Punyashlok Ahilyadevi Holkar Solapur University,
Solapur

NAAC Accredited-2015'B'
Grade (CGPA 2.62)

Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

Structure & Syllabus:
Honors Degree in Design and Development with
B. Tech. (Civil Engineering)

T.Y. B. Tech (Civil Engineering)
w. e. f. Academic Year 2022-23

PUNYASHLOK AHILYADEVI HOLKAR
SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF ENGINEERING & TECHNOLOGY
Honors in Design and Development
(With B. Tech. Civil Engineering)
WEF batch of 2020-21
Effective to S. Y. B. Tech Hons. batch of 2021-22

Course Code	***Course Name***	***Hrs./week***			***Credits***	***Examination Scheme***			
		L	***T***	***P***		***ESE***	***ISE***	***ICA***	***Total***
Semester - IV									
Hn411	Design Thinking	3	1		4	70	30	25	125
Semester - V									
Hn512	Managing Innovation and Entrepreneurship	3		2	4	70	30	25	125
Semester - VI									
Hn613	Engineering System Design Optimization	4		2	5	70	30	25	125
	Seminar			2*	1			50	50
Semester - VII									
Hn714	Civil Engineering System Analysis and Design	3		2	4	70	30	25	125
	Mini Project			2*	1			50	50
Sub Total		13	1	10	19	280	120	200	600

* indicates contact hours

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S. Y. B. Tech. (Civil Engineering) – II, Semester- IV

Hn411: Design Thinking

Teaching Scheme	**Examination Scheme**
Lectures – 3 Hrs/Week, 3 Credits	**ISE –** 30 Marks
Tutorial – 1 Hr/Week, 1 Credit	**ESE –**70 Marks
	ICA – 25 Marks

Course outcomes:

Upon successful completion of course, the students will be able to:

1. Elaborate the critical design thinking skills needed to either improve an existing product or design a new product.
2. Identify Customer Needs and Product Specifications
3. Apply Creativity and Prototyping in Product Development
4. Apply Design Thinking for Service Sector Problem
5. Formulate Product Architecture and Financial Analysis
6. Apply Design for Environment Principles to a product life cycle

SECTION-I

Unit 1: Design Thinking Skills (06)

Difference between design thinking and other traditional approaches, Design Thinking Skills, Application these skills with some example, Design Thinking Mindset, Principles of Design Thinking

Unit 2: Customer Needs and Product Specifications: (09)

Identification of customer needs, Methods to Identify Customer Needs, draft customer needs statements as your first step towards user innovations. Translation of Customer needs into Product specifications quantitatively, establishment of product metrics to define product specifications.

Unit 3: Creativity and Prototyping: (09)

Learn to apply creativity, brainstorming, and concept generation process in designing needs solutions, Explore prototyping methods, strategies, and real-life examples where these have been applied to create a design that represents customer needs and product specifications.

SECTION-II

Unit 4: Design for Services: (07)

Understand design of services, Principles of service design thinking, Tools for service design thinking, and learn how to apply product development frameworks to the service context.

Unit 5 Product Architecture and Financial Analysis: (07)

Learn to use the modular and integral product architectures in determining the building blocks of a product. Learn to perform financial analysis of your project idea and decide if it is backed by a strong business rationale (Worth-It).

Unit 6 Design for Environment: (07)

Learn how to apply design for environment principles to a product life cycle, Learn to select and implement a product development process (staged, spiral, and agile)that's aligned to your project needs.

INTERNAL CONTINUOUS ASSESSMENT (ICA)

Internal Continuous Assessment (ICA) submission shall consist of the following –

1. Write a Case study for demonstrating all the steps of Design Thinking.
2. Perform a Group Discussion for generating ideas
3. Assignments (One Assignment on each unit)

TEXT BOOKS

1. Karl T. Ulrich and Steven D. Eppinger. Product design and development, McGraw-Hill
2. “Designing for growth: A design thinking tool kit for managers”, Jeanne Liedtka and Tim Ogilvie., 2011, ISBN 978-0-231-15838-1
3. “The design thinking playbook: Mindful digital transformation of teams, products, services, businesses and ecosystems”, by Michael Lewrick, Patrick Link, Larry Leifer., 2018, ISBN 978-1-119-46747-2

REFERENCE BOOKS

1. "Presumptive design: Design provocations for innovation", by Leo Frishberg and Charles Lambdin., 2016, ISBN: 978-0-12-803086-8
2. "Systems thinking: Managing chaos and complexity: A platform for designing business architecture.", "Chapter Seven: Design Thinking", by Jamshid Gharajedaghi, 2011, ISBN 978-0-12-385915-0
3. Websites:
   https://www.gasq.org/files/content/gasq/downloads/certification/Design%20Thinking/DesignThinking_Syllabus_0-6-3_EN.pdf

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

T. Y. B. Tech. (Civil Engineering) – I, Semester- V

Hn512: Managing Innovation and Entrepreneurship

Teaching Scheme	**Examination Scheme**
Lectures – 3 Hrs/Week, 3 Credits	**ISE –** 30 Marks
Practical – 2 Hr/Week, 1 Credit	**ESE –**70 Marks
	ICA – 25 Marks

Course outcomes:

Upon successful completion of course, the students will be able to:

1. Elaborate the process of Evolution of entrepreneurship
2. Apply the creativity and innovation approaches for product development
3. Apply innovation strategies for transforming the innovation into entrepreneurial activities.
4. Explain the approaches of motivating entrepreneurs
5. Apply problem identification and problem solving approaches

SECTION-I

Unit 1: Introduction to Entrepreneurship (7 Hrs)

Evolution of entrepreneurship from economic theory Managerial and entrepreneurial competencies. Entrepreneurial growth and development.

Unit 2: Creativity and Innovation: (8 Hrs)

Concepts Shifting Composition of the Economy Purposeful Innovation & the 7 Sources of Innovative Opportunity The Innovation Process.

Unit3: Innovative Strategies: (7 Hrs)

Strategies that aim at introducing an innovation. Innovation & entrepreneurship: Can they work together? Planning - incompatible with Innovation & entrepreneurship.

SECTION-II

Unit 4: Entrepreneurial Motivation: (7 Hrs)

Need for continuous learning & relearning Acquiring Technological Innovation

Entrepreneurial motivation (nAch story) Achievement Motivation in Real life.. Case Study.

Unit 5: International Entrepreneurship: (7 Hrs)

Concepts and Nature of International Entrepreneurship. The changing International environment. Ethics and International Entrepreneurship. Strategic Issues in International Entrepreneurship.

Unit 6: Problem Identification and Problem Solving: (8 Hrs)

Problem Identification. Problem solving. Innovation and Diversification.

INTERNAL CONTINUOUS ASSESSMENT (ICA)

Internal Continuous Assessment (ICA) submission shall consist of the following –

1. Assignments (One Assignment on each unit)

TEXT BOOKS

1. Martin, M.J., 1994, "Managing Innovation and Entrepreneurship in Technology based Firm", John Wiley.
2. Ettlie, J.E., 2000, "Managing Technology Innovation", John Wiley & Sons.
3. Drucker, P. F. (2000), "Discipline of Innovation," Harvard Business Review, May, (originally published 1985, May-June, 63(3), 67-72.1

REFERENCE BOOKS

1. Christensen, C. M. and Raynor, M. E. (2003), The Innovator‟s Solution: Creating and Sustaining Successful Growth, Boston, MA: Harvard Business School Press.
2. Drucker, P. F. (1985), Innovation and Entrepreneurship, New York: Harper.
3. Harvard Business Review on Innovation (Collection of articles), Harvard Business School Press (2001).
4. Harvard Business Review on Entrepreneurship (Collection of articles), Harvard Business School Press (1999)
5. Rogers, E.M. (2003), Diffusion of Innovations, 5th ed., New York: Simon and Schuster.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

T. Y. B. Tech. (Civil Engineering) – II, Semester- VI

Hn613:Engineering System Design Optimization

Teaching Scheme	**Examination Scheme**
Lectures – 4 Hrs/Week, 4 Credits	**ISE –** 30 Marks
Practical – 2 Hr/Week, 1 Credit	**ESE –**70 Marks
	ICA – 25 Marks

Course outcomes:

Upon successful completion of course, the students will be able to:

1. Explain the fundamentals of optimization techniques
2. Solve the single variables problems using various optimization techniques
3. Solve the multivariable problems using various techniques
4. Apply specialized methods to provide solutions to practical problems.
5. Apply Genetic algorithms and evolutionary approaches for solving the practical problems
6. Elaborate various Practical Aspects of Optimization for solving unconventional problems

SECTION I

Unit 1: Introduction (10 Hrs)

Optimization problem formulation, optimization algorithms, applications and examples, different optimization methods available.

Unit 2: Single Variable optimization (10 Hrs)

Optimization criteria, bracketing methods – Exhaustive search method, bound phase method; Region Elimination methods – Fibonacci search method, Golden search method; Gradient based methods – Newton Raphson method, Bisection method; Root finding using optimization technique.

Unit 3: Multi objective optimization (10 Hrs)

Optimization criteria, Different search methods, Unidirectional search, Direct search method – Evolutionary optimization method, Powell‟s conjugate direction method; Gradient based methods – Newton‟s method and Variable metric method.

Section-II

Unit 4: Specialized Methods (10 Hrs)

Integer programming, Geometric programming, simulated annealing, Global optimization using - steep descent method, simulated annealing.

Unit 5: Genetic algorithms and evolutionary approaches (10 Hrs)

Differences and similarities between genetic algorithms and traditional techniques, operators of GAs, Computer program for simulated annealing, Newton Raphson method, Evolutionary optimization method.

Unit 6: Practical Aspects of Optimization (10 Hrs)

Reduction of size of an optimization problem, Fast reanalysis techniques, Sensitivity of optimum solution to problem parameters, Multilevel optimization

INTERNAL CONTINUOUS ASSESSMENT (ICA)

Internal Continuous Assessment (ICA) submission shall consist of the following –

Assignments (One Assignment on each unit)

TEXT BOOKS

1. Singiresu S. Rao, Engineering Optimization: Theory and Practice, Publisher : John Wiley & Sons
2. Kalyanmoy Deb, "Optimization for Engineering design", Prentice Hall, India, 2005.
3. Kalyanmoy Deb, "Multi objective optimization using Evolutionary algorithms", John Wiley, 2001.

REFERENCE BOOKS

1. Ranjan Ganguli, Engineering Optimization: A Modern Approach, Universities Press
2. Hamdy A. Taha Operations Research: An Introduction, Pearson Education India

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

T. Y. B. Tech. (Civil Engineering) – II, Semester- VI

Seminar

Teaching Scheme	**Examination Scheme**
Practical – 2 Hr/Week, 1 Credit	**ICA** – 50 Marks

Students practice speaking in front of a scientific audience and to explore topics in detail. Students will research topics and organize presentations for faculty and other students. The topics may be any aspect of Design and Development related activities preferably in Civil Engineering. This Topic could be a synopsis of the Mini Project giving all the planning and theoretical Background and topic depth assessment related aspects. In addition, students are expected to attend all other seminars. It is expected that students will actively participate by asking questions of the speaker. Following submission is also expected before final delivery of the seminar.

Submit a hard copy of your topic description which will have a tentative title, a paragraph or two describing the topic, as well as several pertinent references (5-8 is sufficient). Proof-read your work for grammar and spelling. Use a citation format from a journal in your discipline, and be consistent in your format. Students will submit a detailed outline (1 – 1.5 pages) of their presentation and also a brief abstract (one or two paragraphs; **250 words max.**) describing their presentation.

Appropriate rubrics should be formed for assessment of Seminar.

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Final. Y. B. Tech. (Civil Engineering) – I, Semester- VII

Hn714: Civil Engineering System Analysis and Design

Teaching Scheme	**Examination Scheme**
Lectures – 3 Hrs/Week, 3 Credits	**ISE –** 30 Marks
Practical – 2 Hr/Week, 1 Credit	**ESE –**70 Marks
	ICA – 25 Marks

Course outcomes:

Upon successful completion of course, the students will be able to:

1. Explain the concepts of system engineering.
2. Apply Measures of Effectiveness for goals and outcomes
3. Apply various tasks of system development
4. Perform the Need Assessment for Systems Development
5. Apply various aspects of system planning
6. Apply various aspects of system design

SECTION-I

Unit1: Fundamental Concepts in Systems Engineering: (6 Hrs)

basic concept of system, systems considerations in civil engineering, development of civil engineering systems, some terms and concepts related to systems thinking, global initiatives in the study of systems

Unit 2: Measures of Effectiveness (MOE) : (8 Hrs)

Classification of system outcomes, hierarchy of desired outcomes: values, goals, and objectives, moes linked with goals and objectives, dimensions of moes. Properties of a desirable moe, common moes used in decision making at any phase of system development , goals and moes at each phase of civil engineering systems development, desired properties of a set of moes for a given analysis

Unit 3: Tasks Within the Systems Development: (8 Hrs)

analytical tasks at each phase of civil systems development, model classification, tools for the task of systems description, analyzing systems in civil engineering, tsystem evaluation, examples of tasks at each phase of systems development

SECTION-II

Unit4: Need Assessment for Systems Development: (8 Hrs)

stages of the needs assessment phase, assessment of system needs, mechanisms for assessing system needs, assessing system needs using user-targeted mechanisms, assessing long-term system needs via demand and supply trends, some issues and considerations in needs assessment

Unit 5: Systems Planning: (8 Hrs)

dimensions (perspectives) of civil system planning, evolving and emerging contexts of systems planning, principles of civil systems planning, system planning process, barriers to effective planning, computations in civil systems planning

Unit 6: System Design: (6 Hrs)

classifications of engineering design, engineering design process, logical and physical design, evaluation of alternative conceptual designs, applications of systems design in selected areas of civil engineering, design failures in civil engineering

INTERNAL CONTINUOUS ASSESSMENT (ICA)

Internal Continuous Assessment (ICA) submission shall consist of the following –

1. Assignments (One Assignment on each unit)

TEXT BOOKS

1. Samuel Labi, Introduction to Civil Engineering Systems: A Systems Perspective to the Development of Civil Engineering Facilities, John Wiley & Sons, Inc., Hoboken, New Jersey , 2014.
2. Geoffrey Gordon, “System Simulation”, Second edition, Prentice Hall, India, 2002.
3. Jerry Banks and John S.Carson, Barry L.Nelson, David M.Nicol, “Discrete Event System Simulation”, Third edition, Prentice Hall, India, 2002.

REFERENCE BOOKS

1. Robert E. Shannon, “System Simulation The art and science”, Prentice Hall, New Jersey, 1995.
2. D.S. Hira, “System Simulation”, S. Chand and company Ltd, New Delhi, 2001.

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B. Tech. Civil Engg- I; Semester – VII

Mini Project

Teaching Scheme	**Examination Scheme**
Practical – 2 Hr/Week, 1 Credit	**ICA** – 50 Marks

The purpose of the mini project is to demonstrate applications of the techniques learned in the courses of the Design and Development. Students should take a case study on any product idea/business case/service related proposal and apply the set of tools learned for Design Thinking, Innovation, Entrepreneurship, Optimisation Techniques or any other allied group of techniques.

The mini project should be supported with the logical flow of tools utilised for solving the selected case study. The assessment should be performed using rubrics based on following aspects:

i. Response of student during problem formulation of mini project

ii. Response of student during implementation stage of the Project

iii. Final assessment based on a presentation and a report on mini project covering Objectives, tools utilised to achieve objectives, results and conclusions.

iv. Any other tangible outcomes like participation in some competition, business case study weighted by some entrepreneurial experts, Product development, patent filling or publication, Interaction with any outside agencies like industry and academic institution of repute.