material handling and plant layout, physical facilities and other organizational functions, Classification of Material Handling Equipments.

2. SelectionofMaterialHandlingEquipments:
   Factors affecting for selection, Material Handling Equation, Choices of Material Handling Equipment, General analysis Procedures, Basic Analytical techniques, The unit load concept, Selection of suitable types of systems for applications, Activity cost data and economic analysis for design of components of Material Handling Systems, Functions and parameters affecting service, Packing and storage of materials.

3. Design of Mechanical HandlingEquipments:
   [A] Design ofHoists:-
   Drives for hoisting, Components, and hoisting mechanisms, Rail traveling components and mechanism, Hoisting gear operation during transient motion, Selecting the motor rating and determining breaking torque for hoisting mechanisms.
   [B] Design ofCranes:-
   Hand-propelled and electrically driven E.O.T. Overheat Traveling Cranes, Traveling

mechanismsofcantileverandmonorailcranes,Designconsiderationsforstructuresof rotarycraneswithfixedradius,Fixedpostandoverheadtravelingcranes,Stabilityof stationary, rotary and traveling rotarycranes.

4. Design of load liftingattachments:
Load chains and types of ropes used in Material Handling System,Forged, Standard and RamshornHooks,CraneGrabsandClamps;GrabBuckets,Electromagnet,Design consideration for conveyor belts, Application ofattachments.

5. StudyofsystemsandEquipmentsusedforMaterialStorage:
Objectives of storage, Bulk material handling, Gravity flow of solids through slides and chutes, Storage in bins and hoppers, Belt conveyors, Bucket-elevators, Screw conveyors, Vibratory Conveyors, Cabin conveyors, Mobile racks etc.

6. MaterialHandling/WarehouseAutomationandSafetyconsiderations:
[A] Storageandwarehouseplanninganddesign,computerizedwarehouseplanning, Need,FactorsandIndicatorsforconsiderationinwarehouseautomation,which function,WhenandHowtoautomate,LevelsandMeansofMechanizations.
[B] Safety and Design, Safety regulations anddiscipline.

Term Work:

Following assignments comprise the laboratory practice:

1. DesignanddevelopmentofMaterialHandlingEquipmentsapplicabletovarious processindustriessuchasSugarIndustry,Powerplants,Automobilemanufacturing, Harbor, Foundriesetc.

2. Report based on visits to industries Manufacturing or using various Material Handling
Equipments.

Reference Books:

1. N.Rudenko,‘MaterialHandlingEquipments’,PeacePublishers,Moscow.
2. JamesM.Apple,‘MaterialHandlingSystemDesign’,John-WilllwyandSons Publication,NewYork.
3. JohnR.Immer,‘MaterialHandling’McGrawHillCo.Ltd.,NewYork.
4. ColinHardi,‘MaterialHandlinginMachineShops’.MachineryPublicationCo. Ltd.,Landon.
5. M.P.Nexandrn,‘MaterialHandlingEquipment’,MIRPublication,Moscow.
6. C. R. Cock and J. Mason, ‘Bulk Solid Handling’, Leonard Hill Publication Co. Ltd.,U.S.A.
7. SpivakovsyA.O.andDyachkovV.K.,‘ConveyingMachines’,VolumesIandII, MIR Publishers,1985.
8. Kulwiac R. A., ‘Material Handling Hand Book’, 2nd edition, JohnWilly Publication,NewYork.

M.Tech. Mechanical (Machine Design) Part – I (Semester – I)
Elective II: Robotics

TeachingScheme:
Lectures : 3 Hoursperweek

ExaminationScheme:
CIE : 30 Marks ESE :70 Marks
Credit : 3

Course Objectives:

1. To develop the student's knowledge in different configurations of robots and their drives.
2. To develop student's skills in performing spatial transformations associated with rigid body motions.
3. To develop student's skills in kinematics analysis of robot systems.
4. To provide the student with knowledge of the sensors , controllers and vision used in robots.

Course Outcomes:

After the completion of course students will be able to

1. Be familiar with different configurations of robots and their drives
2. Apply various transformations using D-H scheme for kinematic modeling of serial robotic manipulator.
3. Develop forward and inverse kinematic models of serial robotic manipulators.
4. Understand use of various sensors , controllers and vision used in robots.

1. RobotFundamentals
   Definitions, History of robots, Present and future trends in robotics, Robot classifications,Robotconfigurations,PointtoPointrobots,ContinuousPathrobots, Work volume, Issues in design and controlling robots, Repeatability, Control resolution, spatial resolution, Precision, Accuracy, Robot configurations, Point to Point robots, Continuous Path robots, Work volume, Applications of robots.Drives used in robots- Hydraulic, Pneumatic and Electric drives, Comparison of drive systems and their relative merits anddemerits.

2. ManipulatorKinematics:
   Matrix Algebra, Inverse of matrices, Rotational groups, Matrix representations of coordinatetransformation,Transformationaboutreferenceframeandmovingframe Forward & Inverse Kinematics examples of 2R, 3R & 3P manipulators, Specifying position and orientation of rigid bodies, Euler's angle and fixed rotation for specifying position and orientation, Homogeneous coordinate transformation and examples D-H representation of kinematics linkages, Forward kinematics of 6R manipulators using D-H representations,Inverse kinematics of 6R manipulators usingD-Hrepresentations,InverseKinematicsgeometricandalgebraicmethods.

3. Robotics Dynamics:
   Velocity Kinematics, Acceleration of rigid body, Mass distribution, Newton's equation, Euler's equation, Iterative Newton –Euler's dynamic formulation, Closed

dynamic, Lagrangian formulation of manipulator dynamics, Dynamic simulation, Computational consideration.

4. Trajectoryplanning:
   Introduction, General considerations in path description and generation, Joint space schemes, Cartesian space schemes, path generation in runtime, planning path using dynamic model point to point and continuous trajectory , 4-3-4 & trapezoidal velocity strategy for robots.

5. RobotSensors:
   Internal and external sensors, position- potentiometric, optical sensors ,encoders - absolute, incremental ,touch and slip sensors velocity and acceleration sensors, proximity sensors, force & torque sensors, Laser range finder, Camera. Micro-controllers, DSP, centralized controllers, Real time operating systems.

6. RobotControllers:
   Essential components-Drive for Hydraulic and Pneumatic actuators, H-bridge drives for D.C. motor Overload over current and stall detection methods, Example of a micro-controller/ microprocessor based robot Controller.

7. RobotVision:-
   Introduction, Image acquisition, Illumination Techniques, Imageconversion, Cameras,Sensors,Cameraandsysteminterface,FramebuffersandGrabbers,Image processing, Lowlevel & high level machine visionsystems.

8. Robot Programminglanguages:
   Introduction the three level of robot programming, requirements of a robot programming language, problems peculiar to robot programming languages.

9. Futuristic topics inRobotics:
   Micro-robotics and MEMS (Micro electo mechanical systems), Fabrication technology for Micro-robotics, Stability issue in legged robots, Under-actuated manipulators, Telecheirs.

Term Work:

Minimum Ten assignments based on above topics.

Reference Books:

1. S.R.Deb,“RoboticsTechnologyandFlexibleAutomation“,TataMcGrawHill 1994.
2. M.P.Groover,M.WeissR.N.Nagel,N.G.Odrey“IndustrialRobotics(Technology, Programming and application s) , McGraw, Hill1996
3. K.S.Fu,R.C.GonzalezandC.S.G.Lee,“Robotics:Control,sensors,visionand inintlligence “,MCGraw-Hill.1987.
4. J.J.Craig , introduction to Robotics , Addision-wesely1989.
5. Klafter , Richard D., et al “ RoboticsEngineering”,PhI,1996.
6. Zuech,Nello,”ApplyingMachineVision“,JohnWileyandsons,1988.

M.Tech. Mechanical (Machine Design) Part – I (Semester – I)

Design Engineering Lab

TeachingScheme: ExaminationScheme:

Tutorial/Practical: 2 Hoursperweek CIE :25MarksESE: 25 Marks

Credit : 2

Course Objectives:

1. To acquire basic understanding of various instrumentation.
2. To acquire complete knowledge of measurement of various parameters.
3. To acquire knowledge of conditioning monitoring and signature analysis.

Course Outcomes:

On successful completion of the course the student should be able to

1. Ability to measure various parameters like displacement, temperature, vacuum pressure,etc.
2. Ability to measure various vibration parameters.
3. Ability to calibrate various instruments.
4. Knowledge of condition monitoring and signature analysis applications.

The following experiments are to be performed in the laboratory:

Laboratory Experiments: (Any Eight)

1. Product Dimension Measurement using Coordinate Measuring Machine.
2. Measurement of vibration parameters using FFT analyzer
3. *Measurement of Sound parameters:*
   a) Sound intensity level b) Sound Power level c) Sound Pressure level
4. *Condition monitoring & signature analysis applications.*
   Vibration signature analysis of different existing machines such as Lathe, Grinder, Blower
5. *Bonding of strain gauges & Stress Analysis of Machine component by strain gauge technique*
6. *Casting of Photoelastic model*
7. *Stress Analysis of Machine component using photoelasticity*
8. Programming On Turning Center (CNC Lathe)
9. Programming On Vertical Machining Center

Reference Books:

1. B. C. Nakra & K. K. Choudhary, " Instrumentation, Measurement & Analysis" Tata McGraw Hill Publications Pvt. Ltd., New Delhi.

2 .Earnest O Doeblin, "Measurement Systems : Applications & Design", McGraw Hill International.

3. Rao, J.S. & Gupta K., "Ind. Course on Theory and Practice Mechanical Vibration", New Age International (P) Ltd., 1984

4. Dally and Riley, "Experimental Stress Analysis". McGraw Hill.

5. Srinath, Lingaiah, Raghavan, Gargesa, Ramachandra and Pant, "Experimental Stress Analysis". Tata McGraw Hill.

6. Sadhu Singh "Experimental Stress Analysis". Hanna publisher

M.Tech. Mechanical (Machine Design) Part – I (Semester – I)

Computer Aided Analysis Lab-I

TeachingScheme: Tutorial/Practical: 2 Hoursperweek

ExaminationScheme: CIE :25MarksESE: 25 Marks

Credit : 2

Course Objectives:

1. To make students understand and learn about analysis and simulation of mechanical parts through software.

Course Outcomes:

On successful completion of the course the student should be able to

1. Knowledge of basic procedure for FEA.
2. To learn CAE software.
3. Use the CAE software for various problems.

Laboratory Experiments: (Any Five)

1. Study of Finite Element Analysis and its different approaches.
2. Basic procedure of FEA & types of elements.
3. Analysis of 1D structural members and verification of the same through manual calculations.
4. Static analysis of mechanical component using 2D element.
5. Thermal Analysis of composite wall.
6. Modal analysis of rotor

References

1. Rao S. S. “Finite Elements Method in Engineering”- 4th Edition, Elsevier,2006
2. Frank L. Stasa,” Applied finite Element Analysis for Engineers”, CBS International Edition,1985.
3. Bathe K. J. Finite Elements Procedures, PHI. Cook R. D., et al. “Concepts and Application of Finite Elements Analysis”- 4th Edition, Wiley & Sons,2003.
4. Zeinkovich, “The Finite Element Method for Solid and Structural Mechanics, 6th Ed., Elsevier2007.
5. Desai C.S and Abel, J.F., Introduction to the finite element Method, Affiliated Eastwest Press Pvt. Ltd. New Delhi2000.

M.Tech. Mechanical (Machine Design) Part – I (Semester – I)

Seminar I

TeachingScheme: ExaminationScheme:

Tutorial/Practical: 2 Hoursperweek CIE :25MarksESE: 25 Marks

Credit : 2

Course Objectives:

1. To understand current real world problems.
2. To acquire the current knowledge of machine designe engineering.
3. To improve communication skill.

Course Outcomes:

On successful completion of the course the student should be able to

1. Apply the ethics in respects to leadership, society responsibility, etc.
2. Learn and integrate through independent learning.
3. To think and create multiple thinking strategies to examine technique issues.
4. Communicate and convey intended meaning using verbal and non-verbal method of communication.

Seminar-Ishouldbebasedontheliteraturesurveyonanytopicrelevanttomachine Design(shouldbehelpfulforselectingaprobabletitleofdissertation).

Each student has to prepare a write up of about 25 pages of "A4" size sheets and submit it in duplicate as the term work.

The student has to deliver a seminar talk in front of the faculty members of the department and his classmates. The faculty members, based on the quality of the work and preparation and understanding of the candidate, shall do an assessment of the seminar internally – jointly.

M.Tech. Mechanical (Machine Design) Part – I (Semester – II)
Mechanics of Machinery

TeachingScheme:	ExaminationScheme:
Lectures : 3 Hoursperweek	CIE : 30 Marks ESE :70 Marks
Tutorial : 1 Hourperweek	TermWork : 25Marks
	Credit : 4

Course Objectives:

1. To impart knowledge on various types of Mechanisms and synthesis
2. To impart skills to analyse the position, velocity and acceleration of mechanisms
3. To familiarize higher pairs like cams and Kinematics Fundamentals

Course Outcomes:

Having successfully completed this course, the student will be able to:

1. Synthesize and analyze four bar mechanisms.
2. Use computers for mechanism animation and analysis.
3. Understand cams.

1. Kinematics of complex mechanisms- Complex mechanisms, Low and high degree of complexity,Goodman'sindirectaccelerationanalysis,Methodofnormalaccelerations,Halland Ault'sauxiliarypointmethod,Carter'smethodandcomparisonofmethods.
2. Advanced kinematics of plane motion- The inflexion circle - Euler-Savary equation, Analytical and graphical determination of diameter of inflection circle - Bobbileier's construction,Collineationaxis-Hartman'sconstruction,Applicationofinflectioncircleto kinematic analysis - Polode curvature - General case and special case, Polode curvature in the four-bar mechanism - Coupler motion, Relative motion of the output and input links, Freudenstein'scollineationaxistheorem-CarterHallcircle,Circling-pointcurve(generalcase).
3. Introductiontosynthesis(Graphicalmethods)-guidingapointthroughtwo,threeandfour distinctpositions-Burmaster'scurve,Functiongeneration-Overlay'smethod,Path generation-Robert'stheorem.
4. Introductiontosynthesis(Analyticalmethods)-Freudenstein'sequation-Precisionpoint approximation - Precision derivative approximation - Method of components - Block synthesis and Reven'smethod.
5. Forces in mechanisms- Free body diagrams - Friction in link connections - Forces in linkages.
6. Cam dynamics-

Forces in rigid systems, Mathematical models, Response of a uniform - Motionundampedcammechanism-Analyticalmethod,Followerresponsebyphase-Plane method-Positionerror,Jump,Crossovershock-Johnson'snumericalanalysis.

Term Work:

Minimum Ten assignments based on above topics.

Reference Books:

1. KinematicsandDynamicsofPlaneMechanismsbyJ.Hirschhorn,McGrawHillBook Co., 1962.
2. Theory of Mechanics by J.E. Shigley, McGraw Hill Book Co., 1961 (for Cam Dynamics topic).

M.Tech. Mechanical (Machine Design) Part – I (Semester – II)
Advanced Materials

TeachingScheme:
Lectures : 3 Hoursperweek

ExaminationScheme:
CIE : 30 Marks ESE :70 Marks
Credit : 3

Course Objectives:

To teach how advanced engineering materials respond to applied mechanical loads in different conditions.

To practice students to determine why metals and alloys are not behaving as expected and can be made to behave as needed using different theories.

To make students to analyze the plastic deformation behavior of metals and the role of imperfections present in the crystals.

To make students know the important steps in material selection with multiple constraints for composites and hybrid materials

Course Outcomes:

After the completion of course students will be able to

1. Summarize ductile and brittle type fracturesusing different theories.
2. Integrate design considerations in mechanical behaviour of advanced materials.
3. Review strengthening mechanisms of materials and selection of materials.

SECTION-I

Tensile testing, Other tests of plastic behaviour, Strain hardening of metals, Strain rate and temperature dependence, Slip in BCC,FCC,HCP crystals, Hardening mechanisms in metals-Strain hardening, solid solution strengthening, Dynamic strain aging, Ductility and fracture, Fracture mechanics, Griffitis theory, Orowan theory, Theoretical facture strength, Irwin's fracture analysis, Fracture mechanics in design, Strain energy release in the J-integral, Creep: Creep mechanics, Temperature dependence of creep, Deformation mechanism maps, Fatigue: S-N curves, Effect of mean stress, Stress concentration, Design estimates, Cyclic stress-strain behaviour, and fatigue of polymers. Design consideration. Mechanical behaviour of ceramics and glasses, Polymers, Composites. Material characterization using optical microscopy and SEM.

SECTION-II

Introduction,Engineeringmaterialsandtheirproperties,Materialpropertycharts,Materialselection- the basics, Material selection-case studies, Process and process selection, Case studies, Multiple constraintsandobjectives,casestudies,Selectionofmaterialsandshape,casestudies,Designingof hybrid materials, case studies, Information and knowledge sources for design, Materials and the environment, Materials and identical design, Forces forchange.

Term Work:

Minimum Eight assignments based on above topics.

Text Books:

1. George E. Dieter: Mechanical Metallurgy-McGraw-Hill
2. William F.Hosford: Mechanical Behaviour of EngineeringMaterials.
3. MichaelF.Ashby,MaterialselectioninMechanicalDesign,3rdEd,Elsevier2005.

Reference Books:

1. R.K.HoneyCombe,“ThePlasticdeformationofmetals”,AmericanSocietyforMetals.
2. Joseph Marin, “Mechanical Behaviour of Engineering Materials” PrinticeHall.
3. J.E.Dorn,“Mechanicalbehaviourofmaterialsatelevatedtemperatures”,McGrawHill.
4. Hellan K., “Introduction to Fracture Mechanics”, McGrawHill.
5. A.J.Kennedy:Processesofcreepandfatigueinmetals-OliverandBoyd-Edinburgh
6. Knott J. F.: Fundamentals of fracture mechanics- Butterworths,London.
7. Fracture Mechanics-“Metals Hand Book” Vol. 8ASME

M.Tech. Mechanical (Machine Design) Part – I (Semester – II)
Advanced Machine Design

TeachingScheme:
Lectures : 3 Hoursperweek

ExaminationScheme:
CIE : 30 Marks ESE :70 Marks
Credit : 3

Course Objectives:

1. To understand fatigue and creep.
2.To acquire knowledge of stress life approach and strain life approach and strain life approach.
3. To understand LEFM app roach and various aspects of fatigue.
4. To understand surface failure methods.

Course Outcomes:

After the completion of course students will be able to

1. Understand and analyze fatigue of various materials.
2. Understand stress life and strain life approach.
3. Understand LEFM approach.
4. Understand aspects of fatigue.
5. Understand surface failure methods.

1. Introduction and fatigue ofmaterials

Role of failure prevention analysis in mechanical design, Modes of mechanicalfailure, Review of failure theories for ductile and brittle materials including Mohr's theory and modified Mohr's theory, Numerical examples. Introductory concepts, High cycle and low cycle fatigue, Fatigue design models, Fatigue design methods, Fatigue designcriteria, Fatigue testing, Test methods and standard test specimens, Fatigue fracture surfaces and macroscopic features, Fatigue mechanisms and microscopic features.

2. Stress-life(s-n)approachandstrain-life(-n)approach

S-N curves, Statistical nature of fatigue test data, General S-N behavior, Mean stress effects, Different factors influencing S-N behaviour, S-N curve representation and approximations, Constant life diagrams, Fatigue life estimation using S-N approach.

Monotonic stress-strain behavior, Strain controlled test methods, Cyclic stress-strain behavior, Strain based approachto life estimation, Determination of strain life fatigueproperties, mean stresseffects, Effect of surface finish, Life estimation by S-N approach.

3. LEFMapproachandstatisticalaspectsoffatigue

LEFM concepts, Crack tip plastic zone, Fracturetoughness, Fatigue crack growth, Mean stress effects, Crack growth lifeestimation. Definitions and quantification of datascatter, Probability distributions, Tolerance limits, Regression analysis offatigue data, Reliability analysis, Problems using the Weibull distribution.

4. Fatiguefromvariableamplitudeloading

Spectrum loads and cumulative damage, Damage quantification and the concepts of Damage fraction and accumulation, Cumulative damage theories, Load interaction and sequence effects, Cycle counting methods, Life estimation using stress life approach.

5. Surfacefailure

Introduction, Surface geometry, Mating surface, Friction, Adhesive wear, Abrasive wear, Corrosion wear, Surface fatiguespherical contact, Cylindrical contact, General contact, Dynamic contactstresses, Surface fatigue strength.

Term Work:

Minimum Ten assignments based on above topics.

Text Books:

1. MetalFatigueinengineering,Ralphl.Stephens,AliFatemi,Robert.R.Stephehs,
2. Henry O.Fuchs, John wiley Newyork,Secondedition.2001
3. FailureofMaterialsinMechanicalDesign,Jack.A.Collins,JohnWiley,Newyork1992.
4. Machine Design, Robert L. Norton,Pearson.

Reference Books:

1. FatigueofMaterials,S.Suresh,CambridgeUniversityPress,Cambridge,U.K
2. FundamentalsofMetalFatigueAnalysis,Julie.A.BenantinePrenticeHall,1990.
3. Fatigue and Fracture, ASM Hand Book, Vol 19,2002.

M.Tech. Mechanical (Machine Design) Part – I (Semester – II)
Elective III-Experimental Stress Analysis

TeachingScheme:	ExaminationScheme:
Lectures : 3 Hoursperweek	CIE : 30 Marks ESE :70 Marks
	Credit : 3

Course Objectives:

1. To gain a working knowledge of core techniques of experimental methods of stress analysis
2. To understand the strength and weakness of experimental methods of stress analysis
3. To be able to use experimental methods to determine stresses of complex geometry jobs subjected to complex loading
4. To understand the impact of experimental methods of stress analysis on Mechanical Design process

Course Outcomes:

On successful completion of the course the student should be able to

1. Learn and understand stress analysis in 2 – dimension and 3 – dimension state of stresses
2. Prepare photoelastic models of machine elements and load them similar to actual loading conditions
3. Paste strain gauges, complete electrical circuits and take reading of strain value at specific points. Convert strain into stress.
4. Apply brittle coating and Moiré fringes, analyze the respective pattern and draw meaningful inferences

1. Photo Elasticity:

- Arrangementofopticalelementsinapolariscope,Theoryofphotoelasticity,Plane & circular polariscope, Isoclinics and isochromatics.
- Model Materials : Properties , selection and method ofcalibration.
- Different methods of analysis: Compensation technique, Principle stresses separation technique, Calibration methods, Fringe Multiplication, Scalingmodel to prototype,Applicationofphotoelasticityfortwodimensionalmodels.
- Three Dimensional Photo elasticity: Stress locking in model materials, Slicing technique, Shear differencemethod.
- Scattered light photoelasticity.
- Dynamic photoelasticity.

2. StrainGauges:

- ElectricalResistancestraingauges:types,gaugefactor,sensitivity,applications.
- Materials ,Bonding of strain gauges : surface preparation ,moisture proofing etc.Types ofbonds,
- Testing of gaugeinstallations.
- Strain measuring circuits, Commercial strainindicators.

- RosetteAnalysis.
- Strain gaugetransducers.
- Cross sensitivity, Temperaturecompensation.
- Semi –Conductor straingauges.

3.CoatingMethodsforstressanalysis:
Coatingstresses,Birefringentcoatings(Photoelastic& Brittlecoatings), Coatingsensitivity,Coatingmaterials,Analysisofbrittle-coatingdata.

4.Holography:
Equationforplanewavesandsphericalwaves Intensity–Coherence– Spherical radiatorasanobject(recordprocess),Hurter–Driffeldcurvereconstructionprocess General case. Holographic setup

5.Moire technique:
Geometricalapproach–sensitivityofMoiredata-datareductionin plane andout planeMoiremethods–Moirephotography–Moiregridproduction.

Term Work:

1. Demonstrationofpreparationof2Dphotoelasticmodel.
2. Demonstrationofpreparationof3Dphotoelasticmodel.
3. Demonstration of stress freezingtechnique.
4. Demonstration of calibration technique of photoelasticmaterial.
5. Evaluation of stresses in photoelastic model by usingpolariscope.
6. Demonstrationofstressanalysistechniquebyusingbrittlecoatingtechnique.
7. Demonstration of stress measurement by using strain gaugerosette.

Text books:

1. Dally and Riley, “Experimental Stress Analysis”. McGrawHill.
2. Srinath,Lingaiah,Raghavan,Gargesa,RamachandraandPant,“ExperimentalStress Analysis”. Tata McGrawHill.
3. Sadhu Singh “Experimental Stress Analysis”. Hannapublisher.
4. Hand Book of Experimental Stress Analysis byHyteneyi.

Reference Books:

1. M. M. Frocht, “Photo elasticity Vol I and Vol II. John Wiley &sons.
2. Perry and Lissner, “Strain GaugePrimer”.
3. Kuske,Albrecht&Robertson“PhotoelasticStressanalysis”JohnWiley&Sons.
4. Dave and Adams, “Motion Measurement and StressAnalysis”.
5. Hand Book of Experimental Stress Analysis”. by A. S. Kobayassin (Ed), SEM/VCH,IIedition.

M.Tech. Mechanical (Machine Design) Part – I (Semester – II)
Elective III- Composite Materials

TeachingScheme:
Lectures : 3 Hoursperweek

ExaminationScheme:
CIE : 30 Marks ESE :70 Marks
Credit : 3

Course Objectives:
1.To teach characteristics, performance and applications of composites with a perspective on utilization of composite materials in machine design

2.To teach students vibration and stability analysis of composite beams, shell and plates.
2.To teach failure predictions of laminated design considerations with examples.

Course Outcomes:
After the completion of course students will be able to

1. Understand characteristics, performance and applications of composites with a perspective on utilization of composite materials in machine design.
2. Analyze vibration and stability of composite beams, shell and plates.
3. Predict failure of laminated joints.

1. Introduction
Definition – Need – General characteristics, Applications – Fibers: Glass, Carbon, Ceramic and Aramid fibers – Matrices: Polymer, Graphite, Ceramic and Metal Matrices – Characteristicsoffibersandmatrices–Smartmaterials–TypesandCharacteristics.

2. Mechanics andperformace
Characteristics of Fiber-reinforced Lamina-Laminates-Interlaminar stresses-Static MechanicalProperties–FatigueandimpactProperties–Environmentaleffects–Fracture Behavior and DamageTolerance.

3. Manufacturing
Bag Moulding – Compression Moulding – Pultrusion-Filament, Winding – Other Manufacturing Processes – Quality Inspection methods.

4. Analysis
Stress Analysis of Laminated Composites Beams, Plates and Shells – Vibration and Stability
Analysis–ReliabilityofComposites–FiniteElementMethodofAnalysis–Analysisof Sandwichstructures.

5. Design
Failure Predictions – Laminate Design Consideration – Bolted and Bonded Joints Design Examples

Term Work:

Minimum Ten assignments based on above topics.

Text Book:

1. Mallick P.K., “Fiber-Reinforced Composites: Materials, manufacturing and Design”, Maneel Dekker Inc, 1993.

Reference Books:

1. HalpinJ.C.,“PrimeronCompositeMaterials,Analysis”,TechomicPublishingCo., 1984.
2. AgarwalB.D.,andBorutmanL.J.,“AnalysisandPerformanceofFiberComposites”, John Wiley and Sons,1990.
3. MallickP.K.andNewmanS.,“CompositeMaterialsTechnology:Processesand Properties”, Hansen Publisher,1993

M.Tech. Mechanical (Machine Design) Part – I (Semester – II)
Elective III- Advanced Machine Tool Design

TeachingScheme:	ExaminationScheme:
Lectures : 3 Hoursperweek	CIE : 30 Marks ESE :70 Marks
	Credit : 3

Course Objectives:

1. To acquire basic understanding of Machine tool design.
2. To acquire complete knowledge design of machine tool structure, guide ways and power screws.
3. To make students understand and learn about spindle and spindle support.
4. To acquire knowledge of dynamics , automation and controls of machine tools

Course Outcomes:

After the completion of course students will be able to

1. Knowledge of basics of Machine tool design
2. Considerably more in-depth knowledge of design of machine tool structure, guide ways and power screws
3. Ability to design spindle and spindle support
4. Knowledge of dynamics, automation.
5. Deeper knowledge of controls of machine tools

1. Introduction: Classification of machine Tools, Elements of machine tools, Selection of speedandfeed,Varioustypesofclutchsystems,Tooldrivesandmechanism,General requirements of machine tool design process as applied to machine tools, layout of machine tool, Various motions introduced in machine tools, Parameters defining limitsofmotions.Requirementsofmachine,toolsdrives,Mechanicalandhydraulics transmission used in machine drives theirelements

2. Design of machine tool structure: Function of machine tool structure and their requirements. Design criteria, Materials, Strength and Rigidity consideration,Process capability and compliance, Static and Dynamic stiffness, Basic design procedure, Design items like beam, column, housing, rams, etc.

3. Design of guide ways and power screws : Function and types of guide ways, Designofslideways,ForceanalysisofLatheguideways,Designofantifrictionguide ways, Design of powerscrews

4. Design of Spindle and spindle support : Function of spindle unit requirement, Materialofspindles,Designcalculations,Designofantifrictionbearings,Sliding bearing used forspindles

5. Dynamics of machine Tools : Vibration of machine tools and dynamic rigidity: Effect of vibrations, Source of\ vibrations, Self excited vibration, Single degree of freedom chatter,Velocityprincipleandrelatedmodels,Regenerativeprinciples,Chatterinlathe, drilling, milling & grinding, Machine tool elastic system, General procedure for assessing dynamic stability of equivalent elastic system.

6. Automation: Automation drives for machine tools, Degree of automation, Semiautomation, analysis of collect action, design of collect, bar feeding mechanism, tooling layout, single spindle mechanism, analysis, swiss type automatic machine. Loadingandunloading.Transferdevices,Modulator-designconceptinprocess gauging.

7. Introductiontomachinetoolcontrol:

Control system of machine tools: Control, mechanical, electrical, hydraulic, numeric and fluidic. Basic principle of control, hydraulic controls, Fluid controls, Numerical controls, Feedback systems, Primary systems programming.

Term Work:

Minimum Ten assignments based on above topics.

Text Books:

1. Machinetooldesign–N.K.Mehta,1984,TataMcGrawHillPublishingCo.Ltd.
2. Principles of Machine tool – G. C. Sen and A. Bhattacharyya, New Central book agency,Calcutta.
3. Design of machine tool – S. K. Basu, Allied PublishersBombay.
4. Machine tools design by Mehta: Tata McGrawHill
5. Machine Tool Design by Bassu & Pal: Oxford &IBH

Reference Books:

1. Designprinciplesofmetalcuttingmachinetools–F.KoenigaBerger
2. Principles of machine tools by Sen et al Central BookAgency
3. Machine tool Design vol. i to iv by Acherken: MirPublishers
4. DesignPrinciplesofMetalcuttingmachinetools:Koenigsberger:Pergamon

M.Tech. Mechanical (Machine Design) Part – I (Semester – II)
Elective IV- Noise and Vibration Harshness

TeachingScheme:
Lectures : 3 Hoursperweek

ExaminationScheme:
CIE : 30 Marks ESE :70 Marks
Credit : 3

Course Objectives:

1. To acquire understanding of Noise and vibrations.
2. To complete knowledge of test facilities and instrumentation.
3. To understand signal processing.
4. To acquire knowledge of NVH control strategies and comfort.

Course Outcomes:

On successful completion of the course the student should be able to

1. Knowledge of design for noise and vibration.
2. Knowledge of signal process.
3. Understanding hydrostatic and hydrodynamic lubrication.
4. Understanding of NVH control strategies.

1. Introduction toNVH:

Sources of noise and vibration, Design features, Common problems, Marque values, Noise quality, Pass-by Noise requirements, Target vehicles and objective targets, Development stages in a new vehicle programme and the altering role of NVH engineers.

2. Sound and vibrationtheory:

Sound measurement, Human sensitivity and weighting factors, Combining sound sources, Acousticalresonances,Propertiesofacousticmaterials,Transientandsteadystateresponse of one degree of freedom system applied to vehicle systems, Transmissibility, Modes of vibration.

3. Test facilities andinstrumentation:

Laboratory simulation: rolling roads (dynamometers), Road simulators, Semi-anechoic rooms,windtunnels,etc.Transducers,signalconditioningandrecordingsystems,Binaural head recordings, Sound intensity technique, Acoustic holography, Statistical Energy Analysis.

4.SignalProcessing:

Sampling, aliasing and resolution, Statistical analysis, Frequency analysis, Campbell's plots, Cascade diagrams, Coherence and correlation functions.

5.NVHcontrolStrategies&comfort:

Source ranking, Noise path analysis, Modal analysis, Design of Experiments, Optimization of dynamic characteristics, Vibration absorbers and Helmholtz resonators, Active control techniques.

Term Work:

Following Experiments/Assignments comprise the laboratory practice:

1. ApplicationofSensorsandrelatedinstrumentsfortimedomainandfrequencydomain.
2. Modaltestingandanalysisfornaturalfrequenciesandmodeshapesforstructures.
3. Random vibration and measurement on vehicles onroad.
4. Internal & External Noise Measurement and spectrumanalysis.
5. Sound intensity measurements in interior commercial/ professional vehicles for source location forharshness.
6. Active noise control techniques for passengercomfort.

Reference Books:

1. Norton M. P., Fundamental of Noise and vibration, Cambridge University Press, 1989
2. Munjal M. L., Acoustic Ducts and Mufflers, John Wiley,1987
3. Baxa,NoiseControlofInternalCombustionEngine,JohnWiley,1984
4. EwinsD.J.,ModelTesting:theoryandpractice,JohnWiley,1995
5. Boris and Kornev, Dynamic Vibration Absorbers, John Wiley,1993
6. McconnellK,"Vibrationtesting,Theoryandpractice",JohnWiley,1995.
7. WongJ.Y.,"TheoryofGroundVehicles",JohnWiley&Sons,NewYork,1978.

M.Tech. Mechanical (Machine Design) Part – I (Semester – II)
Elective IV- Vehicle Dynamics

TeachingScheme:
Lectures : 3 Hoursperweek

ExaminationScheme:
CIE : 30 Marks ESE :70 Marks
Credit : 3

Course Objectives:

1. To understand the fundamentals of Vehicle dynamics.
2. To acquire complete knowledge of suspension, steering system
3. To make students understand and learn about vehicle stability
4. To acquire knowledge of vehicle handling and Aerodynamic Drag of Cars

Course Outcomes:

After the completion of course students will be able to

1. Knowledge of fundamentals of Vehicle dynamics
2. Considerably more in-depth knowledge of suspension, steering system
3. Knowledge of vehicle stability
4. Deeper knowledge of vehicle handling.
5. Knowledge ofAerodynamic Drag of Cars.

1.Introduction:

Classificationofvibration,Definitions,Mechanicalvibratingsystems,Mechanicalvibration andhumancomfort,Modellingandsimulationstudies,Modelofanautomobile,Onedegree of freedom, Two degree of freedom systems, Free, forced and damped vibrations, Magnification and transmissibility, Vibration absorber, multidegree of freedom systems-closedandfarcoupledsystems,Orthogonalityofmodalshapes,Modalanalysis.

2.Suspension:

Requirements, Spring mass frequency, Wheel hop, Wheel shimmy, Choice of suspension spring rate, Calculation of effective spring rate, Vehicle suspension in fore and aft directions, Hydraulic dampers and choice of damper characteristics. Independent, compensated,Rubberandairsuspensionsystems,Rollaxisandvehicleundertheactionof sideforces.

3.Steering systems : Front axle types, Constructional details, Front wheel geometry, Condition for True rolling, skidding, steering linkages for conventional & independent suspensions, Turning radius, Wheel wobble and shimmy, Power and powerassisted steering

4.Stability ofvehicles:

Load distribution, Stability on a curved track and on a slope, Gyroscopic effects, Weight transfer during acceleration and braking, Overturning and sliding, Rigid vehicle-stability and equations of motion, Cross wind handling.

5.Tyres:
Types, Relative merits and demerits, Ride characteristics, Behavior while cornering, slip angle, Cornering force, Power consumed by a tyre, Effect of camber, Camber Thrust.

6.VehicleHandling:
Oversteer,understeer,steadystatecornering,Effectofbraking,drivingtorquesonsteering, Effectofcamber,Transienteffectsincornering,Directionalstabilityofvehicles.

7.Aerodynamic Drag of Cars: Cars as a bluff body, Flow field around car,Drag force,Typesofdragforce,Analysisofaerodynamicdrag,Dragcoefficientofcars,Strategies for aerodynamic development, Low drag profiles, Scope, historical developments, Fundamentals of fluid mechanics, Flow phenomenon related to vehicles, External and Internal flow problem, Resistance to vehicle motion, Performance, Fuel consumption and performance potential of vehicleaerodynamics

Term Work:

(Minimum TEN assignments based on topics mentioned below)

1. AnalysisofdifferentVehicleModelssubjectedvarioustypesofexcitationsin
   i. TimeDomainandii.Frequencydomainusing“C”programsorMATLAB
2. Testing of vehicle Ride comfort using FFTanalyzer.
3. Testing of Vehicle stability using different models andexcitations.
4. Calculationofdragforceanditseffectonthestabilityofthevehicle.

Text Books:

1. ThomasD.Gillespie,“FundamentalsofVehicledynamics”,SAEUSA1992.
2. Thomson W.T., ‘Theory of Vibration with Applications’, CBS Publishers and Distributors, New Delhi.1990.
3. MauriceOlley,“ChassisDesign–PrinciplesandAnalysis”,Bentleypublishers.

Reference Books:

1. WongJ.Y.,“TheoryofGroundVehicles”,JohnWiley&Sons,NewYork,1978.
2. ColeD.E.,“ElementaryVehicleDynamics”,AnnArbor,Michigan,USA,1972.
3. J.G.Giles,‘SteeringSuspensionandTyres,IlliffeBooksLtd.,1968.

M.Tech. Mechanical (Machine Design) Part – I (Semester – II)
Elective IV- Engineering Fracture Mechanics

TeachingScheme:	ExaminationScheme:
Lectures : 3 Hoursperweek	CIE : 30 Marks ESE :70 Marks
	Credit : 3

Course Objectives:

1. The course will treat linear and nonlinear fracture mechanics principles and their applications to structural design.
2. Fracture phenomena in metals and non-metals will be discussed and testing methods will be highlighted.
3. In the end computer assisted techniques for fracture study will be discussed

Course Outcomes:

On completion of the course the student should be able to:

1. Predict material failure for any combination of applied stresses.
2. Estimate failure conditions of a structure
3. Determine the stress intensity factor for simple components of simple geometry
4. Predict the likelihood of failure of a structure containing a defect
5. Determine Environmentally Assisted Cracking in Metals
6. Determine the Fracture Toughness for Testing of Metals.

Reviewof-Mechanicalpropertiesofsolidmaterials,Theoryofelasticity,Stressandstrain, Planestress,Planestrain,Stressfunction,Theoryofplasticity,Yieldstress,Yieldconditions (Mises &Tresca)

1. Introduction:-Macroscopic failure mode, Ideal fracture strength, Energy release rate, FractureModes.

2. Fracture Criteria :-Griffith criterion, Irwin's Fracture Criterion, Stress Intensity Approach,Stressintensityfactor,Cracktipplasticity,Crackopeningdisplacement,Plastic constraint.

3. MethodsforEvaluatingFracturetoughness:-

Numerical Methods:

a. Finite Elements(FE)
b. Finite Differences(FD)
c. Boundary Integral Equations(BIE)

Experimental Methods:

a. ComplianceMethod
b. Photoelasticity
c. Interferometry andHolography

4. Experimental evaluation of Fracture toughness:-
Planestrainfracturetoughness,J–Integral

5. Fatigue mechanics:-
S-N diagram, Fatigue limit, Fatigue crack growth rate, Paris law.

6. Creep mechanics:-
Creep deformation, Creep strength, Creep-fatigue interaction.

Special Note: – No question should be asked on review topic, Derivations

Term Work:

Minimum Ten assignments based on above topics.

Text Books:

1. FractureMechanics,M.Jansen,JZuidema,KJHWanhill,DelftUnivPress
2. Analytical Fracture Mechanics, David J Unger, DoverPublications

Reference Books:

1. Fatigue of Metals, Subra Suresh, Cambridge UniversityPress
2. FractureMechanics,FundamentalsandApplications,Anderson,CRSPress
3. Fatigue of Metals,Pope
4. Hertzberg R. W. *Deformation and Fracture Mechanics of Engineering Materials*. 4th ed. John Wiley & Sons, Inc.,1996.
5. ASTMstandards

M. Tech. Mechanical (Machine Design) Part -I (Semester – II)
Elective IV: Reliability Engineering

TeachingScheme:	ExaminationScheme:
Lectures : 3 Hoursperweek	CIE : 30 Marks ESE :70 Marks
	Credit : 3

Course Objectives:

1. To acquire basic understanding of reliability engineering.
2. To acquire complete knowledge of failure data analysis and reliability measures.
3. To understand reliability models.
4. To understand design for reliability.

Course Outcomes:

After the completion of course students will be able to

1. Knowledge of reliability engineering.
2. Knowledge of understanding of failure data analysis.
3. Knowledge of design for reliability and maintainability.
4. Understanding of reliability testing.

1. Introduction: Brief history, Concepts, Terms and definitions, applications, The life cycle of a system, Concept of failure, Typical engineering failures and their causes, Theory of probability and reliability, Rules of probability, Random variables, Discrete and continuous probabilitydistributions.

2. Failure Data Analysis: Data collection and empirical methods, Estimation of performancemeasuresforungroupedcompetedata,Groupedcompletedata,Analysisof censored data, Fitting probability distributions graphically (Exponential and Weibull) and estimation of distributionparameters.

3. Reliability Measures: Reliability function–R(t), Cumulative distribution function (CDF)–F(t), Probability density function (PDF) – f(t), Hazard rate function-Z(t), Mean timetofailure(MTTF)andMeantimebetweenfailures(MTBF),Mediantimetofailure (t_{med}),mode(t_{mode}),Variance(o^2)andstandarddeviation(o),Typicalformsofhazard rate function, Bathtub curve and conditional reliability.

4. Basic Reliability Models: Constant failure rate (CFR) model, Failure modes, Renewal and Poisson process, Two parameter exponential distribution, Redundancy with CFR model, time-dependent failure models, Weibull, Rayleigh, Normal andLognormal distributions, Burn-in screening for Weibull, Redundancy, Three parameter Weibull, Calculation of R(t), F(t), f(t), Z(t), MTTF, t_{med}, t_{mode}, o^2 and o for above distributions.

5. Reliability Evaluation of Systems: Reliability block diagram, Series configuration, Parallelconfiguration,Mixedconfigurations,redundantsystems,Highlevelversuslow level redundancy, k-out-of-n redundancy, Complex configurations, network reduction anddecompositionmethods,Cutandtiesetapproachforreliabilityevaluation.

6. Maintainability and Availability: Concept of maintainability, Measures of maintainability, Mean time to repair (MTTR), Analysis of downtime, Repair time distributions, Stochastic point processes, Maintenance concept and procedures,

Availability concepts and definitions, Important availabilitymeasures.

7. Design for Reliability and Maintainability: Reliability design process and design methods,Reliabilityallocation,Failuremodes,effectsandcriticalityanalysis(FMECA), Fault tree and success tree methods, Symbols used, Maintainability design process, Quantifiable measures of maintainability, Repair versusreplacement.

8. Reliability Testing: Product testing, Reliability life testing, Burn-in testing, Acceptance testing, Accelerated life testing and reliability growthtesting.

Term Work:

MinimumEightassignmentsbasedonabovetopicswithanemphasisonexamplesof reliability of components andsystems.

Text Books:

1. Charles E. Ebling, 2004, An Introduction to Reliability and Maintainability Engineering,TataMcGrawHillEducationPrivateLimited,NewDelhi.
2. L.S.Srinath,1991,“ReliabilityEngineering”,EastWestPress,NewDelhi.
3. AlessandroBirolini,2010,“ReliabilityEngineering:TheoryandPractice”,Springer.
4. Roy Billiton and Ronald Norman Allan, 1992, “Reliability evaluation of engineering systems: concepts and techniques”,Springer.
5. Patrick D.T. O’Conner, David Newton, Richard Bromley, 2002, “Practical Reliability Engineering”, John Wiley andSons.
6. JoelA.Nachlas,2005,“ReliabilityEngineering:ProbabilisticModelsandMaintenance Methods” Taylor andFrancis.

Reference Books:

1. GuangbinYang,2007,“Lifecyclereliabilityengineering”,JohnWileyandSons.
2. W. R. Blischke, D.N.P. Murthy, 2003, “Case studies in Reliability and Maintenance”, John Wiley andSons.
3. Andrew Kennedy, Skilling Jardine, Albert H. C. Tsang, 2006, “Maintenance, ReplacementandReliability:TheoryandApplications”,CRC/TaylorandFrancis.
4. B. S. Dhillon, Chanan Singh, 1981, Engineering Reliability – New Techniques and Applications”, John Wiley andSons.
5. B.S.Dhillon,1999,“EngineeringMaintainability”,PrenticeHallofIndia.

M.Tech. Mechanical (Machine Design) Part – I (Semester – II)
Computer Aided Analysis Laboratory- II

TeachingScheme:	ExaminationScheme:
Tutorial/Practical: 2 Hoursperweek	CIE :25MarksESE: 25 Marks
	Credit : 2

Course Objectives:

1. To understand and learn analysis and simulation of mechanical put using software.

Course Outcomes:

On successful completion of the course the student should be able to

1. Knowledge of impatis geometry in FEA software.
2. Learn and use of CAE software.
3. Analysis of software for solving various problems.

Laboratory Experiments: (Any Five)

1. Importing geometry in FEA software.
2. Static analysis of truss.
3. Static analysis of a beam.
4. Torsional analysis of a shaft.
5. 3 dimensional Finite Element Analysis of the following using FEA software. (Any One)
   a. Gear tooth analysis
   b. Crane Hook analysis

6.At least one project and a case study should be carried out based on recent Publications / research papers / technical development

References

6. Rao S. S. “Finite Elements Method in Engineering”- 4th Edition, Elsevier,2006
7. Frank L. Stasa,” Applied finite Element Analysis for Engineers”, CBS International Edition,1985.
8. Bathe K. J. Finite Elements Procedures, PHI. Cook R. D., et al. “Concepts and Application of Finite Elements Analysis”- 4th Edition, Wiley & Sons,2003.
9. Zeinkovich, “The Finite Element Method for Solid and Structural Mechanics, 6th Ed., Elsevier2007.
10. Desai C.S and Abel, J.F., Introduction to the finite element Method, Affiliated Eastwest Press Pvt. Ltd. New Delhi2000.

M.Tech. Mechanical (Machine Design) Part – I (Semester – II)

Seminar- II

TeachingScheme: ExaminationScheme:

Tutorial/Practical: 2 Hoursperweek CIE :25MarksESE: 25 Marks

Credit : 2

Course Objectives:

1. To understand current real world problems.
2. To acquire the current knowledge of machine designe engineering.
3. To improve communication skill.

Course Outcomes:

On successful completion of the course the student should be able to

1. Apply the ethics in respects to leadership, society responsibility, etc.
2. Learn and integrate through independent learning.
3. To think and create multiple thinking strategies to examine technique issues.
4. Communicate and convey intended meaning using verbal and non-verbal method of communication.

Seminar II shall be based on tentative topic of dissertation such as review paper on some specific well defined area/ specialized stream of Mechanical Engineering. Each student has to prepare a write up of about 25-30 pages of "A4" size sheets and submit it in IEEE format in duplicate as the term work.

The student has to deliver a seminar talk in front of the teachers of the department and his classmates. The teachers based on the quality of work and preparation and understanding of the candidates, shall do an assessment of the seminar internally. Some marks should be reserved for the attendance of a student in the seminars of other students.

M.Tech. Mechanical (Machine Design) Part – I (Semester – II)
Comprehensive Viva

Examination scheme:
ESE: 50 Marks
Credit : 2

Course Objectives:

To verify the continuous assessment and performance of students by external examiner and internal examiner

Course Outcomes:

On successful completion of the course the student should be able to

Verify their knowledge based on the subjects they have studied in Semester-I and Semester-II.

The students have to prepare on all subjects which they have studied In Ist and IInd semesters The viva will be conducted by the External/Internal Examiner jointly and their appointments will be made by university. The in-depth knowledge, preparation and subjects understanding will be assessed by theExaminers.

M.Tech. Mechanical (Machine Design) Part – II (Semester-III)

Seminar-III

Examinationscheme:
Termwork:50marks
Credit : 2

Course Objectives:

1. To understand current real world problems.
2. To acquire the current knowledge of machine designe engineering.
3. To improve communication skill.

Course Outcomes:

On successful completion of the course the student should be able to

1. Apply the ethics in respects to leadership, society responsibility, etc.
2. Learn and integrate through independent learning.
3. To think and create multiple thinking strategies to examine technique issues.
4. Communicate and convey intended meaning using verbal and non-verbal method of communication.

The student has to prepare the report of training undergone in the industry during vacation aftersemesterII.Itshallincludethebriefdetailsofassignmentcompletedbythecandidate and general observation and analysis. The identified areas for undertaking the dissertation work shall form part of report. The term work marks be based on report and departmental oral exams. The training should be of minimum two weeks from reputed industries and certificate of the same should be part ofreport.

M.Tech. Mechanical (Machine Design) Part – II (Semester-III) One Course from Moodle/Swayam

Teachingscheme:
Tut./Pract.: 5 Hoursperweek

Examinationscheme:
Termwork:50Marks
Credit : 2

Course Objective –

To teach use of Moodle/Swayam as a learning platform designed to provide educators, administrators and learners with a single robust, secure and integrated system to create personalized learning environment.

Course outcome –
On successful completion of the course the student should be able to
Students will be able to choose course of their choice from Moodle/swayam and to be acquaintance with recent developments in Machine design beyond syllabus.

The term work under this submitted by the student shall include.

1) Workdiarymaintainedbythestudentandcountersignedbyhisguide.
2) The content of work diary shall reflect the efforts taken by candidates for

   (a) Searchingthesuitableprojectwork.

   (b)Visitstodifferentfactoriesororganizations.

   (c) The brief report of feasibility studies carried to come to final conclusion.

   (d) Rough sketches

   (e) Design calculations etc. carried by the student.
3) The student has to make a presentation in front of panel of experts in

   addition to guide as decided by departmenthead.

M.Tech. Mechanical (Machine Design) Part – II (Semester-III)
Dissertation Phase-I

Teachingscheme:	Examinationscheme:
Tut./Pract.: 5 Hoursperweek	CIE -50 marks ESE-50marks
	Credit : 8

Course Objectives:

The purpose of a Dissertation is to enable the student to grow deeper knowledge, understanding, capabilities and attitudes in the context of the programme of study. The thesis should be written at the end of the programme and offers the opportunity to investigate more deeply into and synthesize knowledge acquired in previous studies. A thesis for a Master of Technology program should place importance on the technical/scientific/artistic aspects of the subject matter

Course Outcomes:

After the completion of course students will be able to

1. Design and engage in, an independent and sustained critical investigation and evaluation of a chosen research topic.
2. Systematically identify relevant theory and concepts, relate these to appropriate methodologies and evidence, apply correct techniques and draw suitable conclusions.
3. Involve in systematic finding and critical review of appropriate and relevant information sources.
4. Understand and apply ethical standards of conduct in the collection and evaluation of data and other resources.
5. Present research concepts and contexts clearly and effectively both in writing and orally.

The term work under this submitted by the student shall include.

1) Workdiarymaintainedbythestudentandcountersignedbyhisguide.

2) The content of work diary shall reflect the efforts taken by candidates for

(a) Searchingthesuitableprojectwork.

(b)Visitstodifferentfactoriesororganizations.

(c) The brief report of feasibility studies carried to come to final conclusion.

(d) Rough sketches.

(e) Design calculations etc. carried by the student.

3) The student has to make a presentation in front of panel of experts in

addition to guide as decided by departmenthead.

M.Tech. Mechanical (Machine Design) Part – II (Semester-IV)
Dissertation Phase-II

Teachingscheme:	Examinationscheme:
Tut./Pract.: 5 Hoursperweek	Practical :50Marks
	Term work :50Marks
	Credit : 8

Course Objectives:

The purpose of a Dissertation is to enable the student to grow deeper knowledge, understanding, capabilities and attitudes in the context of the programme of study. The thesis should be written at the end of the programme and offers the opportunity to investigate more deeply into and synthesise knowledge acquired in previous studies. A thesis for a Master of Technology programmes should place importance on the technical/scientific/artistic aspects of the subject matter

Course Outcomes:

After the completion of course students will be able to

1.Design and engage in, an independent and sustained critical investigation and evaluation of a chosen research topic.

2. Systematically identify relevant theory and concepts, relate these to appropriate methodologies and evidence, apply correct techniques and draw suitable conclusions.

3.Involve in systematic finding and critical review of appropriate and relevant information sources.

4.Understand and apply ethical standards of conduct in the collection and evaluation of data and other resources.

5.Present research concepts and contexts clearly and effectively both in writing and orally.

The dissertation submitted by the student on topic already approved by university authoritiesonbasisofinitialsynopsissubmittedbythecandidate,shallbeaccordingto following guidelines.

Format of dissertation report:

The dissertation work report shall be typed on A4 size bond paper. The total No. of minimum pages shall not less than 60. Figures, graphs, annexure etc be as per the requirement.

The report should be written in the standard format.

1. Titlesheet
2. Certificate
3. Acknowledgement
4. List of figures,Photographs/Graphs/Tables
5. Abbreviations.
6. Abstract
7. Contents.
8. Text with usual scheme ofchapters.
9. Discussion of the results andconclusions
10. Bibliography (the source of illustrative matter be acknowledged clearly at appropriate place IEEE/ASME/ElsevierFormat)

M.Tech. Mechanical (Machine Design) Part – II (Semester-IV)
Dissertation Phase-III

Teachingscheme:	Examinationscheme:
Tut./Pract.: 5 Hoursperweek	Practical :100Marks
	Credit : 8

Course Objectives:

The purpose of a Dissertation is to enable the student to grow deeper knowledge, understanding, capabilities and attitudes in the context of the programme of study. The thesis should be written at the end of the programme and offers the opportunity to investigate more deeply into and synthesise knowledge acquired in previous studies. A thesis for a Master of Technology programmes should place importance on the technical/scientific/artistic aspects of the subject matter

Course Outcomes:

After the completion of course students will be able to

1.Design and engage in, an independent and sustained critical investigation and evaluation of a chosen research topic.

2. Systematically identify relevant theory and concepts, relate these to appropriate methodologies and evidence, apply correct techniques and draw suitable conclusions.

3.Involve in systematic finding and critical review of appropriate and relevant information sources.

4.Understand and apply ethical standards of conduct in the collection and evaluation of data and other resources.

5.Present research concepts and contexts clearly and effectively both in writing and orally.

The dissertation submitted by the student on topic already approved by university authoritiesonbasisofinitialsynopsissubmittedbythecandidate,shallbeaccordingto following guidelines.

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4. List of figures,Photographs/Graphs/Tables
5. Abbreviations.
6. Abstract
7. Contents.
8. Text with usual scheme ofchapters.
9. Discussion of the results andconclusions
10. Bibliography (the source of illustrative matter be acknowledged clearly at appropriate place IEEE/ASME/ElsevierFormat)