

University of Mumbai



No. AAMS_UGS/ICC/2022-23/ 178

CIRCULAR:-

Attention of the Principals of the Affiliated Colleges and Directors of the Recognized Institutions in Faculty of Science & Technology is invited to this office circular No. UG/219 of 2016-17 dated 12th January, 2017, relating to the revised syllabus as per Choice Based Credit System for Master of Engineering (Mechanical) (Product Design and Development) (Sem. I to IV).

You are hereby informed that the recommendations made by the Board of Studies in **Mechanical Engineering** at its meeting held on 31st May, 2022 and subsequently passed in the Faculty and then by the Board of Deans at its meeting held on 5th July, 2022 vide item No. 6.52 (R) have been accepted by the Academic Council at its meeting held on 11th July, 2022 vide item No. 6.52 (R) and that in accordance therewith, the revised syllabus of **M.E. (Product Design & Development) (Sem.- I to IV) (CBCS) (REV - 2022 Scheme)**, has been brought into force with effect from the academic year 2022-23. (The circular is available on the University's website www.mu.ac.in).

MUMBAI – 400 032
19th November, 2022


(Prof. Sunil Bhirud)
I/c Registrar

To

The Principals of the Affiliated Colleges and Directors of the Recognized Institutions in Faculty of Science & Technology.

A.C/6.52 (R)/11/07/2022

Copy forwarded with Compliments for information to:-

- 1) The Dean, Faculty of Science & Technology,
- 2) The Chairman, Board of Studies in Mechanical Engineering,
- 3) The Director, Board of Examinations and Evaluation,
- 4) The Director, Board of Students Development,
- 5) The Director, Department of Information & Communication Technology,
- 6) The Co-ordinator, MKCL.

Copy to :-

- 1. The Deputy Registrar, Academic Authorities Meetings and Services (AAMS),**
- 2. The Deputy Registrar, College Affiliations & Development Department (CAD),**
- 3. The Deputy Registrar, (Admissions, Enrolment, Eligibility and Migration Department (AEM),**
- 4. The Deputy Registrar, Research Administration & Promotion Cell (RAPC),**
- 5. The Deputy Registrar, Executive Authorities Section (EA),**
- 6. The Deputy Registrar, PRO, Fort, (Publication Section),**
- 7. The Deputy Registrar, (Special Cell),**
- 8. The Deputy Registrar, Fort/ Vidyanagari Administration Department (FAD) (VAD), Record Section,**
- 9. The Director, Institute of Distance and Open Learning (IDOL Admin), Vidyanagari,**

They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above circular and that on separate Action Taken Report will be sent in this connection.

- 1. P.A to Hon'ble Vice-Chancellor,**
- 2. P.A Pro-Vice-Chancellor,**
- 3. P.A to Registrar,**
- 4. All Deans of all Faculties,**
- 5. P.A to Finance & Account Officers, (F.& A.O),**
- 6. P.A to Director, Board of Examinations and Evaluation,**
- 7. P.A to Director, Innovation, Incubation and Linkages,**
- 8. P.A to Director, Board of Lifelong Learning and Extension (BLLE),**
- 9. The Director, Dept. of Information and Communication Technology (DICT) (CCF & UCC), Vidyanagari,**
- 10. The Director of Board of Student Development,**
- 11. The Director, Department of Students Welfare (DSD),**
- 12. All Deputy Registrar, Examination House,**
- 13. The Deputy Registrars, Finance & Accounts Section,**
- 14. The Assistant Registrar, Administrative sub-Campus Thane,**
- 15. The Assistant Registrar, School of Engg. & Applied Sciences, Kalyan,**
- 16. The Assistant Registrar, Ratnagiri sub-centre, Ratnagiri,**
- 17. The Assistant Registrar, Constituent Colleges Unit,**
- 18. BUCTU,**
- 19. The Receptionist,**
- 20. The Telephone Operator,**
- 21. The Secretary MUASA**

for information.

University of Mumbai



Revised Syllabus for

M.E.

(Product Design & Development)

Semester – (I to IV)

(Choice Based Credit System)

(With effect from the academic year 2022-23)

University of Mumbai



O: _____ Title of Course	M.E. (Product Design and Development)
O: _____ Eligibility	Ordinance 0.5134
R: _____ Passing Marks	45%
No. of years/Semesters:	4 semesters
Level:	P.G. / U.G. / Diploma / Certificate
Pattern:	Yearly / Semester
Status:	New / Revised
To be implemented from Academic Year :	With effect from Academic Year : 2022-23

Dr. Vivek Sunnapwar
Chairman
of Board of Studies in Mechanical
Engineering

Dr. Suresh K. Ukarande
Associate Dean,
Faculty of Science and Technology

Dr. Anuradha Majumdar
Dean,
Faculty of Science and
Technology

Preamble

Education in engineering is growing in India and is expected to increase by a factor of several in the near future. The current situation presents a significant challenge in terms of ensuring quality to stakeholders while expanding. To face this challenge, the problem of quality must be addressed, debated, and progressed in a methodical manner. Accreditation is the primary form of quality assurance in higher education, and it signifies that the institution or programme of study is committed to meeting certain minimum stated requirements and is available to external assessment in order to get recognition. The main goal of this accrediting procedure is to assess the outcomes of the programme being evaluated. Program outcomes are a collection of skills and information that a student will possess upon completion of the programme. In keeping with this, the University of Mumbai's Faculty of Science and Technology has taken the lead in implementing the principle of outcome-based education into the curriculum building process.

We are pleased to report that the Postgraduate Program Educational Objectives were completed in a brainstorming session attended by more than 20 members from the University's associated institutes. They were either department heads or senior faculty from the Mechanical Engineering Department. The Program Educational Objectives finalized for the postgraduate program in Mechanical Engineering are listed below;

1. To prepare the Learner with a sound foundation in the mathematical, scientific and engineering fundamentals.
2. To prepare the Learner to use modern tools effectively in order to solve real life problems.
3. To prepare the Learner for a successful career in Indian and Multinational Organisations
4. To encourage and motivate the Learner in the art of self-learning.
5. To inculcate a professional and ethical attitude, good leadership qualities and commitment to social responsibilities in the Learner's thought process.

In addition to the aforementioned, linked Institutes may add 2 to 3 additional programme instructional objectives of their own. In addition to Program Educational Objectives, each course in a postgraduate program's curriculum includes objectives and expected outcomes from the perspective of the learner to support the idea of outcome-based education. We are convinced that even a tiny move in the correct manner will go a long way toward ensuring that the main stakeholders receive high-quality education.

Dr. S. K. Ukarande

Associate Dean

Faculty of Science and Technology

University of Mumbai

Dr Anuradha Muzumdar

Dean

Faculty of Science and Technology

University of Mumbai

Preface

To tackle the challenge of assuring engineering education excellence, the problem of quality must be addressed, debated, and progressed in a methodical manner. Accreditation is the primary way of ensuring the quality of higher education. The main goal of the certification procedure is to determine how good a company is. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited. In line with this, Faculty of Technology of University of Mumbai has taken a lead in incorporating philosophy of outcome-based education in the process of curriculum development.

Faculty of Science and Technology, University of Mumbai, in one of its meetings collectively resolved that, each Board of Studies shall prepare some Program Educational Objectives (PEOs), give freedom to Affiliated Institutes to add few (PEOs), course objectives course outcomes to be clearly defined for each course, so that all faculty members in linked institutes are aware of the depth of approach to the subject to be given, so improving the learning process of students. It was also decided that while changing the curriculum, the most senior academics from institutions and industry specialists should be included.

We are happy to state that the Board of studies has adhered to the resolutions passed by Faculty of Technology and developed curriculum accordingly. In addition to outcome-based education, Choice Based Credit System is also introduced to ensure quality of engineering education.

Choice Based Credit and Grading System allows for a much-needed shift in education focus from teacher-centric to learner-centric, since the workload estimate is based on time spent learning rather than teaching. It also emphasises constant evaluation, which will improve educational quality. University of Mumbai has taken a lead in implementing the system through its affiliated Institutes. Faculty of Technology has devised a transparent credit assignment policy, adopting a ten-point scale to grade learner's performance. REV-2022 scheme is implemented for Master of Engineering from the academic year 2022-2023.

We trust this revised version of syllabus come up to the expectations of all stakeholders. We wish to place on record our sincere thanks and appreciations to the various contributors from the academia and industry for their most learned inputs in framing this syllabus.

Board of Studies in Mechanical Engineering

Dr. Vivek K. Sunnapwar	: Chairman
Dr. S. M. Khot	: Member
Dr. V. M. Phalle	: Member
Dr. Siddappa Bhusnoor	: Member
Dr. S.S. Pawar	: Member
Dr. Sanjay U. Bokade	: Member
Dr. Dhanraj Tambuskar	: Member
Dr. V. B. Tungikar	: Member
Dr. K.P. Karunakaran	: Member
Dr. S. S. Thipse	: Member
Dr. Milind Deshmukh	: Member

Semester I

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total	
PDDC101	Product Design and Development	3	--	--	3	--	--	3	
PDDC102	Rapid Prototyping and Tooling	3		--	3		--	3	
PDDPE101X	Program Elective 1	3	--	--	3	--	--	3	
PDDPE102X	Program Elective 2	3	--	--	3	--	--	3	
PDDIE101X	Institute Elective 1	3	--	--	3	--	--	3	
PDDL101	Program Lab-I CAD: Solid Modeling Lab	--	2	--	--	1	--	1	
PDDSBL101	Skill Based Lab-I Rapid Prototyping and Tooling Lab	--	4 ^{\$}	--	--	2	--	2	
Total		15	06	--	15	03	--	18	
Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract / Oral	Total
		Internal Assessment			End Sem. Exam	Exam. Duration (in Hrs)			
		Test-1	Test-2	Avg					
PDDC101	Product Design and Development	20	20	20	80	3	--	--	100
PDDC102	Rapid Prototyping and Tooling	20	20	20	80	3	--	--	100
PDDPE101X	Program Elective 1	20	20	20	80	3	--	--	100
PDDPE102X	Program Elective 2	20	20	20	80	3	--	--	100
PDDIE101X	Institute Elective 1	20	20	20	80	3	--	--	100
PDDL101	Program Lab-I CAD: Solid Modeling Lab	--	--	--	--	--	25	25	50
PDDSBL101	Skill Based Lab-I Rapid Prototyping and Tooling Lab	--	--	--	--	--	50	50	100
Total		--	--	100	400	--	75	75	650

Course Code	Program Elective 1
PDDPE1011	Materials in Product Design and Development
PDDPE1012	Industrial Design
PDDPE1013	Product Packaging

CourseCode	Program Elective 2
PDDPE1021	Computer Aided Product Development
PDDPE1022	Creativity and innovation in Design
PDDPE1023	Die Design and Development

CourseCode	Institute Elective 1
PDDIE1011	ProductLife cycleManagement
PDDIE1012	ReliabilityEngineering
PDDIE1013	ManagementInformationSystem
PDDIE1014	DesignofExperiments
PDDIE1015	OperationResearch
PDDIE1016	CyberSecurityandLaws
PDDIE1017	DisasterManagement and MitigationMeasures
PDDIE1018	EnergyAudit and Management

Semester II

Course Code	Course Name	Teaching Scheme(Contact Hours)			Credits Assigned				
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total	
PDDC201	Quality Concepts in Design	3	--	--	3	--	--	3	
PDDC202	Design for X	3		--	3		--	3	
PDDPE201X	Program Elective 3	3	--	--	3	--	--	3	
PDDPE202X	Program Elective 4	3	--	--	3	--	--	3	
PDDIE201X	Institute Elective 2	3	--	--	3	--	--	3	
PDDL201	Program Lab-II CAD: Surface Modeling Lab	--	2	--	--	1	--	1	
PDDSBL201	Skill Based Lab-II CAE: Computer Aided Engineering	--	4 ^{\$}	--	--	2	--	2	
Total		15	06	--	15	03	--	18	
Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract / Oral	Total
		Internal Assessment			End Sem. Exam	Exam. Duration (in Hrs)			
		Test-1	Test-2	Avg					
PDDC201	Quality Concepts in Design	20	20	20	80	3	--	--	100
PDDC202	Design for X	20	20	20	80	3	--	--	100
PDDPE201X	Program Elective 3	20	20	20	80	3	--	--	100
PDDPE202X	Program Elective 4	20	20	20	80	3	--	--	100
PDDIE201X	Institute Elective 2	20	20	20	80	3	--	--	100
PDDL201	Program Lab-II CAD: Surface Modeling Lab	--	--	--	--	--	25	25	50
PDDSBL201	Skill Based Lab-II CAE: Computer Aided Engineering	--	--	--	--	--	50	50	100
Total		--	--	100	400	--	75	75	650

Note 1: Skill Based Lab- I and II are focused on the learning through experience. SBL shall facilitate the learner to acquire the fundamentals of practical engineering in his or her specialization in a project-oriented environment. The learning through skill based labs can be useful in facilitating their research work and hence useful in early completion of their dissertation work.

Course Code	Program Elective 3
PDDPE2011	Applied Ergonomics
PDDPE2012	Tribology in Design
PDDPE2013	Polymeric Material and Processing

CourseCode	Program Elective 4
PDDPE2021	Vehicle Design
PDDPE2022	Reverse Engineering
PDDPE2023	Product Marketing

Course Code	Institute Elective 1
PDDIE2011	ProjectManagement
PDDIE2012	FinanceManagement
PDDIE2013	EntrepreneurshipDevelopment andManagement
PDDIE2014	HumanResourceManagement
PDDIE2015	ProfessionalEthicsand CSR
PDDIE2016	ResearchMethodology
PDDIE2017	IPRandPatenting
PDDIE2018	DigitalBusinessManagement
PDDIE2019	EnvironmentalManagement

Semester III

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total	
PPDMP301	Major Project: Dissertation -I	--	20	--	--	10	--	10	
Total		00	20	00	00	10	--	10	
Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract/ Oral	Total
		Internal Assessment			End Sem. Exam	Exam. Duration (in Hrs)			
		Test-1	Test-2	Avg					
PDDMP301	Major Project: Dissertation -I	--	--	--	--	--	100	--	100
Total		--	--	--	--	--	100	--	100

Online Credit Courses

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
PDDOCC301	Online Credit Course - I	--	--	--	--	--	--	3
PDDOCC301	Online Credit Course - II	--	--	--	--	--	--	3
Total		--	--	--	00	00	00	06

Note 2: It is mandatory to complete the Online Credit Courses (OCC) available on NPTEL / Swayam /MOOC or similar platform approved by UoM. These two courses shall be completed in any semester I or II or III, but not later end of the Semester III. University shall make a provision that credits earned with OCC- I and OCC-II shall be accounted in the third semester grade-sheet with actual names of courses. The learner shall be allowed to take up these courses from his or her institute or organisation/ industry where his / her major project is carried out. The students shall complete the courses and shall qualify the exam conducted by the respective authorities/ instructor from the platform. The fees for any such courses and the corresponding examination shall be borne by the learner.

Online Credit Course – I

The learner shall opt for the course in the domain of Research Methodology **or** Research & Publication Ethics or IPR. The opted course shall be of 3 credits of equivalent number of weeks.

Online Credit Course –II

The learner shall opt for the course recommended by Faculty Advisor/ Project Supervisor from the institute. The opted course shall be of 3 credits of equivalent number of weeks.

Semester IV

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total	
PDDMP401	Major Project : Dissertation -II	--	32	--	--	16	--	16	
Total		--	32	--	--	16	--	16	
Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract/ Oral	Total
		Internal Assessment			End Sem. Exam	Exam. Duration (in Hrs)			
		Test-1	Test-2	Avg					
PDDMP401	Major Project : Dissertation -II	--	--	--	--	--	100	100	200
Total		--	--	--	--	--	100	100	200

Total Credits: 68

Note 3: The Dissertation -II submission shall not be permitted till the learner completes all the requirements ME course.

Note 4: The contact hours for the calculation of load of the teacher for Major Project are as follows:
Major Project Dissertation I and II - 02 Hour / week / student

Guidelines for Dissertation-I

Students should do literature survey and identify the problem for Dissertation and finalize in consultation with Guide/Supervisor. Students should use multiple literatures and understand the problem. Students should attempt solution to the problem by analytical/simulation/experimental methods. The solution to be validated with proper justification and compile the report in standard format. Guidelines for Assessment of Dissertation-I.

Dissertation-I should be assessed based on following points

- Quality of Literature survey and Novelty in the problem
 - Clarity of Problem definition and Feasibility of problem solution
 - Relevance to the specialization
 - Clarity of objective and scope
- Dissertation-I should be assessed through a presentation by a panel of Internal examiners and external examiner appointed by the Head of the Department/Institute of respective Programme.

Guidelines for Assessment of Dissertation II

Dissertation II should be assessed based on following points:

- Quality of Literature survey and Novelty in the problem
- Clarity of Problem definition and Feasibility of problem solution
- Relevance to the specialization or current Research / Industrial trends
- Clarity of objective and scope
- Quality of work attempted or learner contribution
- Validation of results
- Quality of Written and Oral Presentation

Students should publish at least one paper based on the work in referred National/ International conference/Journal of repute.

Dissertation II should be assessed by internal and External Examiners appointed by the University of Mumbai.

CourseCode	CourseName	Credits
PDDC101	ProductDesignandDevelopment	03

Objectives

1. Tostudythebasicconceptsof productdesign anddevelopment process.
2. Tostudythe applicabilityof productdesign anddevelopment inindustrialapplications
3. Tostudythekeyreasons fordesign or redesign.

Outcomes: Learnerwillbeableto...

1. Selectanappropriateproductdesign anddevelopmentprocessforagivenapplication
2. Developthemethods tominimize thecost.
3. Understand process of concept development
4. Understand process and methods of product/process testing

Module	DetailedContents	Hrs.
01	Introduction: The Challenges of Product Development, The Product Development Process, Concept Development: The Front-End Process, Adapting the Generic Product Development Process, Opportunity Identification Process	08
02	Product Planning Process Identify Opportunities, Evaluate and Prioritize Projects, Allocate Resources and Plan Timing, Complete Pre-Project Planning, Reflect on the Results and the Process. Identifying Customer Needs: Steps involved in process Product Specifications : Establishing target specification and setting final specification	08
03	Concept Development The Activity of Concept Generation, A Five-Step Method, Concept Selection , Some Method for Choosing a Concept, Overview of Methodology,Concept Screening, Concept Scoring, Concept Testing	08
04	Product Architecture Types of Modularity, Implications of the Architecture, Establishing the Architecture, Delayed Differentiation, Platform Planning Industrial Design Assessing the Need for Industrial Design, The Impact of Industrial Design, The Industrial Design Process, Assessing the Quality of Industrial Design	10
05	Design for Environment, Design for Environment Process Design for Manufacturing, Overview of the DFM Process, Estimate the Manufacturing Costs, Reduce the Costs of Components, Reduce the Costs of Assembly, Reduce the Costs of Supporting, and Consider the Impact of DFM Decisions on Other Factors.	08
06	Prototyping: Principles of Prototyping, Prototyping Technologies, Planning for Prototypes , Robust Design, Design of Experiments, The Robust Design Process, Intellectual Property: Overview of Patents, Utility Patents, Preparing a Disclosure, Elements of Economic Analysis: Quantitative and qualitative analysis. Managing Projects: Understanding and Representing Tasks , Baseline Project Planning	08

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (**on minimum Two Modules**) and the other is either a class test or assignment online problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

References:

1. Karl T Ulrich, Steven D Eppinger , “ Product Design & Development.” Tata McGrawhill New Delhi 2003
2. David G Ullman, “The Mechanical Design Process.” McGrawhill Inc Singapore 1992
3. Kevin Otto & Kristin Wood Product Design: “Techniques in Reverse Engineering and new Product Development.” 1/e 2004 , Pearson Education New Delhi
4. Hollins B & Pugh S “Successful Product Design.” Butterworths London.
5. Baldwin EN & Neibel BW “Designing for Production.” Edwin Homewood Illinois
6. Bralla J G “Handbook of Product Design for Manufacture, McGrawhill New York

CourseCode	CourseName	Credits
PDDC102	RapidPrototypingAndTooling	03

Objectives

1. To familiarize students with rapid prototyping and tooling technologies.
2. To study basic concepts of reverse engineering and their application in product development.
3. To study advanced manufacturing techniques.

Outcomes: Learner will be able to...

1. Communicate with community and professional environment about RPT
2. Classify and select proper rapid prototyping and reverse engineering techniques for specific technical applications.
3. Use detailed knowledge in the field of selected advanced manufacturing methods. Moreover, inspection methods concerning quality of manufactured prototypes are introduced too.
4. Utilize basic reverse engineering technologies, programming and operating sophisticated technical equipment.
5. Think and work in creative and entrepreneur way with giving consideration of economic aspect

Module	Detailed Contents	Hrs
01	Rapid Prototyping • Historical Development • Applications: Design, Planning, Manufacturing and Tooling • Applications: Automotive, Jewelry, Coin and Bio-Medical • Fundamentals of Rapid Prototyping, Design Process • Rapid Prototyping Process Chain	09
02	Subsystem of RP Machine • Subsystem of RP machine - o Optical System - o Mechanical Scanning System - o Computer Interfacing hardware, DAQs - o Signal Flow, 3D Model to RP Prototype • Introduction to 3D Modeling Softwares (Auto-CAD, PROE, CATIA, IDEAS etc.) • Slicing and Scan Path Generation Algorithms • Data Conversion and Transmission • File Formats, IGES, STL • Preprocessing and Post-processing	10
03	Liquid Based Rapid Prototyping Systems • Materials • Stereolithography • Solid Ground Curing • Solid Object UV (Ultra-Violet) Printer • Two Laser System • Micro-stereolithography.	10

04	SolidBasedRapidPrototypingSystems • Materials • LOM(LaminatedObjectManufacturing)System • FDM(FuseDepositionModeling)System • Multi-JetModeling(MJM)System • ModelMakerandPatternMaster ShapeDepositionManufacturingProcess	08
05	PowderBasedRapidPrototypingSystems • Materials • SLS(SelectiveLaserSintering) • (3DP)Three-DimensionalPrinting • (LENS)LaserEngineeredNetShaping • (MJS)MultiphaseJetSolidification • (EBM)ElectronBeamMelting	07
06	Rapid Tooling: Indirect Rapid tooling -Silicon rubber tooling –Aluminum filled epoxy tooling Spray metal tooling, Cast kirkstone, 3Q keltool, etc, Direct Rapid Tooling Direct. AIM, Quick cast process, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft, Tooling vs. hard tooling.	08

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (**on minimum Two Modules**) and the other is either a class test or assignment online problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example, suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

References:

1. Rapid prototyping, Andreas Gebhardt, Hanser Gardener Publications, 2003.
2. Rapid Prototyping and Engineering applications: A toolbox for prototype development, Liou W. Liou, Frank W. Liou, CRC Press, 2007.
3. Rapid Prototyping: Theory and practice, Ali K. Kamrani, Emad Abouel Nasr
4. Rapid Prototyping and Tooling by Hari Prasad & K.S. Badhrinarayan/ Page Turners
5. Paul F. Jacobs- "Stereo lithography and other RP & M Technologies", SME, NY 1996.
6. Flham D.T & Dinjoy S.S - "Rapid Manufacturing" Verlog London 2001.
7. Lament wood, "Rapid automated", Indus press New York

CourseCode	CourseName	Credits
PDDPE1011	MaterialsInProductDesign& Development	03

Objectives

1. To expose the students to the material aspects of Product design.
2. To study importance of material in Process modeling and design for assembly
3. To expose the students to new material processing techniques

Outcomes: Learner will be able to...

1. Understand the behavior of various metals and non-metals
2. Learn about the selection of material for different applications
3. Get exposure to the manufacturing processes in microfabrication

Module	DetailedContents	Hrs.
01	ENGINEERING MATERIAL AND SELECTION Engineering material- Engineering material families, Material Properties- General, mechanical, Thermal, Electrical, optical, Eco-properties, Environmental resistance, Material property charts Material selection - Selection strategy, Material attributes, Attribute limits and material indices, selection procedure, Computer-aided selection, Case Studies	08
02	Process Modeling And Product Design Methods of analysis- Slab, slip line and upper bound solutions- Numerical methods- Effect of Friction- Contact problem- Basic analysis of process- Forging, Drawing and sheet metal forming- machining- Turning- modern materials- micro alloyed and dual phase steel- High strength low alloy metals- Smart materials- Shape memory metals- Metallic Glasses- Nano Materials- Metal foams- Properties and applications for product design.	08
03	NonMetals And Manufacturing General properties and its importance of polymers Thermal and electrical properties mechanical properties- Criteria for selection- Composite materials- fibers- Boron, glass, carbon, organic- Ceramic and metallic fibers- - Matrix materials- Polymer, metal and ceramics- properties and applications- Manufacturing methods of plastic products- Injection and blow moulding –Rotational moulding-Compression moulding-Transfer moulding-layering of composites	10
04	Product Design And Assembly Requirements Structural product analysis- End use behavior- Effect of tooling in product design- Design for joining and assembling- Design for live hinges- Snap fits, design of corners, bushes and ribs- Design considerations- New product design-Methods of decoration-Bonding and cementing techniques- Thermal bonding- Machining of plastics-Parameters and effect- Case studies in material selection with relevance to product design and development	08
05	Development In Materials Processing Microfabrication technologies- Tool formicrofabrication-Diamond and high speed machining- LIGA microfabrication process-Multilayer X-ray lithography-	08
06	Introduction to Smart/Intelligent Materials: Overview of Smart / Intelligent Materials, Primitive Functions of Intelligent Materials, Intelligence Inherent in Materials, Actuator Materials, Sensing Technologies, Micro-sensors, Intelligent Systems, Hybrid Smart Materials, Passive Sensory Smart Structures, Reactive Actuator based Smart Structures, Active Sensing and Reactive Smart Structures, Smart Skins	10

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (**on minimum Two Modules**) and the other is either a class test or assignment online problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example, supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

References:

1. Serop Kalpakjian and Schmid - Manufacturing process for Engineering materials Pearson-2005.
2. Paul Degarmo, Black and Kohser - Materials and processes in Manufacturing- Wiley Student Edition-9th Edition-2005
3. Sami Franssile - Introduction to Micro Fabrication- John Wiley and Sons-UK 2004
4. Harfold Belofsky - Plastic design and processing handbook, Hanser publication-2005
5. Beck - Plastic Product Design-van Nostrand Reinhold 2nd Edition
6. Asbhay, Selection of Materials, El Sevier Publications, 2006.

CourseCode	CourseName	Credits
PDDPE1012	Industrial Design	03

Objectives

1. To expose the students to the industrial design of Product design.
2. To study importance in work place and equipment design

Outcomes: Learner will be able to...

1. Understand the design of Equipment, environmental
2. Learn about the biomechanics, bio thermodynamics, bioenergetics
3. Get exposure to the cognitive ergonomics & human factor application

Module	DetailedContents	Hrs.
01	INTRODUCTION Definition – Human & Machine system – Manual; Mechanical; Automated system, Input of Information - Auditory, Visual, Oral, Olfactory display & Communication. Human Output and Control – Physical work, Manual material handling, Physiological performance: Motor Skill, human control of systems, controls & data entry devices, hand tools & devices.	08
02	WORK PLACE AND EQUIPMENT DESIGN Applied anthropometry, Workspace design and seating, arrangement of components within a Physical space, interpersonal aspects of work place design, and design of repetitive task, design of manual handling activity task, work capacity, stress, and fatigue. Design of Equipment :Ergonomic factors to be considered in the design of displays and control, design for maintainability, design of human computer interaction	10
03	ENVIRONMENTAL DESIGN Vision and illumination design – Climate, Noise, Motion, Sound, and Vibration.	08
04	BIOMECHANICS, Biostatic mechanics, statics of rigid bodies, upper extremity of hand, lower extremity and foot, bending, lifting and carrying, biodynamic mechanics, human body kinematics, kinetics, impact and collision, human activity analysis, ergonomic tools, RULA, REBA, NOISH lifting equation -	08
05	BIO THERMODYNAMICS, BIOENERGETICS Bio-thermal fundamentals, human operator heat transfer, human system Bioenergetics, thermoregulatory physiology, human operator thermo regularity, passive Operator, active operator, heat stress.	08
06	COGNITIVE ERGONOMICS & HUMAN FACTOR APPLICATION Information Theory Information processing, Signal detection theory, Human response, human errors, cognitive task analysis. Human factors applications: Human error, accidents, human factors and the automobile, organizational and social aspects, steps according to ISO.DIS6385, OSHA's approach, virtual environments.	10

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (**on minimum Two Modules**) and the other is either a class test or assignment online problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example, suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only four questions need to be solved.

References:

1. Chandler Allen Phillips, "Human Factors Engineering", John Wiley and sons, New York, 2000
2. Mark S Sanders, "Human Factors in Engineering and Design", McGraw Hill, New York, 1993.
3. Bridger R S, "Introduction to Ergonomics", Taylor and Francis, London, 2003.
4. McCormik, J., Human Factors Engineering and Design, McGraw Hill, 1992.
5. Martin Helander, A guide to Human Factors and Ergonomics, 2nd Edition, CRC, Taylor & Francis Group 2006.

CourseCode	CourseName	Credits
PDDPE1013	ProductPackaging	03

Objectives

1. To study the importance of product packaging in new product development.
2. To study skills needed to create packaging for new products.

Outcomes: Learner will be able to...

1. To understand the various techniques for packaging for a new product.
2. To apply quality assessment and testing techniques to the design and development of new products

Module	Detailed Contents	Hours
01	Introduction: Definition Functions of Packaging, package environment Product & Packaging, Material Characteristics, and Packaging Evaluation.	10
02	Packaging Media (Science, Technology, Manufacture, Conversion, Properties & Applications): Paper & Board, Fibre Board Boxes, Composite Containers, Drums, Celluloses, Glass, Metal Containers and Components, Polymers and Plastics, Flexible Packaging Materials, Wooden Containers, Crates, IBCs, Flexible & Rigid, Textiles and Jute.	09
03	Quality Assessment & Performance Evaluation: Testing, Significance of Testing, Quality Control and Quality Assurance, SQC Techniques, Shelf-life Evaluation, Product Package Compatibility, Migration, Transport-worthiness Testing, Testing of Ancillary Materials, Machine Material Interaction, IMDG, UN/IATA Testing, etc.	07
04	Package Printing: Pre-Press, Printing Processes, Letterpress, Offset, Lithography, Flexography, Gravure, Screen, Pad, Foil Stamping, Digital Printing (Inkjet, Thermal), Computer-to-Plate. Colour Management, Colour Measurement, etc. Package Graphics: Package Design, Role of Graphics, Package Aesthetics, Decoration Aspects, Layout and Feature Selection, etc.	10
05	Package Storage and Handling: Storage Types, Damage Control, Warehousing and Handling Equipments & Techniques, etc.	07
06	Packaging & Environment: Eco Issues, Wastage Control, Wastage Disposal, Eco Friendly Packaging, etc.	09

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum Two Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

References:

1. Walter Soroka, "Fundamentals of packaging technology", 3rd Edition, Institute of Packaging professionals, Naperville, Illinois, USA, 2002.
2. Giles Calver, "What is Packaging Design? Essential design handbook", Rotovision, 2004
3. Steven DuPuis, John Silva, "Package Design Workbook: The Art and Science of Successful Packaging", Rockport Publishers, 2008.
4. William H. Erdei, "Bar Codes—Design, Printing and Quality Control", McGraw Hill Inc., 1998.
5. Joseph F. Hanlon, Robert J. Kelsey, Hallie Forcinio, "Handbook of Packaging Engineering", 3rd edition, CRC Press, 1998
6. Ronald E. Tood, "Printing Inks—Formulations, Principles, Manufacture, and Quality Control Testing", PIRA International 1996
7. Davis, C.G., "Introduction to Packaging Machinery", Packaging Machinery Manufacturers Institute, 1997
8. M. Bakker, "Wiley Encyclopedia of Packaging Technology", John Wiley & Sons Ltd., 2008
9. Sugan E.M. Solke, "Packaging and the Environment, Alternatives, Trends and Solutions", Technomic Publication, Revised Edition, 1994.
10. Nigel Thoobald, "Packaging closures & Sealing systems", CRC Publishers, 2006
Robert F. Lund, "McGraw-Hill Recycling Handbook", 2nd Edition, 2001.

CourseCode	CourseName	Credits
PDDPE1021	ComputerAidedProductDevelopment	03

Objectives

- 1.To impart knowledge on computer graphics which are used routinely in diverse areas as science, engineering, medicine, etc

Outcomes: Learner will be able to...

1. Get familiarized with the computer graphics application in design
2. Understand 3D modeling application in product development.
3. Solve CAE problems that arise in engineering

Module	Detailed Contents	Hrs.
01	Introduction to computer Graphics: Definitions, Classification, Architecture of interactive computer Graphics, Applications Display & Interactive devices Scan Conversion: Pixel plotting, scan conversion of Line, Circle, ellipse, Parabola, Hyperbola. Effects of Scan conversion	10
02	Graphics Programming: -Graphics function, OpenGL interface, Co-ordinates systems, Primitives & Attributes Transformations: -2-D Transformations, 3-D Geometric & modeling Transformations 2-D Viewing & Clipping, 3-D Viewing & Clipping, 3D viewing functions.	08
03	Modeling based on Biomedical data Introduction to medical imaging: Computed tomography (CT), Cone beam CT (CBCT), Magnetic resonance (MR), Noncontact surface scanning, medical scan data, point cloud data. Working with medical scan data: Pixel data operations, Using CT data: a worked example, Point cloud data operations, Two-dimensional formats, Pseudo 3D formats, True 3D formats, File management and exchange.	08
04	Curves: Splines, Bezier & B-Spline Curves Surfaces: Visible Surface detection methods, Hermite, Bezier & B-Spline surfaces	08
05	Virtual Reality: Hidden Lines & Hidden Surfaces: Z-Buffer, Painters, Ray Tracing, Area-Subdivision, Scan Line algorithm Light, Color & Shading Models Animation.	10
06	Virtual Reality: Hidden Lines & Hidden Surfaces: Z-Buffer, Painters, Ray Tracing, Area-Subdivision, Scan Line algorithm Light, Color & Shading Models Animation. Fundamentals of CAE: General procedures of Numerical methods like FEM & FDM, Kinematic analysis & Animation, Features and Application of Commercial packages of CAE.	08

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum Two Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part(a) from module 3 then part(b) will be from any module other than module 3)
4. Only Four questions need to be solved.

References:

1. Computer Graphics by F.S Hill. Jr
2. Computer graphics by Zhigang Xiang & Roy Plastock (Schaum's outline's)
3. Computer Graphics by Hearn & Baker
4. Mathematical elements for Computer Graphics by David F. Rogers, James Alan Adams
5. Procedural elements for Computer Graphics by David F. Rogers, James Alan Adams
6. Mastering CAD/CAM by Ibrahim Zeid
7. Geometric Modelling by Mortenson, M.E.
8. CAD/ CAM, Theory & Practice, Ibrahim Zeid, R. Sivasubramanian, Tata McGraw Hill Publications
9. CAD/CAM Principles and Applications, P. N. Rao, Tata McGraw Hill Publications
10. CAD/CAM Computer Aided and Manufacturing, Mikell P. Groover and Emory W. Zimmers, Jr., Eastern Economy Edition
11. Medical Modelling The Application of Advanced Design and Rapid Prototyping Techniques in Medicine, Richard Bibb, Dominic Eggbeer and Abby Paterson, Woodhead Publishing Series in Biomaterials: Number 91, Elsevier Ltd.

CourseCode	CourseName	Credits
PDDPE1022	Creativity and Innovation inDesign	03

Objectives

1. Tohighlighttheimportanceofcreativityfornewproductdevelopment
2. Tostudyskillsneeded forenhancingcreativethinkingandencouraginginnovation.

Outcomes: Learnerwillbeableto...

1. Understandthe varioustechniques adopted forstimulatingcreativity
2. Applyinnovative processtothedesignand development ofnew products

Module	DetailedContents	Hrs.
01	INTRODUCTION: Needfordesigncreativity–creativethinkingforquality– essentialtheoryaboutdirectedcreativity	10
02	MECHANISMOFTHINKING: Definitionsandtheoryofmechanisms ofmindheuristicsandmodels: attitudes,ApproachesandActionthatsupportcreativethinking	14
03	VISUALIZATION: Advancedstudyofvisualelementsandprinciples- line,plane,shape,form,pattern,texturegradation,color Symmetry.Spatialrelationshipsandcompositions in2and3dimensionalspace- procedureforgenuinegraphicalcomputeranimation–Animationaerodynamics– virtualenvironmentsinscientificVisualization– Unifyingprincipleofdatamanagementforscientificvisualization-Visualization benchmarking	09
04	CREATIVITY: MethodsandtoolsforDirectedCreativity–BasicPrinciples– ToolsofDirectedCreativity–Toolsthatpreparethemindforcreativethought–stimulation of new ideas – Development and Actions: - Processes in creativityICEDIP– Inspiration,Clarification,Distillation,Perspiration,EvaluationandIncubation– Creativity andMotivation The Bridge between man creativity andtherewardsofinnovativeness–ApplyingDirectedCreativitytothechallengeof qualitymanagement	08
05	DESIGN: Process Design, Emotional Design – Three levels of Design – Visceral, BehavioralandReflective-Recyclingandavailability- Creativityandcustomerneedsanalysis– Innovativeproductandservicedesigns,futuredirectionsinthis applicationofcreativitythinkinginqualitymanagement	07
06	INNOVATION: Achieving Creativity – Introduction to TRIZ methodology of Inventive ProblemSolving - the essential factors – Innovator’s solution – creating and sustainingsuccessful growth – Disruptive Innovation model – Segmentive Models – Newmarketdisruption-CommoditiationandDE-commoditiation– ManagingtheStrategyDevelopmentProcess–TheRoleofSeniorExecutiveinLeading NewGrowth–PassingtheBaton	04

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (**on minimum Two Modules**) and the other is either a class test or assignment online problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example, suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

References:

1. Rousing Creativity: Think New Now Floyd Hurr, ISBN 1560525479, Crisp Publications Inc. 1999
2. Geoffrey Petty, "how to be better at Creativity", The Industrial Society 1999
3. Donald A. Norman, "Emotional Design", Perseus Books Group New York, 2004
4. Clayton M. Christensen Michael E. Raynor, "The Innovator's Solution", Harvard Business School Press Boston, USA, 2003
5. Semyon D. Savransky, "Engineering of Creativity – TRIZ", CRC Press New York USA, "2000.

CourseCode	CourseName	Credits
PDDPE1023	DieDesignAndDevelopment	03

Objectives

1. TohighlighttheimportanceofDiedesigninnew productdevelopment.
2. Toimpart theskills needed forenhancingcreativethinkingand encouraginginnovation..

Outcomes: Learnerwillbeableto...

1. Understandthevarioustechniquesadopted forDieDesign.
2. Applystimulatingcreativityandinnovative techniques tothedesignanddevelopmentofdie.

Mo dul e	DetailedContents	H rs .
01	IntroductiontoManufacturingProcess: Shearing,MechanicsofShearing,ShearingForces,BlankingandPunchingMechanisms, Bending, Mechanics of Deep Drawing, Various Forming Processes such as Stretch Forming, Nosing, Expanding, Dimpling, Spinning, Flexible DieForming,BasicDieClassifications andComponents	10
02	ToolandDieMaterials: CarbonandAlloySteels,DesignationsforCarbonandAlloySteels,EffectsofVariousAlloyElement sinSteels,CarbonSteels,AlloySteels,Machinability ofSteels, Mechanical Properties of Steels, Applications of CarbonandAlloy Steels,Tool andDie Steels, Designationand Classificationof ToolandDieSteels,ColdWorkToolandDieSteels,NonferrousMetals,Non-metallic Materials	12
03	DesignofBlankingandPunchingDies: DieBlocks,DieOpeningProfile,FasteningtotheDieShoe,SectionedDie,CalculationofDieBlock Dimensions,Punches,PunchFace,Geometry,Methodsfor Assembling Punches, Punch Calculations, Stripper Plates, StripperForce,StripperDesign,DieComponentsforGuidingandStopping,StockGuidesandGuide Rails,DieStopsandFrenchNotchPunch,Positioningthe IndividualBlank,Pilots,CentreofDiePressure,ExamplesofCoutingDieDesigns	08
04	DesignofBendingDies: SimpleDieDesigns,U-ProfileBendDies,V-profileBendDies,UniversalBendingDies,DiesofComplexDesign,ClosingProfileDies,SpecialBendingDies,CurlingandHinge Dies,Tube-formingDies,Multiple-bendDies,CombinationDies,ProgressiveDies	08
05	DeepDrawingDies: Draw Rings, Draw Rings with Corner Radius, Draw Rings with Conical Profile,Clearances and Tolerances, Calculation of the Dimensions of the Punch and Die,BlankHolders,BlankHolderPressure,BlankHolderForce,DrawBeads,Single-operationDies,Multi-operationDies,ProgressiveDies,IroningDies,DrawingDiesforPieces	08
06	VariousFormingDies: NosingDies,ExpandingandBulgingDies,ExpandingDies,BulgingDies,FlangingDies DieProcessQualityAndAutomation,DieMaintenance: LimitSwitches,Sensors,VisionControl,AutomationandIn-DieProcesses, AutomatedQualityControl,DieMaintenanceandAdjustments,RoleofSoftware'sin Die Design	06

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (**on minimum Two Modules**) and the other is either a class test or assignment online problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example, suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

References:

1. Ivana Suchy, "Handbook of Die Design" 2006, McGraw Hill, ISBN 0-07-146271-6
2. Vukota Boljanovic, "Sheet Metal Forming Processes and Die Design", Industrial Press, New York, ISBN 0-8311-3182-9
3. Joseph Vincent Woodworth, "Dies, Their Construction and Use for the Modern Working of Sheet Metals; A Treatise on the Design, Construction and Use of Dies, Punches", 2010, Cambridge Scholars Publishing, ISBN-13 9781152026681
4. David Smith, "Die Design Handbook" 3rd Edition, 1990, Society of Manufacturing Engineers, ISBN-13 9780872633759
5. Vukota Boljanovic, "Die Design Fundamentals" 3rd Edition, 2005, Industrial Press, ISBN-13 9780831131197.

CourseCode	CourseName	Credits
PDDIE1011	ProductLifeCycleManagement	03

Objectives:

1. To familiarize the students with the need, benefits and components of PLM
2. To acquaint students with Product Data Management & PLM strategies
3. To give insights into new product development program and guidelines for designing and developing a product
4. To familiarize the students with Virtual Product Development

Outcomes: Learner will be able to...

1. Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.
2. Illustrate various approaches and techniques for designing and developing products.
3. Apply product engineering guidelines/thumb rules in designing products for moulding, machining, sheet metal working etc.
4. Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant

M o d u l e	DetailedContents	F r s
01	Introduction to Product Lifecycle Management (PLM): Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications PLM Strategies: Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy, Change management for PLM	10
02	Product Design: Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach, New Product Development (NPD) and Strategies, Product Configuration and Variant Management, The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process	09
03	Product Data Management (PDM): Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation	05
04	Virtual Product Development Tools: For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modeling and simulations in Product Design, Examples/Case studies	05
05	Integration of Environmental Aspects in Product Design: Sustainable Development, Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design	05

06	Life Cycle Assessment and Life Cycle Cost Analysis: Properties, and Framework of LCA, Phases of LCA in ISO Standards, Fields of Application and Limitations of Life Cycle Assessment, Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis	05
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Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

REFERENCES:

1. John Stark, "Product Lifecycle Management: Paradigm for 21st Century Product Realisation", Springer-Verlag, 2004. ISBN: 1852338105
2. Fabio Giudice, Guido La Rosa, Antonino Risitano, "Product Design for the environment- A lifecycle approach", Taylor & Francis 2006, ISBN: 0849327229
3. Saaksvuori Antti, Immonen Anselmie, "Product Life Cycle Management", Springer, Dreamtech, ISBN: 3540257314
4. Michael Grieve, "Product Lifecycle Management: Driving the next generation of lean thinking", Tata McGraw Hill, 2006, ISBN: 0070636265

CourseCode	CourseName	Credits
PDDIE1012	ReliabilityEngineering	03

Objectives:

1. To familiarize the students with various aspects of probability theory
2. To acquaint the students with reliability and its concepts
3. To introduce the students to methods of estimating the system reliability of simple and complex systems
4. To understand the various aspects of Maintainability, Availability and FMEA procedure

Outcomes: Learner will be able to...

1. Apply the concept of Probability to engineering problems
2. Apply various reliability concepts to calculate different reliability parameters
3. Estimate the system reliability of simple and complex systems
4. Carry out a Failure Mode Effect and Criticality Analysis

Module	DetailedContents	Hours
01	Probability theory: Probability: Standard definitions and concepts; Conditional Probability, Baye's Theorem. Probability Distributions: Central tendency and Dispersion; Binomial, Normal, Poisson, Weibull, Exponential, relations between them and their significance. Measures of Dispersion: Mean, Median, Mode, Range, Mean Deviation, Standard Deviation, Variance, Skewness and Kurtosis.	08
02	Reliability Concepts: Reliability definitions, Importance of Reliability, Quality Assurance and Reliability, Bath Tub Curve. Failure Data Analysis: Hazard rate, failure density, Failure Rate, Mean Time To Failure (MTTF), MTBF, Reliability Functions. Reliability Hazard Models: Constant Failure Rate, Linearly increasing, Time Dependent Failure Rate, Weibull Model. Distribution functions and reliability analysis.	08
03	System Reliability: System Configurations: Series, parallel, mixed configuration, k-out-of-n structure, Complex systems.	05
04	Reliability Improvement: Redundancy Techniques: Element redundancy, Unit redundancy, Standby redundancies. Markov analysis. System Reliability Analysis – Enumeration method, Cut-set method, Success Path method, Decomposition method.	08
05	Maintainability and Availability: System downtime, Design for Maintainability: Maintenance requirements, Design methods: Fault Isolation and self-diagnostics, Parts standardization and Interchangeability, Modularization and Accessibility, Repair Vs Replacement. Availability – qualitative aspects.	05

06	Failure Mode, Effects and Criticality Analysis: Failure mode effects analysis, severity/criticality analysis, FMECA examples. Fault tree construction, basic symbols, development of functional reliability block diagram, Fault tree analysis and Event tree Analysis	05
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Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from many module other than module 3)
4. Only Four questions need to be solved.

REFERENCES:

1. L.S.Srinath, "Reliability Engineering", Affiliated East-West Press (P) Ltd., 1985.
2. Charles E. Ebeling, "Reliability and Maintainability Engineering", Tata McGraw Hill.
3. B.S.Dhillon, C.Singh, "Engineering Reliability", John Wiley & Sons, 1980.
4. P.D.T.Conor, "Practical Reliability Engg.", John Wiley & Sons, 1985.
5. K.C.Kapur, L.R.Lamberson, "Reliability in Engineering Design", John Wiley & Sons.
6. Murray R. Spiegel, "Probability and Statistics", Tata McGraw-Hill Publishing Co. Ltd.

CourseCode	CourseName	Credits
PDDIE1013	ManagementInformationSystem	03

Objectives:

1. The course is blend of Management and Technical field.
2. Discuss the roles played by information technology in today's business and define various technologies and architectures on which information systems are built
3. Define and analyze typical functional information systems and identify how they meet the needs of the firm to deliver efficiency and competitive advantage
4. Identify the basic steps in systems development

Outcomes: Learner will be able to...

1. Explain how information systems transform business
2. Identify the impact information systems have on an organization
3. Describe IT infrastructure and its components and its current trends
4. Understand the principal tools and technologies for accessing information from databases to improve business performance and decision making
5. Identify the types of systems used for enterprise-wide knowledge management and how they provide value for businesses

Module	Detailed Contents	Hrs
01	Introduction To Information Systems (IS): Computer Based Information Systems, Impact of IT on organizations, Importance of IS to Society. Organizational Strategy, Competitive Advantages and IS.	4
02	Data and Knowledge Management: Database Approach, Big Data, Data warehouse and Data Mining, Knowledge Management. Business intelligence (BI): Managers and Decision Making, BI for Data analysis and Presenting Results	7
03	Ethical issues and Privacy: Information Security, Threat to IS, and Security Controls	7
04	Social Computing (SC): Web 2.0 and 3.0, SC in business-shopping, Marketing, Operational and Analytic CRM, E-business and E-commerce – B2B B2C. Mobile commerce.	7
05	Computer Networks Wired and Wireless technology, Pervasive computing, Cloud computing model.	6
06	Information System within Organization: Transaction Processing Systems, Functional Area Information System, ERP and ERP support of Business Process. Acquiring Information Systems and Applications: Various System development lifecycle models.	8

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in questionpapers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example, supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only four questions need to be solved.

REFERENCES:

1. Kelly Rainer, Brad Prince, Management Information Systems, Wiley
2. K.C. Laudon and J.P. Laudon, Management Information Systems: Managing the Digital Firm, 10th Ed., Prentice Hall, 2007.
3. D. Boddy, A. Boonstra, Managing Information Systems: Strategy and Organization, Prentice Hall, 2008

CourseCode	CourseName	Credits
PDDIE1014	DesignofExperiments	03

Objectives:

1. To understand the issues and principles of Design of Experiments (DOE)
2. To list the guidelines for designing experiments
3. To become familiar with methodologies that can be used in conjunction with experimental designs for robustness and optimization

Outcomes: Learner will be able to...

1. Plan data collection, to turn data into information and to make decisions that lead to appropriate action
2. Apply the methods taught to real life situations
3. Plan, analyze, and interpret the results of experiments

Module	DetailedContents	Hrs
01	Introduction 1.1 Strategy of Experimentation 1.2 Typical Applications of Experimental Design 1.3 Guidelines for Designing Experiments 1.4 Response Surface Methodology	06
02	Fitting Regression Models 2.1 Linear Regression Models 2.2 Estimation of the Parameters in Linear Regression Models 2.3 Hypothesis Testing in Multiple Regression 2.4 Confidence Intervals in Multiple Regression 2.5 Prediction of new response observation 2.6 Regression model diagnostics 2.7 Testing for lack of fit	08
03	Two-Level Factorial Designs and Analysis 3.1 The 2^2 Design 3.2 The 2^3 Design 3.3 The General 2^k Design 3.4 A Single Replicate of the 2^k Design 3.5 The Addition of Center Points to the 2^k Design, 3.6 Blocking in the 2^k Factorial Design 3.7 Split-Plot Designs	07

04	Two-Level Fractional Factorial Designs and Analysis 4.1 The One-Half Fraction of the 2^k Design 4.2 The One-Quarter Fraction of the 2^k Design 4.3 The General 2^{k-p} Fractional Factorial Design 4.4 Resolution III Designs 4.5 Resolution IV and V Designs 4.6 Fractional Factorial Split-Plot Designs	07
05	Conducting Tests 5.1 Testing Logistics 5.2 Statistical aspects of conducting tests 5.3 Characteristics of good and bad datasets 5.4 Example experiments 5.5 Attribute Vs Variable datasets	07
06	Taguchi Approach 6.1 Crossed Array Designs and Signal-to-Noise Ratios 6.2 Analysis Methods 6.3 Robust design examples	04

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only four questions need to be solved.

REFERENCES:

1. Raymond H. Myers, Douglas C. Montgomery, Christine M. Anderson-Cook, Response Surface Methodology: Process and Product Optimization using Designed Experiment, 3rd edition, John Wiley & Sons, New York, 2001
2. D.C. Montgomery, Design and Analysis of Experiments, 5th edition, John Wiley & Sons, New York, 2001
3. George E P Box, J Stuart Hunter, William G Hunter, Statistics for Experimenters: Design, Innovation and Discovery, 2nd Ed. Wiley
4. W J Dimond, Practical Experiment Designs for Engineers and Scientists, John Wiley and Sons Inc. ISBN: 0-471-39054-2
5. Design and Analysis of Experiments (Springer text in Statistics), Springer by A.M. Dean, and D.T. Voss

CourseCode	CourseName	Credits
PDDIE1015	OperationsResearch	03

Objectives:

1. Formulate a real-world problem as a mathematical programming model.
2. Understand the mathematical tools that are needed to solve optimization problems.
3. Use mathematical software to solve the proposed models.

Outcomes: Learner will be able to...

1. Understand the theoretical workings of the simplex method, the relationship between a linear program and its dual, including strong duality and complementary slackness.
2. Perform sensitivity analysis to determine the direction and magnitude of change of a model's optimal solution as the data change.
3. Solve specialized linear programming problems like the transportation and assignment problems, solve network models like the shortest path, minimum spanning tree, and maximum flow problems.
4. Understand the applications of integer programming and a queuing model and compute important performance measures

M o d u l e	DetailedContents	
01	Introduction to Operations Research: Introduction, , Structure of the Mathematical Model, Limitations of Operations Research Linear Programming: Introduction, Linear Programming Problem, Requirements of LPP, Mathematical Formulation of LPP, Graphical method, Simplex Method Penalty Cost Method or Big M-method, Two Phase Method, Revised simplex method, Duality , Primal – Dual construction, Symmetric and Asymmetric Dual, Weak Duality Theorem, Complimentary Slackness Theorem, Main Duality Theorem, Dual Simplex Method, Sensitivity Analysis Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method. Assignment Problem: Introduction, Mathematical Formulation of the Problem, Hungarian Method Algorithm, Processing of n Jobs Through Two Machines and m Machines, Graphical Method of Two Jobs m Machines Problem Routing Problem, Travelling Salesman Problem Integer Programming Problem: Introduction, Types of Integer Programming Problems, Gomory's cutting plane Algorithm, Branch and Bound Technique. Introduction to Decompositional algorithms.	14
02	Queuing models: queuing systems and structures, single server and multi-server models, Poisson input, exponential service, constant rate service, finite and infinite population	05
03	Simulation: Introduction, Methodology of Simulation, Basic Concepts, Simulation Procedure, Application of Simulation Monte-Carlo Method: Introduction, Monte-Carlo Simulation, Applications of Simulation, Advantages of Simulation, Limitations of Simulation	05
04	Dynamic programming. Characteristics of dynamic programming. Dynamic programming approach for Priority Management, employment smoothing, capital budgeting, Stage Coach/Shortest Path, cargo loading and Reliability problems.	05

05	Game Theory. Competitive games, rectangular game, saddle point, minimax (maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2X2 games.	05
06	Inventory Models: Classical EOQ Models, EOQ Model with Price Breaks, EOQ with Shortage, Probabilistic EOQ Model,	05

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from many module other than module 3)
4. Only Four questions need to be solved.

REFERENCES:

1. Taha, H.A. "Operations Research - An Introduction", Prentice Hall, (7th Edition), 2002.
2. Ravindran, A, Phillips, D.T and Solberg, J.J. "Operations Research: Principles and Practice", John Wiley and Sons, 2nd Edition, 2009.
3. Hiller, F.S. and Lieberman, G.J. "Introduction to Operations Research", Tata McGraw Hill, 2002.
4. Operations Research, S. D. Sharma, Kedar Nath Ram Nath-Meerut.
5. Operations Research, Kanti Swarup, P.K. Gupta and Man Mohan, Sultan Chand & Sons.

CourseCode	CourseName	Credits
PDDIE1016	CyberSecurityandLaws	03

Objectives:

1. To understand and identify different types of cybercrime and cyberlaw
2. To recognize Indian IT Act 2008 and its latest amendments
3. To learn various types of security standards and compliances

Outcomes: Learner will be able to...

1. Understand the concept of cybercrime and its effect on our world
2. Interpret and apply IT law in various legal issues
3. Distinguish different aspects of cyberlaw
4. Apply Information Security Standards compliance during software design and development

M o d u l e	DetailedContents	H r s
01	Introduction to Cybercrime: Cybercrime definition and origin of the world, Cybercrime and information security, Classification of cybercrime, Cybercrime and the Indian IT Act 2000, A global Perspective on cybercrimes.	4
02	Cyber offenses & Cybercrime: How criminals plan the attacks, Social Engg, Cyberstalking, Cybercaf�� and Cybercrimes, Botnets, Attack vector, Cloud computing, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops	9
03	Tools and Methods Used in Cyberline Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft)	6
04	The Concept of Cyberspace E-Commerce, The Contract Aspects in Cyber Law, The Security Aspect of Cyber Law, The Intellectual Property Aspect in Cyber Law, The Evidence Aspect in Cyber Law, The Criminal Aspect in Cyber Law, Global Trends in Cyber Law, Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking, The Need for an Indian Cyber Law	8
05	Indian IT Act. Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act, 2008 and its Amendments	6
06	Information Security Standard compliances SOX, GLBA, HIPAA, ISO, FISMA, NERC, PCI.	6

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination.

In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example, supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only four questions need to be solved.

REFERENCES:

1. Nina Godbole, Sunit Belapure, *Cyber Security*, Wiley India, New Delhi
2. The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi
3. The Information Technology Act, 2000; Bare Act-Professional Book Publishers, New Delhi.
4. Cyber Law & Cyber Crimes by Advocate Prashant Mali; Snow White Publications, Mumbai
5. Nina Godbole, *Information Systems Security*, Wiley India, New Delhi
6. Kenneth J. Knapp, *Cyber Security & Global Information Assurance* Information Science Publishing.
7. William Stallings, *Cryptography and Network Security*, Pearson Publication
8. Websites for more information are available on: The Information Technology Act, 2008-
TIFR: <https://www.tifrh.res.in>
9. Website for more information, A Compliance Primer for IT professionals
: <https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professionals-33538>

CourseCode	CourseName	Credits
PDDIE1017	DisasterManagementandMitigationMeasures	03

Objectives:

1. To understand physics and various types of disaster occurring around the world
2. To identify extent and damaging capacity of a disaster
3. To study and understand the means of losses and methods to overcome / minimize it.
4. To understand role of individual and various organizations during and after disaster
5. To understand application of GIS in the field of disaster management
6. To understand the emergency government response structures before, during and after disaster

Outcomes: Learner will be able to...

1. Get to know natural as well as manmade disaster and their extent and possible effects on the economy.
2. Plan of national importance structures based upon the previous history.
3. Get acquainted with government policies, acts and various organizational structure associated with an emergency.
4. Get to know the simple do's and don'ts in such extreme events and act accordingly.

Module	Detailed Contents	Hours
01	Introduction 1.1 Definition of Disaster, hazard, global and Indian scenario, general perspective, importance of study in human life, Direct and indirect effects of disasters, long term effects of disasters. Introduction to global warming and climate change.	03
02	Natural Disaster and Manmade disasters: 2.1 Natural Disaster: Meaning and nature of natural disaster, Flood, Flash flood, drought, cloudburst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion 2.2 Manmade Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.	09
03	Disaster Management, Policy and Administration 3.1 Disaster management: meaning, concept, importance, objective of disaster management policy, disaster risks in India, Paradigm shift in disaster management. 3.2 Policy and administration: Importance and principles of disaster management policies, command and coordination of disaster management, rescue operations - how to start with and how to proceed in due course of time, study of flowchart showing the entire process.	06
04	Institutional Framework for Disaster Management in India: 4.1 Importance of public awareness, Preparation and execution of emergency management program. Scope and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India. Methods and measures to avoid disasters, Management of casualties, set up of emergency facilities, importance of effective communication among different agencies in such situations. 4.2 Use of Internet and softwares for effective disaster management. Applications of GIS, Remote sensing and GPS in this regard.	06

05	FinancingReliefMeasures: 5.1 Ways to raise finance for relief expenditure, role of government agencies and NGO's inthis process, Legal aspects related to finance raising as well as overall management ofdisasters. VariousNGO's andtheworksthey havecarriedoutin thepast on theoccurrenceof variousdisasters, Ways toapproachthese teams. 5.2 Internationalreliefaidagenciesandtheirrolein extremeevents.	09
06	PreventiveandMitigationMeasures: 6.1 Pre-disaster,duringdisasterandpost-disastermeasuresinsomeeventsingeneral 6.2 Structuralmapping:Riskmapping,assessmentandanalysis,seawallsandembankments,Bi o shield, shelters,earlywarningand communication 6.3 Non Structural Mitigation: Community based disaster preparedness, risk transfer andriskfinancing,capacitydevelopmentandtraining,awarenessandeducation,contingency plans. 6.4 Do'sanddon'tsincaseofdisastersandeffectiveimplementationofreliefaid.	06

Assessment:

Internal:

Assessmentconsistsoftwotestsoutofwhich;oneshouldbecompulsoryclasstestandtheotheriseitheraclasste storassignmenton live problemsorcourse project.

EndSemesterTheoryExamination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in questionpapers of end semester examination. **In question paper weightage of each module will be proportional tonumberofrespectivelecture hours asmentioninthe syllabus.**

1. Questionpaperwill compriseoftotalsixquestion
2. Allquestioncarryequal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 thenpart (b)willbe fromany module otherthan module3)
4. OnlyFour questionneedtobe solved.

REFERENCES:

1. 'DisasterManagement'byHarshK.Gupta,UniversitiesPressPublications.
2. 'DisasterManagement:AnAppraisalofInstitutionalMechanismsinIndia'byO.S.Dagur,published byCentreforlandwarfarestudies,New Delhi, 2011.
3. 'IntroductiontoInternationalDisasterManagement'byDamonCopolla,ButterworthHeinemannElsevierPublications.
4. 'DisasterManagementHandbook'byJackPinkowski,CRCPressTaylorandFrancisgroup.
5. 'Disastermanagement&rehabilitation'byRajdeepDasgupta,MittalPublications,NewDelhi.
6. 'NaturalHazards andDisasterManagement,VulnerabilityandMitigation–RBSingh,RawatPublications
7. Concepts and Techniques of GIS –C.P.Lo Albert, K.W. Yonng – Prentice Hall (India) Publications.(Learners are expected to refer reports published at national and International level and updated informationavailableon authentic websites)

CourseCode	CourseName	Credits
PDDIE1018	EnergyAuditandManagement	03

Objectives:

1. To understand the importance energy security for sustainable development and the fundamentals of energy conservation.
2. To introduce performance evaluation criteria of various electrical and thermal installations to facilitate the energy management
3. To relate the data collected during performance evaluation of systems for identification of energy saving opportunities.

Outcomes: Learner will be able to...

1. To identify and describe present state of energy security and its importance.
2. To identify and describe the basic principles and methodologies adopted in energy audit of a utility.
3. To describe the energy performance evaluation of some common electrical installations and identify the energy saving opportunities.
4. To describe the energy performance evaluation of some common thermal installations and identify the energy saving opportunities
5. To analyze the data collected during performance evaluation and recommend energy saving measures

Module	Detailed Contents	Hours
01	Energy Scenario: Present Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy Security, Energy Conservation and its Importance, Energy Conservation Act-2001 and its Features. Basics of Energy and its various forms, Material and Energy balance	04
02	Energy Audit Principles: Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach- understanding energy costs, Benchmarking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution. Elements of monitoring & targeting; Energy audit Instruments; Data and information-analysis. Financial analysis techniques: Simple payback period, NPV, Return on investment (ROI), Internal rate of return (IRR)	08
03	Energy Management and Energy Conservation in Electrical System: Electricity billing, Electrical load management and maximum demand Control; Power factor improvement, Energy efficient equipments and appliances, star ratings. Energy efficiency measures in lighting system, Lighting control: Occupancy sensors, daylight integration, and use of intelligent controllers. Energy conservation opportunities in: water pumps, industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives.	10
04	Energy Management and Energy Conservation in Thermal Systems: Review of different thermal loads; Energy conservation opportunities in: Steam distribution system, Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system. General fuel economy measures in Boilers and furnaces, Waste heat recovery, use of insulation- types and application. HVAC system: Coefficient of performance, Capacity, factors affecting Refrigeration and Air Conditioning system performance and savings opportunities.	10
05	Energy Performance Assessment: Onsite Performance evaluation techniques, Case studies based on: Motors and variable speed drive, pumps, HVAC system calculations; Lighting System: Installed Load Efficacy Ratio (ILER) method, Financial Analysis.	04

06	EnergyconservationinBuildings: EnergyConservation Building Codes(ECBC): Green Building, LEED rating, ApplicationofNon-ConventionalandRenewableEnergySources	0 3
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Assessment:

Internal:

Assessmentconsistsoftwotestsoutofwhich;oneshouldbecompulsoryclasstestandtheotheriseitheraclasste storassignmenton live problemsorcourse project.

EndSemesterTheoryExamination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in questionpapers of end semester examination. **In question paper weightage of each module will be proportional tonumberofrespectivecture hours asmentioninthe syllabus.**

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4. OnlyFour questionneedtobe solved.

REFERENCES:

1. HandbookofElectrical InstallationPractice,Geofry Stokes,BlackwellScience
2. Designingwithlight: LightingHandbook,ByAnilValia,LightingSystem
3. EnergyManagementHandbook, ByW.C. Turner,John Wileyand Sons
4. Handbook on Energy Audits and Management, edited by A. K. Tyagi, Tata Energy ResearchInstitute(TERI).
5. EnergyManagementPrinciples,C.B.Smith,PergamonPress
6. EnergyConservationGuidebook,DaleR.Patrick,S.Fardo,RayE.Richardson,Fairmont Press
7. Handbookof EnergyAudits, AlbertThumann, W.J. Younger,T. Niehus, CRCPress
8. www.energymanagertraining.com
9. www.bee-india.nic.in

CourseCode	CourseName	Credits
PDDL101	CAD: Solid ModellingLab	01

Simulationstudyusingmathematicalsimulationsoftware(oranyprogramminglanguage)onany six

1.Create 3-D solid models of complex objects given a multi-view representation (minimum 2 to3).

Project: Foragivensystemconsistingoffour tofivecomponentsdoasdescribedbelow;

1. Createsolidmodelsofindividualparts
2. Createreferencegeometryfeatures(planes, axes)
3. Createsolid features usingsweepingandloftingoperations
4. Measureproperties of 3-D CADmodels
5. CreateassembliesofCADpartswithappropriate matingrelationships

Assessment:

Weightagefor LaboratoryProjectshould be40% inFinal Assessmentof LaboratoryWork

EndSemesterExamination: Practical/Oralexaminationistobe conductedbypair ofinternaland
externalexaminers

CourseCode	CourseName	Credits
PDDSBL101	Rapid Prototyping and Tooling Lab	02

Following activity can be demonstrated either in the Institute or visiting any organization where this type of work is done.

1. Study of reverse engineering concepts
2. Demonstration of 3D scanning
3. Study of rapid prototyping machines
4. Demonstration of Fusion Deposition Modeling
5. Demonstration of Selective Laser Sintering
6. Demonstration of Vacuum casting
7. Demonstration of Virtual

Reality Project: In a group of not

more than 4 students

Identify an existing consumer product, develop CAD model, simulate in CAE environment, optimize, develop tooling and make a physical prototype. Prepare a detailed report.

Assessment:

Weightage for Laboratory Projects should be 40% in Final Assessment of Laboratory Work

End Semester Examination: Practical/Oral examination is to be conducted by pair of internal and external examiners

CourseCode	CourseName	Credits
PDDC201	QualityConceptsInDesign	03

Objectives

1. To study importance of various principles of quality in a product or service through.
2. To study application of statistical tools in product development

Outcomes: Learner will be able to...

1. Understand concepts in quality and reliability principles in the design of an engineering product or a service.
2. Apply statistical techniques such as quality houses, control charts, statistical process control method, failure mode effect analysis in new product development process
3. Strategies of designing experiments, methods to uphold the status of six sigma and improve the reliability of a product.

Module	Detailed Contents	Hrs
01	DESIGN FOR QUALITY Quality Function Deployment-House of Quality-Objectives and functions-Targets-Stakeholders-Measures and Matrices-Design of Experiments-Benchmarking.	10
02	FAILURE MODE EFFECT ANALYSIS Basic methods: Refining geometry and layout, general process of product embodiment- Embodiment checklist- Advanced methods: systems modeling, mechanical embodiment principles-FMEA method-Case study	10
03	DESIGN OF EXPERIMENTS Replication, Blocking, Randomization, Degrees of Freedom, Design of experiments-Barriers in the Successful Application of DOE, Methodology of DOE, Analytical Tools of DOE, Two factorial and Full factorial experiments, Fractional Factorial experiments, Orthogonality, Statistical analysis of experiments, Robust Design, ANOVA, Taguchi method, Signal-to-Noise Ratios.	08
04	STATISTICAL CONSIDERATION IN PRODUCT DESIGN AND DEVELOPMENT Frequency distributions and Histograms- Run charts -stem and leaf plots- Pareto diagrams-Cause and Effect diagrams-Box plots-Probability distribution-Statistical Process control-Scatter diagrams-Multivariable charts-Matrix plots and 3-D plots.	08
05	RELIABILITY Reliability-Survival and Failure-Series and parallel systems-Mean time between failure-Weibull distributions(How to calculate or estimate in component level system level introductory only)	08
06	DESIGN FOR SIX SIGMA Basis of SIX SIGMA -Project selection for SIX SIGMA- SIX SIGMA problem solving- SIX SIGMA in service and small organizations - SIX SIGMA and lean production-Lean SIX SIGMA and services	08

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (**on minimum Two Modules**) and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example, suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only four questions need to be solved.

References:

1. Product Design Techniques in Reverse Engineering and New Product Development, KEVIN OTTO & KRISTIN WOOD, Pearson Education (LPE), 2001.
2. Product Design and Development, KARL T. ULRICH, STEVEN D. EPPINGER, TATA McGraw-HILL- 3rd Edition, 2003.
3. The Management and control of Quality-6th edition-James R. Evans, William M Lindsay Pub: south-western
4. Fundamentals of Quality control and improvement 2nd edition, AMITAVA MITRA, Pearson Education Asia, 2002.
5. Design of Experiments Using The Taguchi Approach 16 Steps to Product and Process Improvement, Ranjit K. Roy -Wiley-Interscience (2001)
6. Design and Analysis of Experiments, Angela Dean, Daniel Voss, Danel Draguljić (auth.) - Springer International Publishing (2017)

CourseCode	CourseName	Credits
PDDC202	DesignFor X	03

Objectives

1. To study the concept of design for manufacturing, assembly and environment.
2. To study the product development economics..

Outcomes: Learner will be able to...

1. Apply design concepts for manufacturing, assembly and environment

Module	DetailedContents	Hrs.
01	INTRODUCTION General design principles for manufacturability - strength and mechanical factors, mechanism selection, evaluation method, Process capability - Feature tolerances - Geometric tolerances - Assembly limits - Datum features - Tolerance stacks	05
02	COMPONENT DESIGN - MACHINING CONSIDERATION Design features to facilitate machining - drills - milling cutters - keyways - Doweling procedures, counter sunk screws - Reduction of machined area- simplification by separation - simplification by amalgamation - Design for machinability - Design for economy - Design for clampability – Design for accessibility - Design for assembly COMPONENT DESIGN – CASTING CONSIDERATION Redesign of castings based on Parting line considerations - Minimizing core requirements, machined holes, redesign of cast members to obviate cores. Identification of uneconomical design - Modifying the design - group technology - Computer Applications for DFMA	10
03	DESIGN FOR ASSEMBLY: Assembly processes - Handling and insertion process - Manual, automatic and robotic assembly - Cost of Assembly - Number of Parts - DFA guidelines	11
04	VALUE ENGINEERING: Value – types – functional – operational – aesthetic – cost- – material – Design process – value and worthiness – procedure - brainstorming sessions – evaluation – case studies – value estimation- Value analysis - Design for value - Selection of alternatives - optimization – Implementation.	12
05	DESIGN FOR THE ENVIRONMENT Introduction – Environmental objectives – Global issues – Regional and local issues – Basic DFE methods – Design guide lines – Example application – Lifecycle assessment – Basic method – AT&T's environmentally responsible product assessment - Weighted sum assessment method – Lifecycle assessment method – Techniques to reduce environmental impact – Design to minimize material usage – Design for disassembly – Design for recyclability – Design for remanufacture – Design for energy efficiency – Design to regulations and standards.	07

06	PRODUCT DEVELOPMENT ECONOMICS: Elements of Economics analysis-Quantitative and qualitative analysis- Economic Analysis process-Estimating magnitude and time of future cash inflows and outflows-Sensitivity analysis-Project trade-offs-Trade-off rules-Limitation of quantitative analysis-Influence of qualitative factors on project success	07
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Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (**on minimum Two Modules**) and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example, supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

References:

1. Boothroyd, G, 1980 Design for Assembly Automation and Product Design. New York, Marcel Dekker.
2. Harry Peck, Designing for Manufacture, Pitman Publications, 1983.
3. George E Dieter, Engineering Design, McGraw-Hill International Editions, 2000
4. S.S. Iyer, Value Engineering, New Age International, 2000
5. Charles E. Ebeling, An Introduction to Reliability and Maintainability Engineering, TMH 2000.
6. Bralla, Design for Manufacture handbook, McGraw Hill, 1999.
7. Dickson, John. R, and Corroda Poly, Engineering Design and Design for Manufacture and Structural Approach, Field Stone Publisher, USA, 1995.
8. Fixel, J. Design for the Environment McGraw Hill., 1996.
9. Graedel T. Allen By. B, Design for the Environment Angle Wood Cliff, Prentice Hall. Reason Pub., 1996.
10. Kevin Otto and Kristin Wood, Product Design. Pearson Publication, 2004.

CourseCode	CourseName	Credits
PDDPE2011	AppliedErgonomics	03

Objectives

- 1.Toexposethestudentsto thevariousaspectsofIndustrial Designsoastodevelop newproductsconsideringaesthetics,ergonomics,environment andotherhuman factors.

Outcomes: Learnerwillbeableto...

1. Understandtheimportanceof ergonomicsinthedesign ofnewproducts
2. Learntheeffectofbiomechanics,bio thermodynamics,bioenergeticsonthedesign and developmentof new products.
3. Understandthe effectsofotherhumanfactors

M o d u l e	DetailedContents	H r s .
0 1	HumanFactorsBasics: IntroductiontoHumanFactors,ResearchMethods,DesignandEvaluationTools,VisualSensorySystem,Auditory,Tactile,andVestibularSystems.	1 0
0 2	Human-MachineSystem: Cognition,DecisionMaking,Displays,Control	8
0 3	HumanPerformanceintheWorkplace: AnthropometryandWorkplaceDesign,BiomechanicsofWork,Work Physiology,StressandWorkload	1 0
0 4	Ergonomics-Physicaldesign: User-technologyphysicalinterfacedesign Who are the users? How does the technology fit different user dimensions? Howdoes the technology fit user anatomy? How does the technology fit user strength?Howdoesthetechologyyaccommodatedifferentabilities?Howsafeisthe technology(health,comfort,performance)?Howdousersinteractwithtechnology?	8
0 5	IntroductiontotheconceptofsystemdesignandErgonomics Ergonomicsinproductdesign,theinterfacedesign,Bodydimensionsanditsapplicationindesign,Dimensionaloptimizationforthepopulationanduseofpercentile,Themusculo-skeletalsystemandjointmotionstudy,Humanbodyfollowing the principle oflever, biomechanical stresses onour body.Effectofstresses imposed on body.Designfrom the view point of biomechanics, Workpostureanalysis,StaticandDynamicwork,thevisual,auditoryandthermalenvironment and their impact on design. Controls and display aspects of design.ResearchtechniquesinErgonomicdatageneration,interpretationandapplication ofstatisticalmethods.	8
0 6	IntroductiontobasicelementsofdesignandErgonomics: Line,texture,colour,form,symmetry,balance,scale,mass,unity andvariety.Conceptofvisuallanguageandvisualdesign.IntroductiontoGestaltlaws,compositionandfigureandgroundrelationships.Introductiontoconceptofnegativespace,Useofsymmetry.Generationof patternsandtexturesusingsimple elements.	8

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (**on minimum Two Modules**) and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example, suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only four questions need to be solved.

References:

1. M.S. Sanders and Ernest J. McCormick: Human Factors in engineering and Design, Sixth Edition, McGraw-Hill International Editions, 1987.
2. P.O. Astrand and K. Rodahl, Textbook of work physiology, McGraw Hill, New York, 1970.
3. Wickens, C.D., Lee, J.D., Liu, Y., Gordon Becker, S.E. (2004). An Introduction to Human Factors in Engineering (2nd Ed.). Upper Saddle River, New Jersey: Pearson Prentice-Hall

CourseCode	CourseName	Credits
PDDPE2012	Tribology in Design	03

Objectives

1. To expose the students to the tribology in design, lubrication and lubricants, hydrodynamic lubrication and bearing design and friction and wear.

Outcomes: Learner will be able to...

1. Apply friction/lubrication mechanism to the practical engineering problem.
2. Justify the use of metallic and non-metallic materials.
3. Design mechanical components against wear.
4. Employ different methods to reduce the friction for engineering surface

Module	DetailedContents	Hrs.
01	INTRODUCTION: Introduction to tribology, History of tribology Tribology definition. Tribology in design- bearing material its properties and construction Tribological design of oil seals and gasket. Tribology in industry (Maintenance). Bearing Geometry and Terminology-Types of bearing, Sliding contact, rolling contact bearings. Comparison between sliding and rolling contact bearing.	10
02	LUBRICATION AND LUBRICANTS: Lubrication-Definition, basic modes of lubrication, properties of lubricants, additives, EP lubricants, recycling of used oil, oil conservation, oil emulsion. Selection for general application and special application such as low temperature, high temperature,, extreme Pressure etc.	8
03	HYDRODYNAMIC LUBRICATION AND BEARING DESIGN: Theory of hydrodynamic lubrication, mechanism of pressure development in oil film. Two dimensional Reynold's equation and its limitations, Petroff's equation. Hydrodynamic thrust bearing-Introduction, types. Flat plate thrust bearing-Pressure equation, load, Centre of pressure, frictional force equation. Hydrodynamic lubrication: design of plain fixed pad and tilting pad, slider bearing for steady and varying –loads. Full and partial journal bearing of infinite length, design of journal bearing for steady loads and varying loads. Introduction to design of hydrostatic and Aerostatic bearings. Thrust and radial.	10
04	ELASTOHYDRODYANAMIC LUBRICATION: User-technologyphysicalinterfacedesign Who are the users? How does the technology fit different user dimensions? Howdoes the technology fit user anatomy? How does the technology fit user strength?Howdoesthetechlogyaccommodatedifferentabilities?Howsafeisthe technology(health,comfort,performance)?Howdousersinteractwithtechnology?	8
05	ROLLING CONTACT BEARING : Static and dynamic load capacity, left rating, selection of rolling contact bearing for different applications.	8
06	FRICITION AND WEAR: Friction- Introduction, laws of friction, Friction classification, Types of wear and basic mechanism of wear. Wear properties of friction and anti-friction metallic and nonmetallic materials. Experimental techniques in evaluation of materials. Design of mechanical components against wear. Design of friction surfaces used in clutches and brakes.	8

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (**on minimum Two Modules**) and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example, suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only four questions need to be solved.

References:

1. Cameron A., Basic Lubrication Theory, Wiley Eastern Ltd.
2. Mujumdar B. C., Introduction to Tribology and Bearings, S. Chand and Company Ltd. New Delhi.
3. Andras Z. Szeri, Fluid film lubrication theory & design, 1st Edition, 2005
4. J. Bhatia, Advances in industrial Tribology
5. Rabinowicz E., "Friction and Wear of materials", John Wiley & Sons, UK, 1995
6. Cameron, A. "Basic Lubrication Theory", Ellis Horwood Ltd., UK, 1981
7. Halling, J. (Editor) – "Principles of Tribology", Macmillan – 1984.
8. Williams J.A. "Engineering Tribology", Oxford Univ. Press, 1994.
8. S.K. Basu, S.N. Sengupta & B.B. Ahuja, "Fundamentals of Tribology", Prentice – Hall of India Pvt Ltd, New Delhi, 2005
10. G.W. Stachowiak & A.W. Batchelor, Engineering Tribology, Butterworth-Heinemann, UK, 2005

Course Code	Course Name	Credits
PDDPE2013	Polymeric Materials and Processing	03

Objectives

1. To study the behavior of polymeric materials
2. To study the applicability of polymers for various industrial applications
3. To study the effect of polymeric materials on the environment and vice versa

Outcomes: Learner will be able to...

1. Select an appropriate polymeric material for a given application
2. Choose an appropriate process to fabricate a product from the polymeric material
3. Select an appropriate testing method to evaluate a given property of a polymeric material
4. Develop the method to minimise the effect of polymeric materials on the environment and vice versa.

Module	Detailed Contents	Hrs.
01	Introduction Terminology of plastics, Early history of polymers, Development of plastic products, Designing a polymer structure for improved properties, Plastic properties - Mechanical Properties, Reinforced Properties, Electrical properties, Optical properties, Thermal Properties	8
02	Polymer Characterization Solubility and swelling, concept of average molecular weight, determination of number average, weight average, viscosity average and Z-average molecular weights, polymer crystallinity, analysis of polymers using IR, XRD, thermal (DSC, DMTA, TGA), microscopic (optical and electronic) techniques.	8
03	Industrial Polymers Addition polymers - Polyolefins, Olefin copolymers, Acrylic, Vinyl polymers. Condensation polymers - Polyesters, polyamides, formaldehydes resins Polyurethanes, Ether polymers, cellulosic Polymer, Silicones, Polyblends Interpenetrating polymer Network. Polymers in special uses - High temperature and fire resistance, liquid crystal Polymers, electro active polymer, Polymer supported catalysts, Optical information storage.	10
04	Fabrication Processes Types of processes, tooling for plastic processing, compression moulding, Transfer moulding, Injection moulding of thermoplastics, Injection moulding of thermosetting resins, Extrusion, Pultrusion, Blow Moulding, Calendaring, Rotational moulding, Thermoforming, Casting process, Foaming Process, Reinforcing process	10
05	Polymer Testing Mechanical - static and dynamic tensile, flexural, compressive, abrasion, endurance, fatigue, hardness, tear, resilience, impact, toughness. Conductivity - thermal and electrical, dielectric constant, dissipation factor, power factor, electric resistance, surface resistivity, volume resistivity, swelling, ageing resistance, environmental stress cracking resistance.	10
06	Plastics and Environment Effect of plastics on the environment, effect of environmental factors on the behaviour of plastics in outdoor environment, behaviour of plastics in the biotic environment, behaviour of plastics in the fire environment	6

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (**on minimum Two Modules**) and the other is either a class test or assignment online problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example, suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

References:

1. Industrial Polymers, Specialty Polymers, and Their Applications Manas Chanda and Salil K. Roy CRC Press 2008 Print ISBN: 978-1-4200-8058-2 eBook ISBN: 978-1-4200-8059-9
2. Plastics and the Environment Anthony L. Andrady ISBN: 978-0-471-09520-0
3. Design of Plastic Products Charles A. Harper: Modern Plastics Handbook, McGraw-Hill Professional, 2000
4. Life Cycle Engineering of Plastics: Technology, Economy and Environment Edited By L. Lundquist Y. Leterrier P. Sunderland Imprint: Elsevier ISBN: 978-0-08-043886-3
5. Plastic product design Ronald D. Beck Van Nostrand Reinhold Co., 1980 - Technology & Engineering - 3. Plastics Technology Handbook, Third Edition, edited by Manas Chanda, Salil K. Roy
6. Plastics and the Environment, Anthony L. Andrady, John Wiley & Sons
7. Raw Materials for Industrial Polymers, H. Ulrich, Hanser Publication 1989.
8. Polymer Science, V. R. Gowarikar, John Wiley and Sons 1986.
9. Polymer Chemistry, Malcolm P. Stevens, Oxford University Press, Inc, 1990.
10. Handbook of polymer Testing, Roger Brown, Marcel Dekker Inc, 1999

CourseCode	CourseName	Credits
PDDPE2021	VehicleDesign	03

Objectives

1. Tostudyautomotiveengineeringdevelopment
2. Tostudyapplicationofcomputersin vehicledesign.

Outcomes: Learnerwillbeableto...

1. Selectacommercialsoftwareforvehicledesign
2. Choosmaterial todesignvehicleparts

M od ul e	DetailedContents	H r s .
01	Automotiveengineeringdevelopment: Innovation and Inventions, Styling Development, Streamlining, EngineDevelopments, TransmissionDevelopments,Steering,Brakes,Suspension, WheelsandTyres,InteriorRefinement,SafetyDesign	08
02	Modernmaterialsandtheirincorporationintovehicledesign: Structureandmanufacturingtechnologyofautomotivematerials,MetalsandAlloys,PlasticsandPolym ers,CeramicsandGlasses,CompositeMaterials,MechanicalandPhysicalPropertiesofAutomotiveMa terials,Selectionof AutomotiveMaterials	10
03	Bodydesign:Thestylingprocess: TheStudios,workingenvironmentandstructure,ProductPlanning,ConceptsketchingandPackagerelat edsketching,Fullsizedtapedrawing,ClayModelling,Useof2DCADsystem,Useof3DCADSystem,Re ndering Techniques	10
04	Bodydesign:Aerodynamics: Aerodynamicforces,Drag,Dragreduction,Stabilityandcrosswinds,Noise,Ventilation,Wind tunneltesting,UseofCFD BasicConceptsinDesignandAnalysis: Chassis,Suspensionsystems,Brakingsystems,Transmissionanddriveline,NoiseandVibration	08
05	Occupantaccommodation:anergonomicsapproach: Ergonomics in Automotive Industry, Ergonomic methods and tools to promoteoccupantaccommodation,Standards,GuidelinesandRecommendations, Anthropometry,Testing	08
06	Futuretrendsinautomobiledesign: Mechanicalpossibilities,AdvancesinManufacturingMethods,Materials advances,Energyconservation,Powersystems,Electrical,ElectronicandHybridpossibilities,Vehic leinformationandnavigationsystems	08

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum Two Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example, supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

References:

1. Julian Happian-Smith, "An Introduction to Modern Vehicle Design", 2002, Butterworth-Heinemann, ISBN 075065044 3
2. John Fenton, "Advances in Vehicle Design", 1999, Professional Engineering Publishing, ISBN-13 9781860581816
3. Sanders, M.S. and McCormick, E.J., "Human Factors in Engineering and Design" (7th edition) McGraw-Hill
4. Smith, W.F. (1993). "Fundamentals of Materials Science and Engineering." McGraw-Hill
5. ISBN 0-07-059202-0
6. Beranek, L.L. (1971). "Noise and Vibration Control". McGraw-Hill.
7. Bralla, J.B. (ed.) (1986). "Handbook of Product Design for Manufacturing—a Practical Guide to Low Cost Production." McGraw-Hill. ISBN 0-07-007130-6.
8. Ryan Boroff, Tony Lewin, "How to Design Cars Like a Pro", 2010, Motorbooks International, ISBN-13 9780760336953
9. Geoff Wardle, Freeman Thomas, Stacey Macey, Ralph Gilles, Gordon Murray, Stuart Macey, "H-point: The Fundamentals of Car Design and Packaging", 2009, Ingram Pub Services, ISBN-13 9781933492377
10. MR Fernando F. Palma P., "Car Design: Futuristic Concepts", 2009, Createspace, ISBN-13 9781448618767
11. Bilal Salim, "Design and Fabrication of a Hybrid Car", 2012, LAP Lambert Academic Publishing, ISBN-13 9783659157264

CourseCode	CourseName	Credits
PDDPE2022	ReverseEngineering	03

Objectives

1. To study Understand the Reverse Engineering (RE) Methodology.
2. To study patent and copyright issues.

Outcomes: Learner will be able to...

1. Understand of basic engineering systems.
2. Apply the terminologies related to reverse engineering, forward engineering, and reverse engineering.
3. Understand Reverse Engineering methodologies.
4. Apply Reverse engineering in Mechanical Systems..

M o d u l e	DetailedContents	H r s .
01	Introduction Historical Background, Industrial Evolution, Reinvention of Engineering Marvels from Nature, Reverse Engineering in Modern Industries, Reverse Engineering vs. Machine Design, Motivation and Challenge, Analysis and Verification, Accreditation, Part Criticality, Applications of Reverse Engineering	07
02	Geometrical Form Surface and Solid Model Reconstruction, Scanning Instruments and Technology, Principles of Imaging, Cross-Sectional Scanning, Digital Data, Computational Graphics and Modeling, Data Refinement and Exchangeability, Dimensional Measurement, Case Studies, Part Tolerance, Additive Prototyping Technologies, Subtractive Prototyping Processes, Rapid Injection Molding, Steps of Geometric Modeling	08
03	Material Characteristics and Analysis Alloy Structure Equivalency, Phase Formation and Identification, Mechanical Strength, Hardness Part Durability and Life Limitation Part Failure Analysis, Fatigue, Creep and Stress Rupture, Environmentally Induced Failure	10
04	Material Identification and Process Verification Material Specification, Composition Determination, Microstructure Analysis, Manufacturing Process Verification	12
05	Data Process and Analysis Statistical Analysis, Data Analysis, Reliability and the Theory of Interference, Weibull Analysis, Data Conformity and Acceptance, Data Report Part Performance and System Compatibility Performance Criteria, Methodology of Performance Evaluation, System Compatibility	08
06	Acceptance and Legality Legality of Reverse Engineering, Legal Definition of Reverse Engineering, Legal Precedents on Reverse Engineering, Patent, Copyrights, Copyright Codes, Legal Precedents on Copyrights, Trade Secret, Case Study of Reverse Engineering Trade Secret, Third-Party Materials	07

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum Two Modules) and the other is either a class test or assignment online problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example, supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

References:

1. Wego Wang, "Reverse Engineering: Technology of Reinvention", ISBN-13: 978-1439806302, CRC Press
2. Kevin Otto, "Product Design: Techniques in Reverse Engineering and New Product Development", ISBN-13: 9788177588217, Dorling Kindersley
3. Robert Messler, "Reverse Engineering: Mechanisms, Structures, Systems & Materials", McGraw Hill Education, ISBN: 9780071825160
4. Raja, Vinesh, Fernandes, Kiran J., "Reverse Engineering An Industrial Perspective" ISBN 978-1-84628-856-2, Springer

CourseCode	CourseName	Credits
PDDPE2023	ProductMarketing	03

Objectives

1. To provide the student with an overview of marketing research techniques.
2. To impart fundamental knowledge of marketing research and its application in the front end of product development

Outcomes: Learner will be able to...

1. Choose appropriate marketing analysis tools.
2. Understand consumer behaviour and need for product development
3. Select pricing for products and services

Module	Detailed Contents	Hours
01	Advanced Marketing Planning Introduction: Concept, nature, scope and importance of marketing; Marketing concept and its evolution; Marketing mix; Strategic marketing planning – an overview. Market Analysis and Selection: Marketing environment – macro and micro components and their impact on marketing decisions; Market segmentation and positioning;	08
02	Consumer Behaviour Introduction to Consumer Behaviour (CB): Nature and Importance of CB, application of CB in Marketing, Consumer Research process. Consumer Decision making Process: • Problem recognition • Information Search Process and Evaluation • Purchasing process • Postpurchase behaviour	08
03	Marketing Research An overview of the Marketing Research Process, Research Designs, Exploratory Research, Descriptive Research, Experimental Research, Uncontrollable Variables: History, Maturation, Testing Effect, Measurement of Variation and Interactive Effect. Types of Data-Primary Data and Secondary Data, Secondary Data Sources for MR in India.	08

04	Pricing Strategies An Introduction to Pricing Basic Frameworks Overview of common pricing methods Psychology and Measurement The role of consumer psychology in pricing Price Discrimination Effective market segmentation New product pricing and building	08
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05	BrandStrategy ConceptofBrand,SignificanceofBrandingforConsumersandforFirms,BrandingChallengesandOppor tunities,ConceptofBrandEquity,Costbased,Pricebased andCustomerbased Brand Equity,CustomerBasedBrandEquity SourcesofBrandEquity-BrandAwarenessandBrandImage,Keller’sCBBEModel-Identity, Meaning,ResponseandRelationships.BrandPositionin g DefinitionofTargetMarket&MarketSegmentation,DefiningtheCompetitive FrameofReference,EstablishingthePointsofParity&Pointsofdifference.	08
06	DesigningtheSupplyChainnetwork UnderstandingthesupplyChain,Designingthedistributionnetwork,DesigningandPlanningTransport ation Network	08

Assessment:

Internal:

Assessmentconsistsoftwotestsoutofwhich;oneshouldbecompulsoryclasstest(**onminimumTwoModule**
s)andthe otheris eitheraclasstestorassignment onlive problemsor courseproject.

EndSemesterTheoryExamination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered
 inquestion papers of end semester examination. **In question paper weightage of each module will
 beproportionalto numberofrespectivelecturehours as mention inthesyllabus.**

1. Questionpaperwill compriseoftotal sixquestion
2. Allquestion carryequalmarks
3. Questionswillbe mixed innature(for examplesupposed Q.2 haspart(a) from module
 3thenpart(b) will be from anymoduleotherthan module 3)
4. OnlyFourquestions need to be solved.

References:

1. Kotlar,Philip,MarketingManagement,PrenticeHall,NewDelhi.
2. Loudan, DavidLandBitta,A.J.DellaConsumerBehaviour
3. SchiffmanLGandKanuk LLConsumerBehaviour
4. Nair,SujaR,ConsumerBehaviourinIndian
5. MarketingResearch:Text&Cases, Boyd,Westfall&Stasch,RD Irwin
6. Research ForMarketingDecisions,Green&Tull,PrenticeHall
7. ThomasT.Nagle,theStrategyand TacticsofPricing,PrenticeHall
8. PricingaPortfolioof Productscomplements &substitutes newproduct pricing
9. StrategicBrandManagement,Keller,Parmeswaran&Jacob,Pearson
10. BrandManagement,KirtiDutta,OxfordPublishing
11. SupplyChainManagementStrategy,PlanningandOperationbySunilChopra,PearsonEducation.

CourseCode	CourseName	Credits
PDDIE2011	ProjectManagement	03

Objectives:

1. To familiarize the students with the use of a structured methodology/approach for each and every unique project undertaken, including utilizing project management concepts, tools and techniques.
2. To appraise the students with the project management lifecycle and make them knowledgeable about the various phases from project initiation through closure.

Outcomes: Learner will be able to...

1. Apply selection criteria and select an appropriate project from different options.
2. Write work breakdown structure for a project and develop a schedule based on it.
3. Identify opportunities and threats to the project and decide an approach to deal with them strategically.
4. Use Earned value technique and determine & predict status of the project.
5. Capture lessons learned during project phases and document them for future reference

M o d u l e	DetailedContents	H r s
01	ProjectManagementFoundation: Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project lifecycles (typical & atypical) Project phases and stage gate process. Role of project manager. Negotiations and resolving conflicts. Project management in various organization structures. PM knowledge areas as per Project Management Institute (PMI).	5
02	InitiatingProjects: How to get a project started, Selecting project strategically, Project selection models (Numeric / Scoring Models and Non-numeric models), Project portfolio process, Projects sponsor and creating charter; Project proposal. Effective project team, Stages of team development & growth (forming, storming, norming & performing), team dynamics.	6
03	ProjectPlanning andScheduling: Work Breakdown structure (WBS) and linear responsibility chart, Interface Co-ordination and concurrent engineering, Project cost estimation and budgeting, Top down and bottom up budgeting, Networking and Scheduling techniques. PERT, CPM, GANTT chart. Introduction to Project Management Information System (PMIS).	8
04	PlanningProjects: Crashing project time, Resource loading and leveling, Goldratt's critical chain, Project Stakeholders and Communication plan. Risk Management in projects: Risk management planning, Risk identification and risk register. Qualitative and quantitative risk assessment, Probability and impact matrix. Risk response strategies for positive and negative risks	6
05	5.1 ExecutingProjects: Planning monitoring and controlling cycle. Information needs and reporting, engaging with all stakeholders of the projects. Team management, communication and project meetings. 5.2 Monitoring and Controlling Projects: Earned Value Management techniques for measuring value of work completed; Using milestones for measurement; change requests and scope creep. Project audit. 5.3 Project Contracting Project procurement management, contracting and outsourcing,	8

06	6.1 Project Leadership and Ethics: Introduction to project leadership, ethics in projects. Multicultural and virtual projects. 6.2 Closing the Project: Customer acceptance; Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report; doing a lessons learned analysis; acknowledging successes and failures; Project management templates and other resources; Managing without authority; Areas of further study.	6
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Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (**on minimum Two Modules**) and the other is either a class test or assignment online problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example, supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

References:

1. Jack Meredith & Samuel Mantel, Project Management: A Managerial approach, Wiley India, 7th Ed.
2. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5th Ed, Project Management Institute PA, USA
3. Gido Clements, Project Management, Cengage Learning.
4. Gopalan, Project Management, Wiley India
5. Dennis Lock, Project Management, Gower Publishing England, 9th Ed.

CourseCode	CourseName	Credits
PDDIE2012	FinanceManagement	03

Objectives:

1. Overview of Indian financial system, instruments and market
2. Basic concepts of value of money, returns and risks, corporate finance, working capital and its management
3. Knowledge about sources of finance, capital structure, dividend policy

Outcomes: Learner will be able to...

1. Understand Indian financial system and corporate finance
2. Take investment, finance as well as dividend decisions

M o d u l e	DetailedContents	H r s
01	Overview of Indian Financial System: Characteristics, Components and Functions of Financial System. Financial Instruments: Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills. Financial Markets: Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market Financial Institutions: Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges	06
02	Concepts of Returns and Risks: Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio. Time Value of Money: Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.	06
03	Overview of Corporate Finance: Objectives of Corporate Finance; Functions of Corporate Finance — Investment Decision, Financing Decision, and Dividend Decision. Financial Ratio Analysis: Overview of Financial Statements — Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios; Limitations of Ratio Analysis.	09
04	Capital Budgeting: Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion — Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value (NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR) Working Capital Management: Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities.	10
05	Sources of Finance: Long Term Sources — Equity, Debt, and Hybrids; Mezzanine Finance; Sources of Short Term Finance — Trade Credit, Bank Finance, Commercial Paper; Project Finance. Capital Structure: Factors Affecting an Entity's Capital Structure; Overview of Capital Structure Theories and Approaches — Net Income Approach, Net Operating Income Approach, Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure	05

06	Dividend Policy: Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches—Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach	0 3
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Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (**on minimum Two Modules**) and the other is either a class test or assignment online problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example, supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

References:

1. Fundamentals of Financial Management, 13th Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.
2. Analysis for Financial Management, 10th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.
3. Indian Financial System, 9th Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.
4. Financial Management, 11th Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi.

CourseCode	CourseName	Credits
PDDIE2013	EntrepreneurshipDevelopmentand Management	03

Objectives:

1. Toacquaint withentrepreneurshipandmanagement ofbusiness
2. UnderstandIndianenvironmentforentrepreneurship
3. Ideaof EDP, MSME

Outcomes: Learnerwill beableto...

1. Understandtheconceptofbusinessplan andownerships
2. Interpretkeyregulationsandlegal aspectsofentrepreneurshipinIndia
3. Understandgovernmentpoliciesforentrepreneurs

M od ule	DetailedContents	H r s
01	OverviewOfEntrepreneurship: Definitions,RolesandFunctions/ValuesofEntrepreneurship, History of Entrepreneurship Development, Role of Entrepreneurshipin the National Economy, Functions of an Entrepreneur, Entrepreneurship and Forms ofBusiness Ownership RoleofMoneyandCapitalMarketsinEntrepreneurialDevelopment:Contributionof GovernmentAgenciesinSourcinginformationforEntrepreneurship	0 4
02	BusinessPlansAndImportanceOfCapitalToEntrepreneurship: PreliminaryandMarketingPla ns,ManagementandPersonnel,Start- upCostsandFinancingaswellasProjectedFinancialStatements,LegalSection,Insurance,Suppliersa ndRisks,Assumptions and Conclusion, Capital and its Importance to the Entrepreneur EntrepreneurshipAndBusinessDevelopment: StartingaNewBusiness,BuyinganE xistingBusiness,NewProductDevelopment,BusinessGrowthandtheEntrepreneur LawanditsRelevancetoBusiness Operations	0 9
03	Women'sEntrepreneurshipDevelopment,Socialentrepreneurship-roleandneed,EDP cell,roleofsustainabilityandsustainabledevelopmentforSMEs,casestudies,exercises	0 5
04	IndianEnvironmentforEntrepreneurship: keyregulationsandlegalaspects,MSMED Act 2006 and its implications, schemes and policies of the Ministry of MSME,role and responsibilities of various government organisations, departments, banks etc.,Role of State governments in terms of infrastructure developments and support etc.,Publicprivatepartnerships,NationalSkilldevelopmentMission,CreditGuarantee Fund,PMEGP,discussions,groupexercisetc	0 8
05	Effective Management of Business: Issues and problems faced by micro and smallenterprises and effective management of M and S enterprises (risk management, creditavailability,technologyinnovation,supplychainmanagement,linkagewithlarge industries),exercises,e-Marketing	0 8
06	AchievingSuccessInTheSmallBusiness: Stagesofthesmallbusinesslifecycle,four typesoffirm-levelgrowthstrategies,Options–harvestingorclosingsmallbusinessCritical Successfactors ofsmallbusiness	0 5

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum Two Modules) and the other is either a class test or assignment online problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example, suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only four questions need to be solved.

References:

1. Poornima Charantimath, Entrepreneurship development-Small Business Enterprise, Pearson
2. Education Robert D Hisrich, Michael P Peters, Dean A Shepherd, Entrepreneurship, latest edition, The McGraw Hill Company
3. Dr TN Chhabra, Entrepreneurship Development, Sun India Publications, New Delhi
4. Dr CN Prasad, Small and Medium Enterprises in Global Perspective, New Century Publications, New Delhi
5. Vasant Desai, Entrepreneurial development and management, Himalaya Publishing House
6. Maddhurima Lall, Shikah Sahai, Entrepreneurship, Excel Books
7. Rashmi Bansal, STAY hungry STAY foolish, CIIE, IIM Ahmedabad
8. Law and Practice relating to Micro, Small and Medium Enterprises, Taxmann Publication Ltd.
9. Kurakto, Entrepreneurship-Principles and Practices, Thomson Publication
10. Laghu Udyog Samachar
11. www.msme.gov.in
12. www.dcmesme.gov.in
13. www.msme training.gov.in

CourseCode	CourseName	Credits
PDDIE2014	HumanResourceManagement	03

Objectives:

1. To introduce the students with basic concepts, techniques and practices of the human resource management.
2. To provide opportunity of learning Human resource management (HRM) processes, related with the functions, and challenges in the emerging perspective of today's organizations.
3. To familiarize the students about the latest developments, trends & different aspects of HRM.
4. To acquaint the student with the importance of inter-personal & inter-group behavioral skills in an organizational setting required for future stable engineers, leaders and managers.

Outcomes: Learner will be able to...

1. Understand the concepts, aspects, techniques and practices of the human resource management.
2. Understand the Human resource management (HRM) processes, functions, changes and challenges in today's emerging organizational perspective.
3. Gain knowledge about the latest developments and trends in HRM.
4. Apply the knowledge of behavioral skills learnt and integrate it within interpersonal and intergroup environment emerging as future stable engineers and managers.

Module	Detailed Contents	Hrs
01	Introduction to HR - Human Resource Management- Concept, Scope and Importance, Interdisciplinary Approach Relationship with other Sciences, Competencies of HR Manager, HRM functions. - Human resource development (HRD): changing role of HRM– Human resource Planning, Technological change, Restructuring and rightsizing, Empowerment, TQM, Managing ethical issues.	5
02	Organizational Behavior (OB) - Introduction to OB Origin, Nature and Scope of Organizational Behavior, Relevance to Organizational Effectiveness and Contemporary issues - Personality: Meaning and Determinants of Personality, Personality development, Personality Types, Assessment of Personality Traits for Increasing Self Awareness - Perception: Attitude and Value, Effect of perception on Individual Decision-making, Attitude and Behavior. - Motivation: Theories of Motivation and their Applications for Behavioral Change (Maslow, Herzberg, McGregor); - Group Behavior and Group Dynamics: Work groups formal and informal groups and stages of group development. Team Effectiveness: High performing teams, Team Roles, cross functional and self-directed team. - Case study	7
03	Organizational Structure & Design - Structure, size, technology, Environment of organization; Organizational Roles & conflicts: Concept of roles; role dynamics; role conflicts and stress. - Leadership: Concepts and skills of leadership, Leadership and managerial roles, Leadership styles and contemporary issues in leadership. - Power and Politics: Sources and uses of power; Politics at workplace, Tactics and strategies.	6

04	HumanresourcePlanning - Recruitment and Selection process, Job-enrichment, Empowerment - Job-Satisfaction, employee morale. - Performance Appraisal Systems: Traditional & modern methods, Performance Counseling, Career Planning. - Training & Development: Identification of Training Needs, Training Methods	5
05	Emerging Trends in HR - Organizational development; Business Process Re-engineering (BPR), BPR as a tool for organizational development, managing processes & transformation in HR. Organizational Change, Culture, Environment - Cross Cultural Leadership and Decision Making: Cross Cultural Communication and diversity at work, Causes of diversity, managing diversity with special reference to handicapped, women and ageing people, intra company cultural difference in employee motivation.	6
06	HR&MIS Need, purpose, objective and role of information system in HR, Applications in HRD in various industries (e.g. manufacturing R&D, Public Transport, Hospitals, Hotels and service industries) Strategic HRM Role of Strategic HRM in the modern business world, Concept of Strategy, Strategic Management Process, Approaches to Strategic Decision Making; Strategic Intent – Corporate Mission, Vision, Objectives and Goals Labor Laws & Industrial Relations Evolution of IR, IR issues in organizations, Overview of Labor Laws in India; Industrial Disputes Act, Trade Unions Act, Shops and Establishments Act	10

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (**on minimum Two Modules**) and the other is either a class test or assignment online problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

References:

1. Stephen Robbins, Organizational Behavior, 16th Ed, 2013
2. V SPRao, Human Resource Management, 3rd Ed, 2010, Excel publishing
3. Aswathapa, Human resource management: Text & cases, 6th edition, 2011
4. C.B. Mamoria and SV Gankar, Dynamics of Industrial Relations in India, 15th Ed, 2015, Himalaya Publishing, 15th edition, 2015
5. P. Subba Rao, Essentials of Human Resource management and Industrial relations, 5th Ed, 2013, Himalaya Publishing
6. Laurie Mullins, Management & Organizational Behavior, Latest Ed, 2016, Pearson Publications

CourseCode	CourseName	Credits
PDDIE2015	ProfessionalEthicsandCorporateSocial Responsibility(CSR)	03

Objectives:

1. To understand professional ethics in business
2. To recognize corporate social responsibility

Outcomes: Learner will be able to...

1. Understand rights and duties of business
2. Distinguish different aspects of corporate social responsibility
3. Demonstrate professional ethics
4. Understand legal aspects of corporate social responsibility

Module	Detailed Contents	Hours
01	Professional Ethics and Business: The Nature of Business Ethics; Ethical Issues in Business; Moral Responsibility and Blame; Utilitarianism: Weighing Social Costs and Benefits; Rights and Duties of Business	04
02	Professional Ethics in the Marketplace: Perfect Competition; Monopoly Competition; Oligopolistic Competition; Oligopolies and Public Policy Professional Ethics and the Environment: Dimensions of Pollution and Resource Depletion; Ethics of Pollution Control; Ethics of Conserving Depletable Resources	08
03	Professional Ethics of Consumer Protection: Markets and Consumer Protection; Contract View of Business Firm's Duties to Consumers; Due Care Theory; Advertising Ethics; Consumer Privacy Professional Ethics of Job Discrimination: Nature of Job Discrimination; Extent of Discrimination; Reservation of Jobs.	06
04	Introduction to Corporate Social Responsibility: Potential Business Benefits—Triple bottom line, Human resources, Risk management, Supplier relations; Criticisms and concerns—Nature of business; Motives; Misdirection. Trajectory of Corporate Social Responsibility in India	05
05	Corporate Social Responsibility: Articulation of Gandhian Trusteeship Corporate Social Responsibility and Small and Medium Enterprises (SMEs) in India, Corporate Social Responsibility and Public-Private Partnership (PPP) in India	08
06	Corporate Social Responsibility in Globalizing India: Corporate Social Responsibility Voluntary Guidelines, 2009 issued by the Ministry of Corporate Affairs, Government of India, Legal Aspects of Corporate Social Responsibility—Companies Act, 2013.	08

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (**on minimum Two Modules**) and the other is either a class test or assignment online problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example, supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only four questions need to be solved.

References:

1. Business Ethics: Texts and Cases from the Indian Perspective (2013) by Ananda Das Gupta; Publisher : Springer.
2. Corporate Social Responsibility: Readings and Cases in a Global Context (2007) by Andrew Crane, Dirk Matten, Laura Spence; Publisher: Routledge.
3. Business Ethics: Concepts and Cases, 7th Edition (2011) by Manuel G. Velasquez; Publisher: Pearson, New Delhi.
4. Corporate Social Responsibility in India (2015) by Bidyut Chakrabarty, Routledge, New Delhi.

CourseCode	CourseName	Credits
PDDIE2016	ResearchMethodology	03

Objectives:

1. To understand Research and Research Process
2. To acquaint students with identifying problems for research and develop research strategies
3. To familiarize students with the techniques of data collection, analysis of data and interpretation

Outcomes: Learner will be able to...

1. Prepare a preliminary research design for projects in their subject matter areas
2. Accurately collect, analyze and report data
3. Present complex data or situations clearly
4. Review and analyze research findings

Module	Detailed Contents	Hrs
01	Introduction and Basic Research Concepts 1.1 Research– Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Research methods vs Methodology 1.2 Need of Research in Business and Social Sciences 1.3 Objectives of Research 1.4 Issues and Problems in Research 1.5 Characteristics of Research: Systematic, Valid, Verifiable, Empirical and Critical	09
02	Types of Research 2.1. Basic Research 2.2. Applied Research 2.3. Descriptive Research 2.4. Analytical Research 2.5. Empirical Research 2.6 Qualitative and Quantitative Approaches	07
03	Research Design and Sample Design 3.1 Research Design–Meaning, Types and Significance 3.2 Sample Design– Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques Sampling Errors	07
04	Research Methodology 4.1 Meaning of Research Methodology 4.2. Stages in Scientific Research Process: a. Identification and Selection of Research Problem b. Formulation of Research Problem c. Review of Literature d. Formulation of Hypothesis e. Formulation of research Design f. Sample Design g. Data Collection h. Data Analysis i. Hypothesis testing and Interpretation of Data j. Preparation of Research Report	08
05	Formulating Research Problem 5.1 Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis	04
06	Outcome of Research 6.1 Preparation of the report on conclusion reached 6.2 Validity Testing & Ethical Issues 6.3 Suggestions and Recommendation	04

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (**on minimum Two Modules**) and the other is either a class test or assignment online problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example, supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

References:

1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBSPublishers Distributors.
2. Kothari, C.R., 1985, Research Methodology- Methods and Techniques, New Delhi, Wiley Eastern Limited.
3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nd ed), Singapore, Pearson Education

CourseCode	CourseName	Credits
PDDIE2017	IPRandPatenting	03

Objectives:

1. To understand intellectual property rights protection system
2. To promote the knowledge of Intellectual Property Laws of India as well as International treaty procedures
3. To get acquainted with Patent search and patent filing procedure and applications

Outcomes: Learner will be able to...

1. understand Intellectual Property assets
2. assist individuals and organizations in capacity building
3. work for development, promotion, protection, compliance, and enforcement of Intellectual Property and Patenting

Module	Detailed Contents	Hours
01	Introduction to Intellectual Property Rights (IPR): Meaning of IPR, Different category of IPR instruments - Patents, Trademarks, Copyrights, Industrial Designs, Plant variety protection, Geographical indications, Transfer of technology etc. Importance of IPR in Modern Global Economic Environment: Theories of IPR, Philosophical aspects of IPR laws, Need for IPR, IPR as an instrument of development	05
02	Enforcement of Intellectual Property Rights: Introduction, Magnitude of problem, Factors that create and sustain counterfeiting/piracy, International agreements, International organizations (e.g. WIPO, WTO) active in IPR enforcement Indian Scenario of IPR: Introduction, History of IPR in India, Overview of IP laws in India, Indian IPR, Administrative Machinery, Major international treaties signed by India, Procedure for submitting patent and Enforcement of IPR at national level etc.	07
03	Emerging Issues in IPR: Challenges for IP in digital economy, e-commerce, human genome, biodiversity and traditional knowledge etc.	05
04	Basics of Patents: Definition of Patents, Conditions of patentability, Patentable and non-patentable inventions, Types of patent applications (e.g. Patent of addition etc), Process Patent and Product Patent, Precautions while patenting, Patent specification Patent claims, Disclosures and non-disclosures, Patent rights and infringement, Method of getting a patent	07
05	Patent Rules: Indian patent act, European scenario, US scenario, Australian scenario, Japanese scenario, Chinese scenario, Multilateral treaties where India is a member (TRIPS agreement, Paris convention etc.)	08
06	Procedure for Filing a Patent (National and International): Legislation and Salient Features, Patent Search, Drafting and Filing Patent Applications, Processing of patent, Patent Litigation, Patent Publication, Time frame and cost, Patent Licensing, Patent Infringement Patent databases: Important websites, Searching international databases	07

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (**on minimum Two Modules**) and the other is either a class test or assignment online problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example, supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

References:

1. Rajkumar S. Adukia, 2007, A Handbook on Laws Relating to Intellectual Property Rights in India, The Institute of Chartered Accountants of India
2. Keayla BK, Patents system and related issues at a glance, Published by National Working Group on Patent Laws
3. TSengupta, 2011, Intellectual Property Law in India, Kluwer Law International
4. Tzen Wong and Graham Dutfield, 2010, Intellectual Property and Human Development: Current Trends and Future Scenario, Cambridge University Press
5. Cornish, William Rodolph & Llewelyn, David. 2010, Intellectual Property: Patents, Copyrights, Trade Marks and Allied Rights, 7th Edition, Sweet & Maxwell
6. Lous Harns, 2012, The Enforcement of Intellectual Property Rights: A Case Book, 3rd Edition, WIPO
7. Prabhuddha Ganguli, 2012, Intellectual Property Rights, 1st Edition, TMH
8. R Radha Krishnan & S Balasubramanian, 2012, Intellectual Property Rights, 1st Edition, Excel Books
9. MAshok Kumar and Mohd Iqbal Ali, 2011, Intellectual Property Rights, 2nd Edition, Serial Publications
10. Komal Bansal and Praishit Bansal, 2012, Fundamentals of IPR for Engineers, 1st Edition, BS Publications
11. Entrepreneurship Development and IPR Unit, BITS Pilani, 2007, A Manual on Intellectual Property Rights,
12. Mathew Y Maa, 2009, Fundamentals of Patenting and Licensing for Scientists and Engineers, World Scientific Publishing Company
13. NS Rathore, SM Mathur, Priti Mathur, Anshul Rathi, IPR: Drafting, Interpretation of Patent Specifications and Claims, New India Publishing Agency
14. Vivien Irish, 2005, Intellectual Property Rights for Engineers, IET
15. Howard B Rockman, 2004, Intellectual Property Law for Engineers and Scientists, Wiley-IEEE Press

CourseCode	CourseName	Credits
PDDIE2018	DigitalBusinessManagement	03

Objectives:

1. To familiarize with digital business concept
2. To acquaint with E-commerce
3. To give insights into E-business and its strategies

Outcomes: The learner will be able to.....

1. Identify drivers of digital business
2. Illustrate various approaches and techniques for E-business and management
3. Prepare E-business plan

Module	Detailed content	Hours
1	Introduction to Digital Business- Introduction, Background and current status, E-market places, structures, mechanisms, economics and impacts Difference between physical economy and digital economy, Drivers of digital business- Big Data & Analytics, Mobile, Cloud Computing, Social media, BYOD, and Internet of Things (digitally intelligent machines/services) Opportunities and Challenges in Digital Business,	09
2	Overview of E-Commerce E-Commerce- Meaning, Retailing in e-commerce-products and services, consumer behavior, market research and advertisement B2B-E-commerce-selling and buying in private e-markets, public B2B exchanges and support services, e-supply chains, Collaborative Commerce, Intra business EC and Corporate portals Other E-C models and applications, innovative EC System-From E-government and learning to C2C, mobile commerce and pervasive computing EC Strategy and Implementation- EC strategy and global EC, Economics and Justification of EC, Using Affiliate marketing to promote your e-commerce business, Launching a successful online business and EC project, Legal, Ethics and Societal impacts of EC	06
3	Digital Business Support services: ERP as e-business backbone, knowledge to apps, information and referral system Application Development: Building Digital business Applications and Infrastructure	06
4	Managing E-Business- Managing Knowledge, Management skills for e-business, Managing Risks in e-business Security Threats to e-business -Security Overview, Electronic Commerce Threats, Encryption, Cryptography, Public Key and Private Key Cryptography, Digital Signatures, Digital Certificates, Security Protocols over Public Networks: HTTP, SSL, Firewall as Security Control, Public Key Infrastructure (PKI) for Security, Prominent Cryptographic Applications	06

5	E-Business Strategy -E-business Strategic formulation- Analysis of Company's Internal and external environment, Selection of strategy, E-business strategy into Action, challenges and E-Transition (Process of Digital Transformation)	04
6	Materializing business: From Idea to Realization -Business plan preparation Case Studies and presentations	08

Assessment:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test (**on minimum Two Modules**) and the other is either a class test or assignment online problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six questions
2. All questions carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

References:

1. A text book on E-commerce, Er Arunrajan Mishra, Dr W K Sarwade, Neha Publishers & Distributors, 2011
2. E-commerce from vision to fulfilment, Elias M. Awad, PHI-Restricted, 2002
3. Digital Business and E-Commerce Management, 6th Ed, Dave Chaffey, Pearson, August 2014
4. Introduction to E-business-Management and Strategy, Colin Combe, ELSVIER, 2006
5. Digital Business Concepts and Strategy, Eloise Coupey, 2nd Edition, Pearson
6. Trend and Challenges in Digital Business Innovation, Vinocenzo Morabito, Springer
7. Digital Business Discourse Erika Darics, April 2015, Palgrave Macmillan
8. E-Governance- Challenges and Opportunities in: Proceedings in 2nd International Conference theory and practice of Electronic Governance
9. Perspectives the Digital Enterprise – A framework for Transformation, TCS consulting journal Vol.5
10. Measuring Digital Economy - A new perspective - DOI:10.1787/9789264221796-en OECD Publishing

CourseCode	CourseName	Credits
PDDIE2019	EnvironmentalManagement	03

Objectives:

1. UnderstandandidentifyenvironmentalissuesrelevanttoIndiaandglobalconcerns
2. Learnconcepts ofecology
3. Familiariseenvironmentrelatedlegislations

Outcomes: Learnerwill beableto...

1. Understandtheconcept ofenvironmental management
2. Understandecosystemandinterdependence,foodchainetc.
3. Understandandinterpretenvironmentrelatedlegislations

Mod ule	DetailedContents	H rs
01	Introduction and Definition of Environment: Significance of EnvironmentManagement for contemporarymanagers,Career opportunities. EnvironmentalissuesrelevanttoIndia,SustainableDevelopment,TheEnergy scenario.	1 0
02	GlobalEnvironmentalconcerns:GlobalWarming,AcidRain,OzoneDepletion,HazardousW astes,Endangeredlife-species,LossofBiodiversity, Industrial/Man-madedisasters,Atomic/Biomedical hazards,etc.	0 6
03	ConceptsofEcology:Ecosystemsandinterdependencebetweenlivingorganisms, habitats,limitingfactors,carryingcapacity, foodchain,etc.	0 5
04	ScopeofEnvironmentManagement,Role&functionsofGovernmentasaplanningandregulati ngagency. EnvironmentQualityManagementandCorporateEnvironmentalResponsibility	1 0
05	TotalQualityEnvironmentalManagement,ISO-14000,EMScertification.	0 5
06	GeneraloverviewofmajorlegislationslikeEnvironmentProtectionAct,Air(P&CP) Act,Water(P&CP)Act,Wildlife ProtectionAct,Forest Act,FactoriesAct,etc.	0 3

Assessment:

Internal:

Assessmentconsistsoftwotestsoutofwhich;oneshouldbecompulsoryclasstest(**onminimumTwoModule s**)andthe otheris eitheraclasstestorassignment online problemsor courseproject.

EndSemesterTheoryExamination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered inquestion papers of end semester examination. **In question paper weightage of each module will beproportionalto numberof respectivelecturehoursas mention in the syllabus.**

1. Questionpaperwill compriseoftotal sixquestion
2. Allquestion carryequalmarks
3. Questionswillbe mixed innature(for example supposedQ.2 haspart(a) from module 3thenpart(b) will be from anymoduleotherthan module 3)
4. OnlyFour questions need to be solved.

References:

1. Environmental Management: Principles and Practice, C J Barrow, Routledge Publishers London,1999
2. A Handbook of Environmental Management Edited by Jon C. Lovett and David G. Ockwell, EdwardElgarPublishing
3. EnvironmentalManagement,**TVRamachandra andVijayKulkarni,TERIPress**
4. Indian Standard Environmental Management Systems — Requirements With Guidance For Use,BureauOf Indian Standards, February2005
5. Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Macmillan India,2000
6. IntroductiontoEnvironmentalManagement,MaryKTheodoreandLouiseTheodore,CRCPress
7. EnvironmentandEcology,MajidHussain,3rdEd.AccessPublishing,2015

CourseCode	CourseName	Credits
PDDL201	CAD:SurfaceModelling Lab	01

Introduction to surface modelling

1. Coordinate transformations (translation, rotation, scaling, reflection)
2. Working with drawings, views, dimensions and tolerances.
3. Sheet metal design
4. Surface Modelling

Project:

1. Create CAD models of any two given objects involving above features, such as car side mirror body, mouse body, bottles etc.

Assessment:

Weightage for Laboratory Projects should be 40% in Final Assessment of Laboratory Work

End Semester Examination: Practical/Oral examination is to be conducted by pair of internal and external examiners

CourseCode	CourseName	Credits
PDDSBL201	ComputerAidedEngineering Lab	02

Introduction to computer aided engineering

1. Modelling of an element/system
2. Finite Element Analysis of an element/system (Involves element selection, assigning properties, meshing, assigning loads and boundary conditions, analysis and result interpretation)
3. Optimization of an element/system (minimization of mass) through FEA.

Project: Select any engineering element/system and optimize the design through FEA approach

Assessment:

Weightage for Laboratory Projects should be 40% in Final Assessment of Laboratory Work

End Semester Examination: Practical/Oral examination is to be conducted by a pair of internal and external examiners

CourseCode	CourseName	Credits
PDDOCC301	Online Credit Courses	03+03

GuidelinesforOnline Credit Courses

It is mandatory to complete the Online Credit Courses (OCC) available on NPTEL / Swayam /MOOC or similar platform approved by UoM. These two courses shall be completed in any semester I or II or III, but not later end of the Semester III. University shall make a provision that credits earned with OCC- I and OCC-II shall be accounted in the third semester grade-sheet with actual names of courses. The learner shall be allowed to take up these courses from his or her institute or organisation/ industry where his / her major project is carried out. The students shall complete the courses and shall qualify the exam conducted by the respective authorities/ instructor from the platform. The fees for any such courses and the corresponding examination shall be borne by the learner.

Online Credit Course – I

The learner shall opt for the course in the domain of Research Methodology **or** Research & Publication Ethicsor IPR. The opted course shall be of 3 credits of equivalent number of weeks.

Online Credit Course –II

The learner shall opt for the course recommended by Faculty Advisor/ Project Supervisor from the institute. The opted course shall be of 3 credits of equivalent number of weeks.

CourseCode	CourseName	Credits
PPDMP301/ PDDMP401	Major Project :Dissertation (IandII)	10 +16

Note 3:The Dissertation -II submission shall not be permitted till the learner completes all the requirements ME course.

Note 4:The contact hours for the calculation of load of the teacher for Major Project are as follows:
Major Project Dissertation I and II - 02 Hour / week / student

Guidelines for Dissertation-I

Students should do literature survey and identify the problem for Dissertation and finalize in consultation with Guide/Supervisor. Students should use multiple literatures and understand the problem. Students should attempt solution to the problem by analytical/simulation/experimental methods. The solution to be validated with proper justification and compile the report in standard format. Guidelines for Assessment of Dissertation-I.

Dissertation-I should be assessed based on following points

- Quality of Literature survey and Novelty in the problem
- Clarity of Problem definition and Feasibility of problem solution
- Relevance to the specialization
- Clarity of objective and scope Dissertation-I should be assessed through a presentation by a panel of Internal examiners and external examiner appointed by the Head of the Department/Institute of respective Programme.

Guidelines for Assessment of Dissertation II

Dissertation II should be assessed based on following points:

- Quality of Literature survey and Novelty in the problem
- Clarity of Problem definition and Feasibility of problem solution
- Relevance to the specialization or current Research / Industrial trends
- Clarity of objective and scope
- Quality of work attempted or learner contribution
- Validation of results
- Quality of Written and Oral Presentation

Students should publish at least one paper based on the work in referred National/ International conference/Journal of repute.

Dissertation II should be assessed by internal and External Examiners appointed by the University of Mumbai.