List of Revised Courses

Department: ***Mechanical Engineering***

Program Name : *M. Tech.*

Academic Year: 2021-22

List of Revised Courses

Sr. No.	Course Code	Name of the Course
01.	MEPATT2	Advanced Computer Aided Design
02.	MEPATP1	Professional Elective-1 (Tribology and Surface Engineering)
03.	MEPATP1	Professional Elective-1(Mechanics of Composite Materials)
04.	MEPATP2	Professional Elective-2 (Design and Analysis of Experiments)
05	MEPAPT1	Numerical Simulation Lab

विभागाध्यक्ष / Head
यांत्रिकी अभियांत्रिकी विभाग / Mechanical Engg. Dept.
प्रौद्योगिकी संस्थान / Institute of Technology
गुरु घासीदास वि.वि. / Guru Ghasidas V.V.
कोनी, बिलासपुर (छ.ग.) / Koni, Bilaspur (C.G.)

Minutes of Meetings (MoM) of Board of Studies (BoS)

Academic Year: 2021-22

School : *School of Studies of Engineering and Technology*

Department : *Mechanical Engineering*

Date and Time: *October 30, 2021 – 2:30 AM*

Venue : *G-25*

Minutes of Meeting

An online meeting of the Board of Studies of Mechanical Engineering was held on 30-10-2021 at 02:30 PM. The meeting was attended by the following members:

1.	Chairman, BOS Present	Prof. T. V. Arjunan Head, Dept. of Mechanical Engg.
2.	Member, Academic Expert Present	Prof. S. Murugan Dept. of Mechanical Engg., NIT Rourkela
3.	Member, BOS Present	Dr. Pankaj Kumar Gupta Assoc. Prof., Dept. of Mech. Engg.
4.	Member, BOS Present	Mrs. Shweta Singh Asst. Prof., Dept. of Mech. Engg.
5.	Member, Industry Expert Present	Mr. Vivek Singh, Executive Engineer, Damodar Valley Corporation Kodarma Thermal Power Station, Jharkhand

The scheme and course syllabi for M.Tech. (Machine Design) was discussed. With the consent of all the members, the course scheme and syllabi for M.Tech. (Machine Design) was finalized under guidelines in AICTE Model curriculum (2018), and new courses were added/modified in the list of electives. The following were the salient features discussed in the meeting:

1. Computer Aided Design course was suggested to be renamed as Advanced CAD with advanced topics included, such as introduction to Finite Element analysis.
2. The course content for Tribology now includes topics pertaining to Surface Engineering, and therefore, the course is renamed to Tribology and Surface Engineering.
3. A topic on Experimental uncertainty analysis was added in the course on Design and Analysis of Experiments.
4. New courses on Design of Thermal Systems, Computational Fluid Dynamics and Noise, Vibration & Harshness were added in department electives due to their increasing role in Design involving multi-physics phenomena.
5. A course on Research methodology & IPR is included.

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These changes shall be effective from Academic session 2021-2022.

The detailed Scheme of Credits and Syllabi of M.Tech. (Machine Design) courses is attached herewith for reference.

30/10/2021
Prof. T. V. Arjunan
Chairman, BOS

30.10.2021
Dr.Pankaj K. Gupta
Member, BOS

30/10/2021
Mrs. Shweta Singh
Member, BOS

Dr. S. Murugan
Professor
Department of Mechanical Engineering
NIT, Rourkela

Prof. S. Murugan
Academic Expert

Email Consent Given
Mr. Vivek Singh
Industry Expert

विभागाध्यक्ष/Head
यांत्रिकी अभियांत्रिकी विभाग/Mechanical Engg. Dept.
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कोनी, बिलासपुर (छ.ग.)/Koni, Bilaspur (C.G.)

Gmail - Re: Approval of the BOS minutes https://mail.google.com/mail/u/0/?ik=8bfbe818c6&view=pt&search=all...

Gmail

Pankaj Kumar Gupta <pankajkgupta@gmail.com>

Re: Approval of the BOS minutes

vivek singh <vivek.singh.dvc@gmail.com> Fri, Nov 19, 2021 at 3:08 PM
To: Pankaj Kumar Gupta <pankajkgupta@gmail.com>
Cc: s murugan <murugans@nitrkl.ac.in>, muruganresearch@yahoo.com, "T.V.Arjunan" <arjun_nivi@yahoo.com>

Dear sir,
The attcahed sylabus of M Tech. machine design and B Tech. 2nd year had been checked and found OK. Approval from my end is accorded.

With Regards
Vivek Singh
Sr. Divisional Engg. (M)
DVC KTPS

[Quoted text hidden]

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SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA(A CENTRAL UNIVERSITY)
CBCS-NEW, STUDY & EVALUATION SCHEME
PROPOSED W.E.F. SESSION 2021-2022
M.Tech. I Year (SEMESTER I)

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	IA	ESE	SUB-TOTAL	
1.	MEPATT1	Advanced Mechanics of Solids	3	-	-	40	60	100	3
2.	MEPATT2	Advanced Computer Aided Design	3	-	-	40	60	100	3
3.	MEPATP1	Professional Elective-1	3	-	-	40	60	100	3
4.	MEPATP2	Professional Elective-2	3	-	-	40	60	100	3
5.	MEPATP3	Professional Elective-3	3	-	-	40	60	100	3
6.	IPPATC1	Research Methodology & IPR	2	-	-	40	60	100	2
		Total	**17**	**-**	**-**	**240**	**360**	**600**	**17**
PRACTICALS									
1.	MEPAPT1	Numerical Simulation Lab	1	-	2	30	20	50	2
		Total	**1**	**-**	**2**	**30**	**20**	**50**	**2**
GRAND TOTAL			**18**	**-**	**2**	**270**	**380**	**650**	**19**

Total Credits : **19**
Total Contact Hour : **20**
Total Marks : **650**

*INTERNAL ASSESSMENT- Two Class Test of 20 Marks each will be conducted.
L-LECTURE, T-TUTORIAL, P-PRACTICAL, ESE –END SEMESTER EXAMINATION

Professional Elective-1	Professional Elective-2	Professional Elective-3
Tribology and Surface Engineering	Advanced Engineering Materials	Advanced Synthesis of Mechanisms
Mechanics of Composite Materials	Design and Analysis of Experiments	Mechanical Vibrations
Design of Thermal Systems	Design for Manufacturing & Assembly	Advanced Mechanical Design

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CBCS-NEW, STUDY & EVALUATION SCHEME
PROPOSED W.E.F. SESSION 2021-2022
M.Tech. I Year (SEMESTER II)

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	IA	ESE	SUB-TOTAL	
1.	**MEPBTT1**	Advanced Engineering Design	3	-	-	40	60	100	3
2.	**MEPBTT2**	Finite Elements in Design	3	-	-	40	60	100	3
3.	**MEPBTP1**	Professional Elective-4	3	-	-	40	60	100	3
4.	**MEPBTP2**	Professional Elective-5	3	-	-	40	60	100	3
5.		Open Elective	3	-	-	40	60	100	3
6.		Audit Course	2	-	-	40	60	100	2
		Total	**17**	**-**	**-**	**240**	**360**	**600**	**17**
PRACTICALS									
1.	**MEPBPT1**	Design Lab	1	-	2	30	20	50	2
2.	**MEPBPT2**	Modeling and Analysis Lab	1	-	2	30	20	50	2
		Total	**2**	**-**	**4**	**60**	**40**	**100**	**4**
GRAND TOTAL			**19**	**-**	**4**	**300**	**400**	**700**	**21**

Total Credits : **21**
Total Contact Hour : **23**
Total Marks : **700**

*INTERNAL ASSESSMENT- Two Class Test of 20 Marks each will be conducted.
L-LECTURE,T-TUTORIAL,P-PRACTICAL, ESE –END SEMESTER EXAMINATION

Professional Elective-4	Professional Elective-4	Open Elective
Product Design and Development	Computational Fluid Dynamics	Business Analytics
Fracture Mechanics	Smart Materials & Structures	Operations Research
Theory of Plates and Shells	Optimization Techniques in Engineering Design	Industrial Safety
Noise, Vibrations and Harshness	Rotor Dynamics	Composite Materials
		Waste to Energy
		Internet of Things
		Cost Management of Engineering Projects
		MOOCs

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Subject: **Advanced Computer Aided Design (MEPATT2)**

		Credits			
Type:	Programme Core	L	T	P	Total
Teaching Scheme:	Lectures: 3 hours/week	3	0	0	3

Course outcomes: **At the end of the course, students will be able to**

1 Apply geometric transformations and projection methods in CAD

2 Develop geometric models to represent curves

3 Design surface models for engineering design

4 Model engineering components using solid modelling techniques for design

5 Analyze the solid model and able to calculate its property through basic fundamental of FEM

Syllabus Contents:

Module-I: Introduction: Introduction to CAE, CAD. Role of CAD in Mechanical Engineering, Design process, software tools for CAD, Geometric modelling. Introduction to Geometric Modeling for Design: Introduction to CAGD, CAD input devices, CAD output devices, CAD Software, Display Visualization Aids, and Requirements of Modelling.

Module-II: Transformations in Geometric Modeling: Introduction, Translation, Scaling, Reflection, Rotation in 2D and 3D. Homogeneous representation of transformation, Concatenation of transformations. Computer-Aided assembly of rigid bodies, Applications of transformations in design and analysis of mechanisms, etc. Implementation of the transformations using computer codes.

Module-III: Projections: Projective geometry, transformation matrices for Perspective, Axonometric projections, Orthographic and Oblique projections. Implementation of the projection formulations using computer codes. Basics of curves, parametric and non-parametric curves, analytical and synthetic curves, parametric representation of analytical and synthetic curves, Hermite curves, curve manipulations, Bèzier curves, B-splines, rational curves, wire frame models.

Module-IV: Surfaces in Geometric Modeling for Design: Differential geometry of surfaces, Parametric representation, Curvatures, Developable surfaces. Surfaces entities (planar, surfac of revolution, lofted etc). Free-for surface models (Hermite, Bezier, B-spline surface). Boundary interpolating surfaces (Coon's). Implementation of the all the surface models using computer codes.

Module-V: Solids in Geometric Modeling for Design: Solid entities, Boolean operations, Topological aspects, Invariants. Write-frame modeling, B-rep of Solid Modelling, CSG approach of solid modelling. Popular modeling methods in CAD softwares. Data Exchange Formats and CAD Applications; analytic solid modeling (ASM), introduction to finite element method (FEM), 1-D FEM analysis.

References:

- Zeid I. & Subramanian R. S., CAD/CAM Theory and practice, Tata McGraw Hill.
- Michael E. Mortenson, Geometric Modeling, Tata McGraw Hill, 2013
- A. Saxena and B. Sahay, Computer-Aided Engineering Design, Anamaya Publishers, New Delhi, 2005
- Rogers, David F., An introduction to NURBS: with historical perspective, Morgan Kaufmann Publishers, USA, 2001
- David F. Rogers, J. A. Adams, Mathematical Elements for Computer Graphics, TMH, 2008
- Newman W.M.&SproullR.F.,Principles of Interactive Computer Graphics,Tata McGraw Hill.
- Groover M.P. &Zimmers E.,CAD/CAM: Computer-Aided Design and Manufacturing, Pearson Education

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Subject: **Tribology and Surface Engineering (MEPATP)**

		Credits			
Type:	Programme Elective	L	T	P	Total
Teaching Scheme:	Lectures: 3 hours/week	3	0	0	3

Course outcomes: **At the end of the course, students will be able to**

1 Analyze properties of lubricant and select proper lubricant for a given application.

2 Identify tribological performance parameters of sliding contact in different lubrication regimes

3 Design and select appropriate bearings for a given application

4 Predict the type of wear and volume of wear in metallic and polymer surfaces

5 Understand the physical chemistry related to interface/surface such as formation of interface and adsorption to solid surface

Syllabus Contents:

Module I: Introduction to Tribology, friction, wear and lubrication

Module II: Chemical and physical state of the solid surface and of lubricants

Module III: Hydrodynamic lubrication, Elasto-Hydrodynamic lubrication, Boundary lubrication

Module IV: Coating deposition by hard facing – Flame spraying, thermal plasma and HVOF spraying; Coating deposition from the vapour phase (CVD, PVD, PECVD); Surface treatments by thermal and chemical processes

Module V: Tribological applications of materials, Coatings, and surface treatments, Case studies.

References:

- Bhushan, B., Gupta, B.K, Handbook of tribology : materials, coatings, and surface treatments, New York : McGraw-Hill, c1991
- Holmberg, K, Coatings tribology : properties, techniques, and applications in surface engineering, New York, 1994
- Stolarski, T. A, Tribology in machine design, Oxford : Heinemann Newnes, 1990
- Stachowaik, G.W., Batchelor, A.W., Engineering Tribology, 3rd Ed., Elsevier, 2010.
- Andras Z. Szeri, Fluid film lubrication theory and design, Cambridge University press, 1998.
- Neale MJ, Tribology Hand Book, CBS Publications, 2012
- Williams JA, Engineering Tribology, Oxford Univ. Press, 2001
- Cameron A, Basic lubrication theory, Ellis Horwood Ltd., 2002

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Subject: **Mechanics of Composite Materials (MEPATP)**

		Credits			
Type:	ProgrammeElective	L	T	P	Total
Teaching Scheme:	Lectures: 3 hours/week	3	0	0	3

Course outcomes: **At the end of the course, students will be able to**

1 Understand the characteristics of composite materials

2 Select suitable manufacturing processes to develop fiber reinforced composites.

3 Analyze the micro and macro mechanical behavior of fiber reinforced composites

4 Develop the governing equations for bending, buckling and vibration of laminated plates

5 Design the composite structures for engineering applications

Syllabus Contents:

Module-I: Introduction to composite materials: Classification and characteristics of composite materials, Mechanical behavior of composite materials, Basic terminology of laminated fiber reinforced composite materials, Manufacturing of laminated fiber reinforced composite materials.

Module-II: Techniques for composites manufacturing: Hand laminating (or Wet Lay-up) and the Autoclave processing of composites, Filament winding and fiber placement, Pultrusion, Liquid composite molding.

Module-III: Micromechanical behavior of lamina: Stress-strain relation for anisotropic materials, Stiffness, Compliances, Engineering constants, Restriction on Engineering constants, Stress- strain relation for plane stress in orthotropic materials.

Module-IV: Macro mechanical behavior of laminates and plate theories: Elastic approach to stiffness, Mechanics of materials approach to stiffness, Mechanics of materials approach to strength, Classical laminate theory, Special cases of laminate stiffness, Strength of laminates, Inter laminar stresses, Axisymmetric shells.

Module-V: Bending, Buckling, and Vibration of Laminated Composites: Governing equations for Bending, Buckling, and Vibration of laminated plates, Deflection of simply supported laminated composites.

References:

- Ronald F. Gibson, Principles of composite material mechanics, CRC Press, 2011
- Robert M Jones, Mechanics of Composite Materials, Taylor & Francis, 2000
- Lawrence E. Nielsen, Nielson, Paul Nielsen, Mechanical Properties of Polymers and Composites, Second Edition, CRC press, 2000

Subject: **Design and Analysis of Experiments (MEPATP)**

		Credits			
Type:	Programme Elective	L	T	P	Total
Teaching Scheme:	Lectures: 3 hours/week	3	0	0	3

Course outcomes: **At the end of the course, students will be able to**

1 Formulate objective(s) and identify key factors in designing experiments for a given problem

2 Develop appropriate experimental design to conduct experiments for a given problem

3 Analyze experimental data to derive valid conclusions

4 Optimize process conditions by developing empirical models using experimental data

5 Design robust products and processes using parameter design approach

Syllabus Contents:

Module-I: Fundamentals of Experimentation: Role of experimentation in rapid scientific progress, Historical perspective of experimental approaches, Steps in experimentation, Principles of experimentation; Error and Uncertainty Analysis

Module-II: Simple Comparative Experiments: Basic concepts of probability and statistics, Comparison of two means and two variances, Comparison of multiple (more than two) means & ANOVA;

Module-III: Experimental Designs: Factorial designs, fractional factorial designs, orthogonal arrays, standard orthogonal arrays & interaction tables, modifying the orthogonal arrays, selection of suitable orthogonal array design, analysis of experimental data;

Module-IV: Response Surface Methodology: Concept, linear model, steepest ascent, second order model, regression;

Module-V: Taguchi's Parameter Design: Concept of robustness, noise factors, objective function & S/N ratios, inner-array and outer-array design, data analysis

References:

- Montgomery DC, Design and Analysis of Experiments, 7th Edition, John Wiley & Sons, NY, 2008
- Ross PJ, Taguchi Techniques for Quality Engineering, McGraw-Hill Book Company, NY, 2008

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Subject: **Numerical Simulation Lab (MEPAPT1)**

		Credits			
		L	T	P	Total
Type:	ProgrammeCore				
Teaching Scheme:	Lectures: 3 hours/week	1	0	2	2

Course outcomes: **At the end of the course, students will be able to**

1 Understand numerical techniques using MATLAB/SCILAB

2 Formulate and solve problems using numerical methods

3 Build 2D and 3D representation of objects using CAD software

4 Design surfaces and solids as per geometrical requirements

Syllabus Contents:

- To know the history and features of MATLAB & the local environment of MATLAB
- Write a program to find the roots of an equation using Bi-section method, Regula-falsi method and Newton Raphson method
- Find the addition, subtraction, multiplication, transpose and inverse of matrices
- Find the area enclosed between the curves in MATLAB/SCILAB
- Find the derivative of an equation in MATLAB/SCILAB
- Find the roots of equations, find the values at different points and plot the graph
- Plot the surface for an equation
- Introduction to CAD software and working with features like Extrude & Revolve in sketch mode
- 3D modeling of different components using CAD software
- Assembly modelling in CAD software: Generating, editing and modifying drawings
- Surface modeling of different mechanical components in CAD software
- Presenting different orthographic/isometric views of 3D models in CAD software

References:

- Lab Instruction Manual

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Subject: **Modeling and Analysis Lab (MEPBPT2)**

		Credits			
		L	T	P	Total
Type:	ProgrammeCore				
Teaching Scheme:	Lectures: 3 hours/week	1	0	2	2

Course outcomes: **At the end of the course, students will be able to**

1 Develop programs for modeling the synthetic curves and surfaces

2 Develop finite element code to solve problems involving Trusses, Beams and Frames

3 Solve structural problems using finite element software

4 Execute mini project involving both modeling and analysis

Syllabus Contents:

- Develop Programs for Transformations and Synthetic curves in CAD
- Model solids with features like Hole, Round, Chamfer and Rib
- Model solids with features like Pattern, Copy, Rotate, Move and Mirror
- Advanced modeling tools (Sweep, Blend, Variable section Sweep etc)
- Introduction to developing program for finite element analysis in MATLAB
- Solution of Trusses problems using the developed code
- Solution of Beams and Frames using the developed code
- Solution of problems involving triangular element using the developed code
- Introduction to FEA software, ANSYS
- Solution of problems of Trusses using ANSYS
- Solution of problems of Beams and Frames using ANSYS
- Solution of problems involving triangular element etc. using ANSYS
- Solution of 3D analysis problems using ANSYS

References:

- Lab Instruction Manual

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Subject: **Design Lab (MEPBPT1)**

		Credits			
		L	T	P	Total
Type:	ProgrammeCore				
Teaching Scheme:	Lectures: 3 hours/week	1	0	2	2

Course outcomes: **At the end of the course, students will be able to**

1 Understand advanced features of MATLAB

2 Analyze single degree of freedom free and forced vibrations

3 Evaluate free and forced single and multi-degree of freedom vibration

4 Design suitable MATLAB code for engineering problems on vibrations

Syllabus Contents:

- To know the history and features of MATLAB & the local environment of MATLAB
- Free Vibration of Single Degree of Freedom Systems
- Forced Vibration of Single Degree of Freedom Systems
- Response Under a Periodic Force of Irregular Form
- Response Under a General Periodic Force
- Two Degree of Freedom Systems - Free Vibration analysis
- Multi-degree of freedom systems - Natural frequencies and mode shapes
- Free vibration of damped system
- Modal analysis for undamped systems
- Harmonic excitations

References:

- Lab Instruction Manual

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