Walchand College of Engineering

(Government Aided Autonomous Institute)

Vishrambag, Sangli-416415

1947

Course Content for S. Y. M. Tech. Mechanical (Design Engineering)

Semester - III and IV

2023-24

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course Information

Programme	M. Tech. (Mechanical Design Engineering)
Class, Semester	Second Year M. Tech., Sem III
Course Code	6DE645
Course Name	Dissertation Phase I
Desired Requisites:	Concept knowledge of research methodology, project management, mechanical engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	6 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	100	0	0	100
		Credits: 03			

Course Objectives

1	To develop the student to apply the knowledge gained to identify problems for research and provide the solutions by self-study and interaction with stakeholders.
2	Acquire knowledge to tackle real world problems of societal concerns
3	Impart flexibility to the student to have increased control over his/ her learning
4	Teachers would serve as mentor/facilitator of inquiry and reflection rather than as an instructor
5	Enhance a students' learning through increased interaction with peers and colleagues.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Search the existing literature and identification of research problem	IV	Analyzing
CO2	Design and develop the solution for complex engineering problem	V	Evaluating
CO3	Create the new knowledge in the specialized field	VI	Creating

Course Content

Students are expected to carry out independent research work on the chosen topic. In this semester it is expected that the student has carried out substantial research work including exhaustive literature survey, formulation of the research problem, development/fabrication of experimental set-up (if any/required) and testing, and analysis of initial results thus obtained. In fourth semester, the students continue their dissertation work. It is expected that the student has completed most of the experimental/computation works and analyzed the results so obtained as proposed in the synopsis. The work should be completed in all respects this semester. The students are required to submit the dissertation work in the form of report as per the institute rule

Textbooks

1	As per the research topic

References

1	National and International Journals

Useful Links

1	https://nptel.ac.in/courses/121/106/121106007/
2	https://www.youtube.com/watch?v=mAVswCbz_jM&feature=emb_imp_woyt
3	https://nptel.ac.in/courses/110/104/110104073/
4	https://nptel.ac.in/courses/110/107/110107081/

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1			1		2
CO2	1		1		2	1
CO3		2				1
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.						

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course Information

Programme	M. Tech. (Mechanical Design Engineering)
Class, Semester	Second Year M. Tech., Sem III
Course Code	6DE646
Course Name	Dissertation Phase II
Desired Requisites:	Concept knowledge of research methodology, project management, mechanical engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	6 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	0	100	0	100
		Credits: 03			

Course Objectives

1	To develop the student to apply the knowledge gained to identify problems for research and provide the solutions by self-study and interaction with stakeholders.
2	Acquire knowledge to tackle real world problems of societal concerns
3	Impart flexibility to the student to have increased control over his/ her learning
4	Teachers would serve as mentor/facilitator of inquiry and reflection rather than as an instructor
5	Enhance a students' learning through increased interaction with peers and colleagues.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Search the existing literature and identification of research problem	IV	Analyzing
CO2	Design and develop the solution for complex engineering problem	V	Evaluating
CO3	Create the new knowledge in the specialized field	VI	Creating

Course Content

Students are expected to carry out independent research work on the chosen topic. In this semester it is expected that the student has carried out substantial research work including exhaustive literature survey, formulation of the research problem, development/fabrication of experimental set-up (if any/required) and testing, and analysis of initial results thus obtained. In fourth semester, the students continue their dissertation work. It is expected that the student has completed most of the experimental/computation works and analyzed the results so obtained as proposed in the synopsis. The work should be completed in all respects this semester. The students are required to submit the dissertation work in the form of report as per the institute rule

Textbooks

1	As per the research topic

References

1	National and International Journals

Useful Links

1	https://nptel.ac.in/courses/121/106/121106007/
2	https://www.youtube.com/watch?v=mAVswCbz_jM&feature=emb_imp_woyt
3	https://nptel.ac.in/courses/110/104/110104073/
4	https://nptel.ac.in/courses/110/107/110107081/

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1			1		2
CO2	1		1		2	1
CO3		2				1
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.						

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
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Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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AY 2023-24

Course Information

Programme	M. Tech. (Mechanical Design Engineering)
Class, Semester	Second Year M. Tech., Sem III
Course Code	6DE647
Course Name	Dissertation Phase III
Desired Requisites:	Concept knowledge of research methodology, project management, mechanical engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	8 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	00	00	100	100
		Credits: 04			

Course Objectives

1	To develop the student to apply the knowledge gained to identify problems for research and provide the solutions by self-study and interaction with stakeholders.
2	Acquire knowledge to tackle real world problems of societal concerns
3	Impart flexibility to the student to have increased control over his/ her learning
4	Teachers would serve as mentor/facilitator of inquiry and reflection rather than as an instructor
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Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Search the existing literature and identification of research problem	IV	Analyzing
CO2	Design and develop the solution for complex engineering problem	V	Evaluating
CO3	Create the new knowledge in the specialized field	VI	Creating

Course Content

Students are expected to carry out independent research work on the chosen topic. In this semester it is expected that the student has carried out substantial research work including exhaustive literature survey, formulation of the research problem, development/fabrication of experimental set-up (if any/required) and testing, and analysis of initial results thus obtained. In fourth semester, the students continue their dissertation work. It is expected that the student has completed most of the experimental/computation works and analyzed the results so obtained as proposed in the synopsis. The work should be completed in all respects this semester. The students are required to submit the dissertation work in the form of report as per the institute rule

Textbooks

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4	https://nptel.ac.in/courses/110/107/110107081/

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1			1		2
CO2	1		1		2	1
CO3		2				1
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.						

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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AY 2023-24

Course Information	
Programme	M. Tech. (Mechanical Design Engineering)
Class, Semester	Second Year M. Tech., Sem III
Course Code	6DE611
Course Name	Advanced Finite Element Method
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	Student will be able to develop his own FE formulation for static problems.
2	Student will be able to decide the best suited method for transient analysis.
3	Student will be able to appreciate the amount of computational efforts required to solve non Linear problem.
4	Student will understand mathematical modelling technique for beams and plate.
5	Student will be able to apply various beam and plate theories to develop FE model. Through course project student will apply his understanding of FE in his/ her own field

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Solve non-linear problems using FEM.	III	Applying
CO2	Analyse structural analysis using beam, plate and shell elements	IV	Analysing
CO3	Evaluate the given design problem using FEM	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Linear static analysis :** Weighted residual formulation, shape functions, numerical integrations.	6
II	**Solution methods to solve linear transient problems**: Explicit and implicit methods, Newmark family of methods, conditional and unconditionally stable methods and determination of correct time step.	7
III	**Non-linear finite Element Method:** Ways of non-linearities, mathematical treatment, Picard's method, Newton's method, advantages and limitations of each method, snap through problem.	7
IV	**Analysis of beams:** Euler Bernoulli beam theory, Timoshenko beam theory, Formulation of beam element using both above theories, their advantages and limitations, solution strategies to overcome limitations.	7
V	**Analysis of plates and shells:** Basics of plate theory, thin and thick plates, FE formulation based on various plate theories, plate elements, continuity requirements.	7

VI	**Course Project – self learning:** The student is expected to define his/ her own problem which involves substantial Complications in terms of geometry, boundary conditions etc. in any field and then try to solve the same either by developing own code or using commercially available software's. Difficulties will be discussed in class in common or individually.	6
Textbooks		
1	Cook, R. D., Malkus D. D. and PleshaM. E., "Concepts and Applications of Finite Element Analysis", 4th edition, 2001.	
2	Bathe, K. J., "Finite Element Procedures",1st edition,2008	
3	Hughes, T. J. R., "The Finite Element Method – Linear Static and Dynamic Finite Element Analysis", 2012.	
References		
1	Belytschko, T., Liu, W. K. and Moran, B., "Nonlinear Finite Elements for Continua and Structures".	
2	Brebbia C. A. and Dominguez J. "Boundary Elements an Introductory Course	
Useful Links		
1	https://www.youtube.com/watch?v=MldJ6WHCsvQ	
2	https://www.youtube.com/watch?v=cHiFQ-cESkg	
3	https://www.youtube.com/watch?v=URbiADhc_rA&list=PLD53819B88894AEDF	
4	https://www.youtube.com/watch?v=pCSpBYfbYYA	

CO-PO Mapping

	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2		2	2		
CO2	3				3	
CO3						3

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2023-24

Course Information	
Programme	M. Tech. (Mechanical Design Engineering)
Class, Semester	Second Year M. Tech., Sem III
Course Code	6DE612
Course Name	Multi body Dynamics
Desired Requisites:	Dynamics of machine, Kinematics and Theory of machine

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	Derive equations of motion for interconnected bodies in multi-body systems with three dimensional Motion.
2	Write programs to solve constrained differential equations for analyzing multi-body systems.
3	Lead team projects in academic research or the industry that require modelling and simulation of multi-body systems.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Implement and analyze methods of formulating equations of motion for Interconnected bodies.	IV	Analysing
CO2	Simulate and analyze all types of static and dynamic behaviours of the multi-body systems including the kineto-static analysis.	III	Applying
CO3	Demonstrate an improved technical writing and presentation skills.	VI	Creating

Module	**Module Contents**	**Hours**
I	**Introduction:** The method of constraints for planar kinematic analysis. Revolute, prismatic, gear and cam pairs are considered together with other 2 degrees-of-freedom types of constraints.	6
II	**Basic principles for analysis of multi-body systems:** The automatic assembly of the systems of equations for position, velocity and acceleration analysis. Iterative solution of systems of nonlinear equations. Geometry of masses	6
III	**Dynamics of Planar Systems:** Dynamics of planar systems. Systematic computation and assembly of mass matrix. Computation of planar generalized forces for external forces and for actuator-spring-damper element. Simple applications of inverse and forward dynamic analysis. Numerical integration of first-order initial value problems.	7
IV	**Kinematics of rigid bodies in space:** Reference frames for the location of a body in space. Euler angles and Euler parameters. The formula of Rodrigues. Screw motion in space. Velocity, acceleration and angular velocity.	6

V	**Kinematic analysis of spatial systems:** Basic kinematic constraints. Joint definition frames. The constraints required for the description in space of common kinematic pairs (revolute, prismatic, cylindrical and spherical). Equations of motion of constrained spatial systems.	7
VI	**Computation of Forces:** Computation of spatial generalized forces for external forces and for actuator-spring-damper element	6

Textbooks	
1	Wittenburg, J., Dynamics of Systems of Rigid Bodies, B.G. Teubner, Stuttgart, 1977.
2	Kane, T.R, Levinson, D.A., Dynamics: Theory and Applications, McGraw-Hill Book Co., 1985
3	Nikravesh, P.E., Computer Aided Analysis of Mechanical Systems, Prentice-Hall Inc., Englewood Cliffs, NJ, 1988

References	
1	Roberson, R.E., Schwertassek, R., Dynamics of Multibody Systems, Springer-Verlag, Berlin, 1988.
2	Haug, E.J., Computer-Aided Kinematics and Dynamics of Mechanical Systems-Basic Methods, Allyn and Bacon, 1989.
3	Huston, R.L., Multibody Dynamics, Butterworth-Heinemann, 1990.
4	Schielen, W. ed., Multibody Systems Handbook, Springer-Verlag, Berlin, 1990

Useful Links	
1	https://www.youtube.com/watch?v=hik3wGrz8Ws&list=PL9-f9hWLZS60x5tV2kffJ8OZm8ds2IEZJ
2	https://www.youtube.com/watch?v=fEdz91oWrts
3	https://www.youtube.com/watch?v=tdkFc88Fw-M
4	https://www.youtube.com/watch?v=8AGseLCAc8w

CO-PO Mapping

	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2			2		
CO2	2				1	3
CO3	2				2	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2023-24

Course Information	
Programme	M. Tech. (Mechanical Design Engineering)
Class, Semester	Second Year M. Tech., Sem III
Course Code	6DE613
Course Name	Experimental Stress Analysis
Desired Requisites:	Strength of material, Material Science

Teaching Scheme		Examination Scheme (Marks)			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To make the student familiar with techniques of experimental stress analysis.
2	To study strain gauge bridge configurations and related instrumentation to take readings.
3	To use different polariscope arrangements along with auxiliary equipment required for photoelasticity.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Analyze the photoelastic data by various methods.	III	Analysing
CO2	Determine the strains and stresses in photoelastic coating by using reflection polariscope.	V	Evaluating
CO3	Apply various methods and instrumentation for strain measurement.	III	Applying

Module	Module Contents	Hours
I	**Introduction to ESA:** Introduction to ESA, Advantages of ESA techniques, Necessity of various ESA methods, methodology of problem solving by ESA. Introduction of few concepts of Mechanics of materials	6
II	**Photo Elasticity:** Theory of Photo Elasticity, Optics related to photo elasticity- Ordinary light, Monochromatic light, polarized light, natural and artificial birefringence, Stress optic law in two dimensions abnormal incidence, material fringe value in terms of stress function, Effect of stressed model in plane polariscope–Isoclinics, Isochromatics, Criterion for selection of model materials, Properties of commonly employed photo elastic materials, Casting technique and machining of model, Conclusions pertaining to material	7
III	**Methods of Analysis:** Determination of direction of Principal stresses at given point, Determination of exact fringe order N and the principal stress difference ($\sigma 1 - \sigma 2$) at the given point, Separation methods: Method based on Hook's Law, Electrical analogy method, Oblique incidence method, Shear difference method. Scaling model results to prototype.	7

IV	**Strain Measurement Using Strain Gauges:** Introduction, types, construction and material, Gauge factor, cross or transverse sensitivity, correction for transverse strain effect, semiconductor strain gauge. Selection and Mountings of Strain Gauges: Grid, backing, adhesive, mounting methods, checking gauge installation, Moisture proofing. Strain Gauge/Circuitry: Measurement of force or load, Measurement of torque	7
V	**Application of Strain Gauges:** Introduction, Analysis of strain gauge data by analytical and graphical methods, Analysis when principal stress directions are known, Analysis when principal stress directions are unknown, Delta rosette, Tee-rosette, Four element rectangular rosette, Rectangular rosette – Two and three element	6
VI	**Brittle Coating and Moir Method:** Brittle coating method - merits, demerits and applications, Moiré fringe method - merits, demerits and applications, Birefringent coating-principle and working of reflection polariscope.	6

Textbooks	
1	Dally J. W., Riley W. F. "Experimental Stress Analysis", McGraw Hill, Third Edition 1991.
2	Dr.Sadhu Singh, "Experimental Stress Analysis", Khanna Publishers, Fourth Edition, 2015.

References	
1	Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant B.,Ramachandra, K., "Experimental Stress Analysis", Tata McGraw-Hill, New Delhi, 1984.
2	Abdul Muben, "Experimental Stress Analysis", DhanpatRai& Co, First edition, 1987.
3	Window A. L., "Strain Gauge Techniques", Springer Publications, Second edition, 1992.

Useful Links	
1	https://www.youtube.com/watch?v=Ujtv5NY4Sq8
2	https://www.youtube.com/watch?v=n5oP5CswTAY&list=PL16JJHgYPkvMyabXO3RVs0YoqwSdMo4YT&index=8
3	https://www.youtube.com/watch?v=ZTXYwdPznkA&list=PL16JJHgYPkvMyabXO3RVs0YoqwSdMo4YT&index=27
4	https://www.youtube.com/watch?v=OUSDiI8UOJA&list=PL16JJHgYPkvMyabXO3RVs0YoqwSdMo4YT&index=30

CO-PO Mapping

	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2		2			3
CO2	2		2			3
CO3	2		2			3

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
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AY 2023-24

Course Information	
Programme	M. Tech. (Mechanical Design Engineering)
Class, Semester	Second Year M. Tech., Sem III
Course Code	6DE614
Course Name	Product Lifecycle Management
Desired Requisites:	Concept knowledge of product design, management

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To prepare students to develop products by technical and managerial and software skills.
2	To make the students familiar with increased product complexity and to maintain product quality.
3	To develop skills to identify the gaps between current product development process.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Discuss the importance and the concept of Product Lifecycle Management and its need.	II	Understanding
CO2	Exploit the methodology to set the Product Lifecycle Management Vision and Develop Product Lifecycle Management strategy	III	Applying
CO3	Analyze the recent developments to perform product structure modelling with relationship	IV	Analysing

Module	**Module Contents**	**Hours**
I	Product life cycle – Introduction, growth, maturity & decline, Product Lifecycle, Management-Definition & Overview, Background for Product Lifecycle Management-corporate challenges, Need of Product Lifecycle Management, Components/Elements of Product Lifecycle Management, Emergence of Product Lifecycle Management, Significance of Product Lifecycle Management - life cycle problems to be resolved.	6
II	Product Lifecycle Management Life cycle model- plan, design, build, support & dispose. Threads of Product Lifecycle Management computer aided design (CAD), engineering data management (EDM), Product data management (PDM), computer integrated manufacturing (CIM). Weaving the threads into Product Lifecycle Management, comparison of Product Lifecycle Management to Engineering resource planning (ERP). Product Lifecycle Management characteristics - singularity, cohesion, traceability, reflectiveness, Information Mirroring Model. External drivers- scale, complexity, cycle times, globalization & regulation. Internal drivers - productivity, innovation, collaboration & quality. Boardroom drivers – income, revenues & costs	7

III	Collaborative Product Development, Mapping Requirements to specifications. Part Numbering, Engineering Vaulting, Product reuse, Engineering Change Management, Bill of Material and Process Consistency. Digital Mock up and Prototype development. Virtual testing and collateral. Introduction to Digital Manufacturing.	6
IV	Product life cycle management system- system architecture, Information models and product structure, Information model, the product information data model, the product model, functioning of the system. Reasons for the deployment of Product Lifecycle Management systems.	6
V	Product Data issues – Access, applications, Archiving, Availability, Change, Confidentiality. Product Workflow, The Link between Product Data and Product Workflow, Key Management Issues around Product Data and Product Workflow, Company's Product Lifecycle Management vision, The Product Lifecycle Management Strategy, Principles for Product Lifecycle Management strategy, Preparing for the Product Lifecycle Management strategy.	7
VI	Different phases of product lifecycle and corresponding technologies, Foundation technologies and standards e.g. visualization, collaboration and enterprise application integration, Core functions e.g., data vaults, document and content management, workflow and program management, Functional applications e.g., configuration management. Human resources in product lifecycle.	7

Textbooks	
1	Grieves Michael, Product Lifecycle Management- Driving the Next Generation of Lean Thinking, McGraw-Hill, 2006. ISBN 0071452303.
2	Antti Sääksvuori, Anselmi Immonen, Product Life Cycle Management - Springer, 1st Edition (Nov.5, 2003)
3	Stark, John. Product Lifecycle Management: 21st Century Paradigm for Product Realization, Springer- Verlag, 2004. ISBN 1852338105.
4	Kari Ulrich and Steven D. Eppinger, Product Design & Development, McGraw Hill International Edns, 1999.
References	
1	Product Design & Process Engineering, McGraw Hill – Kogalkusha Ltd., Tokyo, 1974.
2	Effective Product Design and Development – by Stephen Rosenthol, Business One Orwin, Homewood 1992 ISBN 1-55623-603-4.
3	Clement, Jerry; Coldrick, Andy; & Sari, John. Manufacturing Data Structures, John Wiley & Sons, 1992. ISBN 0471132691
4	Clements, Richard Barrett. Chapter 8 ("Design Control") and Chapter 9 ("Document Control") in Quality Manager's Complete Guide to ISO 9000, Prentice Hall, 1993. ISBN 013017534X.
Useful Links	
1	https://www.youtube.com/watch?v=MsnbqLWjlmA&list=PLeL2LKQLdbQvCnx
2	https://nptel.ac.in/courses/112/107/112107217/
3	https://www.youtube.com/watch?v=NDcaDUKQutE&list=PLSGws_74K018yZOnbSaqW
4	https://www.youtube.com/watch?v=m-OMvTWf9mE

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1				1	2
CO2			2	3		1

CO3			2	3		1

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2023-24

Course Information	
Programme	M. Tech. (Mechanical Design Engineering)
Class, Semester	Second Year M. Tech., Sem III
Course Code	6IC602
Course Name	Constitution of India
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 0			

Course Objectives

1	To review and create awareness on various provisions in the constitution of India.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain the premises informing the twin themes of liberty and freedom from a civil rights perspective.	II	Understanding
CO2	Address the growth of Indian opinion regarding modern Indian intellectuals constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism	II	Understanding
CO3	Address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution	II	Understanding

Module	**Module Contents**	**Hours**
I	History of Making of the Indian Constitution Drafting Committee, (Composition & Working)	4
II	**Philosophy of the Indian Constitution :** Preamble, Salient Feature	4
III	**Contours of Constitutional Rights:** Fundamental Rights; Right to Equality; Right to Freedom; Right against Exploitation; Right to Freedom of Religion; Cultural and Educational Rights; Right to Constitutional Remedies; Directive Principles of State Policy; Fundamental Duties.	5
IV	**Organs of Governance:** Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions	5
V	**Local Administration:** District"s Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy	5

VI	**Election Commission:** Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.	5

Textbooks	
1	Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
2	M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014
3	D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015
References	
1	The Constitution of India, 1950 (Bare Act), Government Publication
Useful Links	
1	https://en.wikipedia.org/wiki/Constituent_Assembly_of_India
2	https://nptel.ac.in/courses/129/106/129106003/
3	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-lw02/
4	https://eci.gov.in/about/about-eci/the-functions-electoral-system-of-india-r2/

CO-PO Mapping

	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1			1			
CO2	2					
CO3				1		2

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	M. Tech. (Mechanical Design Engineering)
Class, Semester	Second Year M. Tech., Sem IV
Course Code	6DE691
Course Name	Dissertation Phase IV
Desired Requisites:	

Teaching Scheme (Hrs)		**Examination Scheme (Marks)**			
Practical	10	**LA1**	**LA2**	**ESE**	**Total**
Interaction	-	100	0	0	100
		Credits: 5			

Course Objectives

1	To develop the student to apply the knowledge gained to identify problem for research provide the solutions by self-study and interaction with stake holders
2	Acquire knowledge to tackle real world problems of societal concerns
3	Impart flexibility to the student to have increased control over his/ her learning.
4	Teachers would serve as mentor/facilitator of inquiry and reflection rather than as an instructor
5	Enhance student's learning through increased interaction with peers and colleagues.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Search the existing literature and identification of research problem	IV	Analysing
CO2	Design and develop the solution for complex engineering problem	V	Evaluating
CO3	Create the new knowledge in the specialized field	VI	Creating

Course Contents

Students are expected to carry out independent research work on the chosen topic. In this semester it is expected that the student has carried out substantial research work including exhaustive literature survey, formulation of the research problem, development/fabrication of experimental set-up (if any/required) and testing, and analysis of initial results thus obtained. In fourth semester, the students continue their dissertation work. It is expected that the student has completed most of the experimental/computation works and analyzed the results so obtained as proposed in the synopsis. The work should be completed in all respects in this semester. The students are required to submit the dissertation work in the form of report as per the institute rule.

Text Books

1	As per the research topic

References

1	National and International Journals

Useful Links

1	https://nptel.ac.in/courses/110/104/110104073/

CO-PO Mapping

	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1			1		2
CO2			1		2	

CO3		2				2
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.						

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

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Course Information	
Programme	M. Tech. (Mechanical Design Engineering)
Class, Semester	Second Year M. Tech., Sem IV
Course Code	6DE692
Course Name	Dissertation Phase V
Desired Requisites:	

Teaching Scheme (Hrs)		**Examination Scheme (Marks)**			
Practical	10	**LA1**	**LA2**	**ESE**	**Total**
Interaction	-	0	100	0	100
		Credits: 5			

Course Objectives	
1	To develop the student to apply the knowledge gained to identify problem for research provide the solutions by self-study and interaction with stake holders
2	Acquire knowledge to tackle real world problems of societal concerns
3	Impart flexibility to the student to have increased control over his/ her learning.
4	Teachers would serve as mentor/facilitator of inquiry and reflection rather than as an instructor
5	Enhance student's learning through increased interaction with peers and colleagues.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Search the existing literature and identification of research problem	IV	Analysing
CO2	Design and develop the solution for complex engineering problem	V	Evaluating
CO3	Create the new knowledge in the specialized field	VI	Creating

Course Contents

Students are expected to carry out independent research work on the chosen topic. In this semester it is expected that the student has carried out substantial research work including exhaustive literature survey, formulation of the research problem, development/fabrication of experimental set-up (if any/required) and testing, and analysis of initial results thus obtained. In fourth semester, the students continue their dissertation work. It is expected that the student has completed most of the experimental/computation works and analyzed the results so obtained as proposed in the synopsis. The work should be completed in all respects in this semester. The students are required to submit the dissertation work in the form of report as per the institute rule.

Text Books	
1	As per the research topic

References	
1	National and International Journals

Useful Links	
1	https://nptel.ac.in/courses/110/104/110104073/

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**

CO1				1		
CO2	1		1		2	2
CO3		2				2
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.						

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

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Course Information	
Programme	M. Tech. (Mechanical Design Engineering)
Class, Semester	Second Year M. Tech., Sem IV
Course Code	6DE693
Course Name	Dissertation Phase VI
Desired Requisites:	

Teaching Scheme (Hrs)		Examination Scheme (Marks)			
Practical	12	**LA1**	**LA2**	**ESE**	**Total**
Interaction	-	0	0	100	100
		Credits: 6			

Course Objectives

1	To develop the student to apply the knowledge gained to identify problem for research provide the solutions by self-study and interaction with stake holders
2	Acquire knowledge to tackle real world problems of societal concerns
3	Impart flexibility to the student to have increased control over his/ her learning.
4	Teachers would serve as mentor/facilitator of inquiry and reflection rather than as an instructor
5	Enhance student's learning through increased interaction with peers and colleagues.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Search the existing literature and identification of research problem	IV	Analysing
CO2	Design and develop the solution for complex engineering problem	V	Evaluating
CO3	Create the new knowledge in the specialized field	VI	Creating

Course Contents

Students are expected to carry out independent research work on the chosen topic. In this semester it is expected that the student has carried out substantial research work including exhaustive literature survey, formulation of the research problem, development/fabrication of experimental set-up (if any/required) and testing, and analysis of initial results thus obtained. In fourth semester, the students continue their dissertation work. It is expected that the student has completed most of the experimental/computation works and analyzed the results so obtained as proposed in the synopsis. The work should be completed in all respects in this semester. The students are required to submit the dissertation work in the form of report as per the institute rule.

Text Books

1	As per the research topic

References

1	National and International Journals

Useful Links

1	https://nptel.ac.in/courses/110/104/110104073/

CO-PO Mapping

	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1			1		2
CO2	1		1		2	2

CO3		2				2
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.						

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

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Course Information	
Programme	M. Tech. (Mechanical Design Engineering)
Class, Semester	Second Year M. Tech., Sem IV
Course Code	6IC601
Course Name	Value Education
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 0			

Course Objectives

1	To impart knowledge on value of education and self- development.
2	To imbibe good values in students.
3	To highlight importance of character.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain value of education and self- development.	II	Understanding
CO2	Summarize importance of good character, and Behaviour development.	V	Evaluating

Module	**Module Contents**	**Hours**
I	Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism, Moral and non- moral valuation. Standards and principles, Value judgments.	6
II	Importance of cultivation of values, Sense of duty. Devotion, Self-reliance, confidence, Concentration. Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline.	6
III	Personality and Behaviour Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour universal brotherhood and religious tolerance, True friendship, Happiness vs. suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature	7
IV	Character and Competence –Holy books vs. Blind faith, Self-management and Good health, science of reincarnation, Equality, Nonviolence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control. Honesty, Studying effectively	7

Text Books

1	Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

References

1	

Useful Links

1	https://nimsuniversity.org/wp-content/uploads/2018/02/Value-Education-Human-Rights-and-Legislative-Procedures.pdf
2	http://cbseacademic.nic.in/web_material/ValueEdu/Value%20Education%20Kits.pdf
3	https://www.verywellmind.com/personality-development-2795425

4	https://trudreadz.com/2019/09/10/blind-faith-in-religion-destroys-our-ability-to-critically-think-for-ourselves/

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2				1	2
CO2	1		1			2
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.						