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Choice Based Credit System (CBCS) in Light of NEP-2020

M.Tech in Industrial Engineering

(2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTIE111	DSE	Ergonomic and Industrial Safety	60	20	20	0	0	2	1	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;

***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

To (A) Explain the psychology of human behavior as it relates to workplace safety, (B) Identify ergonomic hazards, (C) Recommend appropriate controls, and relate the human and workplace factors which contribute to ergonomic hazards.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Explain the psychology of human behavior as it relates to workplace safety.
2. Identify ergonomic hazards; recommend appropriate controls.
3. Relate the human and workplace factors which contribute to ergonomic hazards.

Syllabus

UNIT-1 **(8Hrs)**

Ergonomics: Definition, Application, Brief History, Effectiveness and Cost-Effectiveness of Ergonomics Human Factors and Ergonomics, Systems of the Human Body, Anatomy of Spine and Pelvis Related to Posture Biomechanics, Muscular System, Ergonomics and the Musculoskeletal System, Costs of Back Injuries.

UNIT-2 **(8Hrs)**

Muscular Work and Nervous Control of Movements, Types of Muscular Work, Muscular Fatigue, Types of Muscle Contractions, Measurement of Muscular Strength, Anthropometry:

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Definition, Terminology, Myth of the Average Human, Principles of Universal Design, Anthropometric Measurements

UNIT-3 **(8Hrs)**

Design of Workplaces and Hand Tools, Work Design Analysis, Designing for Hand Use, Types of Injuries and Disorders. Work-Related Musculoskeletal Disorders, Types of Work-Related MSD's, Task-related Factors, Personal Risk Factors, Impact on Industry, Ergonomic Program for WMSD's.

UNIT-4 **(8Hrs)**

Heavy Work and Evaluating Physical Workloads and Lifting, Heavy Work, Manual Material Handling & Lifting, Classification and Risks, NIOSH Lifting Guidelines, Job Demands and Workplace Stress, Mental Fatigue/Shift-work Fatigue.

UNIT-5 **(8Hrs)**

Information Ergonomics: Controls, and Displays, Mental Workload Measurement, Primary and Secondary Task Performance, Controls and Displays (Types), Control Layout and Design, How to Implement An Ergonomic Program, Management and Employee Involvement, Setting Up the Ergonomics Program, Problem Identification, Hazard Prevention and Control, Training.

Reference Books:

1. Robert Bridger, "Introduction to Ergonomics", CRC Press; 3rd edition, 2008.
2. Scott, P.A.; Charteris, J.; Bridger, R.S, "Global Ergonomics", Elsevier Science, 2000.

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***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

3. Rieske, David W., Asfahl, C. Ray, "Industrial Safety and Health Management", Pearson, 2018.
4. Joel M. Haight; Jeffery C. Camplin; Chritopher A. Janicak; Anjan K. Majumder; Linda S. Rowley; Kathy, "Principles of Industrial Safety" ASSE, 2009.

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MTIE151	DSE	Industrial Energy Control and Audit	60	20	20	0	0	2	1	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs)

Describe various theories of organizations, their characteristics, strengths, and weaknesses. (A) Concept of energy conservation. (B) Energy audit; material energy balanced and energy action planning. (C) Monitoring and Targeting and thermal energy management.

Course Outcomes (COs)

course outcomes are:

1. Student able to understand the energy conservation concepts.
2. Students able to understand the techniques energy audit.
3. Student able to explain the material energy balance and energy action planning.
4. Students able to understand the monitoring and targeting of energy.

Syllabus

Unit-I **(8Hrs)**

Energy Control: Concept of energy control, energy demand and supply, economic analysis; Duties and responsibilities of energy managers.

Energy Conservation: Basic concept, energy conservation in Household, Transportation, Agricultural, service and Industrial sectors, Lighting, HAVC.

Unit-II **(10Hrs)**

Energy Audit: Definition, need and types of energy audit; Energy management (Audit) approach: Understanding energy cost, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirement; Fuel & energy substitution; Energy audit instruments; Energy conservation Act; Duties and

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MTIE151	DSE	Industrial Energy Control and Audit	60	20	20	0	0	2	1	0	3

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responsibilities of energy manager and auditors.

Unit-III **(8Hrs)**

Material energy balance: Facility as an energy system; Method for preparing process flow; material and energy balance diagrams.
Energy Action Planning: Key elements, force field analysis; Energy policy purpose, perspective, content, formulation, rectification.

Unit-IV **(8Hrs)**

Monitoring and Targeting: Definition monitoring & targeting; Data and information analysis.
Electrical Energy management: energy conservation in motors, pumps and fan systems; energy efficient motors.

Unit-V **(9Hrs)**

Thermal Energy management: Energy conservation in boilers, steam turbine and industrial heating system; Application of FBC; Cogeneration and waste heat recovery; Thermal insulation; Heat exchangers and heat pump; Building Energy Management.

Reference Books:

1. Murphy & Mckay, "Energy Management", BSP Books Pvt. Ltd., 2015.
2. Smith CB, "Energy Management Principle", Pergamon Press, New York, 2007.
3. Rajan GG, "Optimising Energy Efficiency in Industry", TMH, 2011.
4. Callaghan P O, "Energy Management", McGraw-Hill Book Company, 2001.
5. Amit Kumar Tyagi, "Handbook on Energy Audit and Management", Tata Energy Research Institute, 2007.

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MTIE161	DSE	Engineering Economic Analysis	60	20	20	0	0	2	1	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs)

Describe various theories of organizations, their characteristics, strengths, and weaknesses. (A) Fundaments of engineering economics. (B) Analytical concepts of investments; Value analysis and Productivity measurement models (C) Describe the basic concepts of the multicriteria methods.

Course Outcomes (COs)

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

1. Student able to understand the engineering economics.
2. Student able to learn the investment decision making and cost benefit analysis.
3. Student able to understand the value analysis.
4. Student able to learn the productivity management and implementation strategies.

Syllabus

Unit-I **(8Hrs)**

Fundamentals of engineering economy, interest formulas; calculation of equivalence; basic methods of making economic analysis; money-time relationships and cost of capital. Basics of financial reports and analysis with ratios

Unit-II **(8Hrs)**

Analytical concepts of investment decisions under conditions of certainty and uncertainty; selection of alternatives, risk and sensitivity; applications of break even analysis.
Project life cycle management- selection, cash flow analysis, cost-benefit analysis, cost-effectiveness analysis, risk management and resource management.

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MTIE161	DSE	Engineering Economic Analysis	60	20	20	0	0	2	1	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
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Unit-III **(8Hrs)**

Economic analysis for manufacturing, marketing and service systems; Value analysis, depreciation and depletion calculation methods; Theory and practice of valuation, Industrial valuation cases; Economic analysis of repair, replacement and overhaul.

Unit-IV **(8Hrs)**

Productivity measurement models; Productivity management and implementation strategies; Learning curve; Technology management ; cost benefit analysis of ERP, CRM, PDM and PLM; Economics of flexibility, lean thinking, reconfigurations, integration and collaborations in supply chains.

Unit-V **(8Hrs)**

Multiple criteria methods; Applications of Goal programming and Data Envelopment Analysis; Venture Management, knowledge networking, and Balanced Score card.

References

1. H. G. Thuesen, W. J. Fabrycky, and G. J. Thuesen, "Engineering Economy", Prentice Hall International, 1993.
2. E. Paul De Garmo, and J. R. Canada, "Engineering Economy", Prentice Hall, 1997.
3. J. C. T. Mao, "Quantitative Analysis of Financial Decisions", Macmillan Publishing Co. Inc. NY., 1969.
4. K. K. Humphreys, "Cost and Optimization Engineering", 3rd Edition, McGraw Hill International Edition, Industrial Engineering Series, 1991.
5. Prem Vrat, G. D. Sardana and B. S. Sahay, "Productivity Management - A Systems Approach", Narosa Publishing House, New Delhi, 2018.
6. R. H. Nanavati, "Theory and Practice of Valuation", Lakhani Book, 2019.

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MTIE161	DSE	Engineering Economic Analysis	60	20	20	0	0	2	1	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

7. J. A. Timmons, "New Venture Creation", McGraw Hill International Edition Business Series, 2019.
8. Prasanna Chandra, "Projects –planning, analysis and control", Tata McGraw Hill, 2018.

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MTIE221	DSE	Facility Layout and Design	60	20	20	0	0	2	1	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
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Course Educational Objectives (CEOs):

To introduction with (A) Study of production facilities, including location, planning, design and maintenance, (B) product flow, space and activity relationships, personnel requirements, (C) , material handling.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Student would be able to understand the need define and analyze product, process and schedule design.
2. Student would be able to understand various available design algorithms theoretically and using necessary modern engineering tools.
3. Student would be able to analyses solve facility design problems through analyzing layout models.
4. Students would be able to prepare and present a facilities planning project report by using facility layout models-algorithms and applying standards of professional and ethical responsibility.

Syllabus

UNIT I **(8Hrs)**

Introduction of Plant Facility

Concept of Plant Facility, It's Scope, Importance and objectives. Nature of Location Decision, Need for facility location planning, General procedures and Factors influencing location decisions, Facility Location Models, economics and cost analysis, Rural and urban location.

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MTIE221	DSE	Facility Layout and Design	60	20	20	0	0	2	1	0	3

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UNIT II **(8Hrs)**

Plant Location

Plant location analysis – factors, costs, location decisions – single facility location models, multi facility location models- set covering problem – warehouse location problems.

UNIT III **(8Hrs)**

Facilities Layout

Facilities requirement, objective of plant layout and principles, advantages , factors influencing plant layout, types of manufacturing system, types of layout, plant layout procedure, line balancing.

UNIT IV **(9Hrs)**

Layout Designs

Design cycle – SLP procedure, Industrial plant design considerations, types of production types of layout, factors affecting layout tools, Techniques & procedure used in workstation and plant layout, quantitative techniques in plant layout, developing Product and Process Layouts, Comparing Layouts, criteria for computerized facility layout, concept of computerized layout programs like CRAFT, CORELAP, ALDEP & PLANTET.

UNIT V **(9Hrs)**

Material Handling and Plant Maintnance

Material Handling:

Scope and functions of Material handling , Manual mechanical Handling ratio, Principles of material handling , Analysis of material handling problem, Classification of Material Handling

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system, Material Handling in stores and warehouses , automation in part handling ,handling and industrial robots, Optimum allocation of Material Handling equipment Principles, unit load concept, material handling system design, selection and specification, containers and packaging

Plant Maintenance:

Role of maintenance management , Organization & systems of maintenance management , Different types of maintenance management , Their purpose and features, Preventive and Predictive maintenance techniques, Introduction to Total Productive Maintenance: Concepts, Tools and Procedure

Reference Books:

1. Tompkins, J.A. and J.A.White, "Facilities planning", John Wiley, 2003.
2. Richard Francis.L. and John A.White, "Facilities Layout and location – an analytical approach", PHI., 2002.
3. James Apple, M.Plant layout and "Material Handling", John Wiley, 1977.
4. Pannerselvam,R, "Production and Operations Management", PHI,2007
5. Telsang M., "Industrial engineering & Production Management" S.Chand,2013

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MTIE231	DSE	Reliability Analysis and prediction	60	20	20	0	0	2	1	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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Course Educational Objectives (CEOs)

Topics covered include (A) reliability mathematics, organization and analysis of data, reliability modeling and system reliability evaluation techniques. (B) Environmental factors and stresses are taken into account in computing the reliability of the involved components. (C) The limitations of models, methods, procedures, algorithms and programmers are outlined. (D) The treatment of maintained systems is designed to aid the worker in analyzing systems with more realistic and practical assumptions. (E) Fault tree analysis is also extensively discussed, incorporating recent developments.

Course Outcomes (COs)

Having successfully completed the module, you should be able to demonstrate knowledge and understanding of the following:

1. Reliability, its model and evaluation techniques.
2. Factor affecting reliability.
3. Limitations.
4. Fault Tree Analysis.

Syllabus

Unit-I **(8Hrs)**

Reliability Engineering: An overview. Historical development, Reliability: A birth-to-death problem. Reliability: An interdisciplinary effort. Reliability education and research, Problems of developing countries, Reliability prediction and analysis, Problems in prediction and analysis. Challenges for future. Scope of the book.

Reliability Mathematics. Classical set theory. Boolean algebra. Sample space. Definitions of

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MTIE231	DSE	Reliability Analysis and prediction	60	20	20	0	0	2	1	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
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probability. Basic properties of probability. Independent events. Conditional probability. Multiplication theorem. Total probability theorem. Bayes' theorem. Random variables. Probability distributions. Cumulative distributions. Mathematical expectation. Variance. Covariance and correlation. Moments. Moment generating functions. Probability distributions. Joint probability distributions. Distributions of several random variables. Some useful limit theorems. Estimation theory. Laplace transform. Markov processes. Random number generation.

Unit-II **(10Hrs)**

Reliability Data Analysis and Management. The reliability function. Mean time to failure. Variance. The bathtub curve. Linear hazard models. Other hazard models. Analysis of failure data. Probability graph papers. Illustrations. Hazard function plots. Selection of a distribution. Statistical estimation of failure data. Interval estimates. Reliability data management.

Unit - III **(8Hrs)**

Reliability Prediction from Stress-Strength Models. Stresses due to internal and external environments. Physics of failures. Reliability from stress-strength distributions. Reliability from similar stress-strength distributions. Reliability from dissimilar stress-strength distributions. Graphical approach. Time dependent stress-strength models. Environmental factors. Environmental testing; Test specifications. Stress derating. Estimation of part failure rate.

System Reliability Modeling. System modeling. Assumptions for modeling. Two state modeling. Three-state models.

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COURSE CODE	CATE GORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTIE231	DSE	Reliability Analysis and prediction	60	20	20	0	0	2	1	0	3

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Unit – IV **(8Hrs)**

Reliability Evaluation Techniques. Non path sets or cut sets approaches. Tie set and cut set approaches. Reliability evaluation of flow networks, Path sets/cut sets enumeration.

Maintainability Analysis Measures of system performance. State space approach. Network approach. Conditional probability approach. Three state systems. Preventive maintenance. Condition-based maintenance.

Unit-V **(8Hrs)**

System Analysis Through Fault Trees. Important definitions. Event oriented analysis. Fault tree definitions and symbols. Structure function and coherence. Fault tree construction. Fault tree simplification. Fault tree evaluation. Importance measures of events. Measures of importance in multistate systems. Modularization in fault trees. Common cause/dependent failure analysis. Automatic synthesis of fault trees. Computer codes for fault tree analysis.

Reference Books:

1. K.B. Misra, "Reliability Analysis and Prediction", Volume 1, 1st Edition; Elsevier Science' 2012
2. Naikan, "Reliability Engineering and Life Testing" PHI, 2016
3. Patrick D. T. O'Connor, "Practical Reliability Engineering" Wiley, 2008

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Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth	Vishwavidyalaya, Indore	Vishwavidyalaya, Indore
Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

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Shri Vaishnav Institute of Technology and Science

Choice Based Credit System (CBCS) in Light of NEP-2020

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MTIE241	DSE	Decision Modelling	60	20	20	0	0	2	1	0	3

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Course Educational Objectives (CEOs):

To introduction with (A) the Problem Solving Process and the Analytic Modeling Process, (B) Descriptive Assessment criteria and weights, Values and Normative Choice, (C) Choice under Uncertainty.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Formulate quantitative business models for real business problems;
2. Develop and apply linear programming models to a variety of business problems using the graphical solution technique;
3. Student will be able to understand the Analytic Modeling Process.
4. Student will be able to solve problem based on Descriptive Assessment criteria and weights
5. Student will be able to analyze problem based on uncertainty.

Syllabus

UNIT 1 **(8Hr)**

The Problem Solving Process: Overview of Problem solving, the problem solving process in policy management, Problem identification: the elements of decision making, actors and decision makers, Attributes, Criterion, Objective and Goal, Actions and Decision variables, Problem Definition (Evaluation measure, measurement scale, binary preference relations), Problem solution: Preference aggregation, Dominant and efficient alternative, preference graph, Sensitivity analysis.

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UNIT 2 **(8Hrs)**

The Analytic Modeling Process: Introduction to analytic modeling process, Model verification and validation,. The as abstraction of reality, the analytic modeling process, structure model: definition and elements, action, criteria. Formal models: general aspects, descriptive vs normative preference elicitation, Resolution Models: general resolution approach, resolution complexity.

UNIT 3 **(8Hrs)**

Descriptive Assessment criteria and weights: Introduction to Descriptive Assessment criteria and weights. Relative intensity and weights: consistent assessment, Relative importance and ratio scale. Hierarchical decomposition of criteria: structural model and formal model. Aggregation of criteria : differentiation power of criteria and computational aspects.

UNIT 4 **(9Hrs)**

Values and Normative Choice: Introduction, The structural model: conceptual aspect. Formal model of value theory: motivation and axioms of value theory, preferential independence, additive value functions, linear value functions, value function over time streams, Interpretation of 2 value functions. The Resolution Models: general approach, assessment of mutual preferential independence, elicitation of 2 dimensional value functions and component value functions.

UNIT 5 **(8Hrs)**

Choice under Uncertainty: Introduction, decision making under complete uncertainty: structural model, formal model (Wald's MaxMin rule, Savage's MinMax regrets rule, Hurwicz's Optimism-Pessimism Index), Resolution model. Decision making under risk: structural model, formal model; concept of probability theory. Decision rules: Individual risk, collective risk etc.

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MTIE241	**DSE**	**Decision Modelling**	60	20	20	0	0	2	1	0	3

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***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Reference Books:

1. Barbara von Halle, Larry Goldberg, "The Decision Model: A Business Logic Framework Linking Business and Technology"; CRS press, 2009.
2. James R. Evans, "Statistics, Data Analysis, and Decision Modeling", Pearson Central Publication, 2012.
3. Cliff Ragsdale, "Spreadsheet Modeling and Decision Analysis: A Practical Introduction to Business Analytics", 2019.
4. Stephen G. Powell and Kenneth R. Baker, "The Art of Modeling with Spreadsheets", 2000.

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MTIE301	PW/I	Dissertation Phase I	0	0	0	300	200	0	0	20	10

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;

Course Educational Objectives (CEOs):

Students obtain a hands-on experience by converting a small novel idea/technique into a working model/prototype or analysis etc. applying multi-disciplinary skills and / or knowledge and working in at team/individual.

Course Outcomes (COs):

At the end of the course, student will be able-

1. To conceptualise a novel idea / technique into a product.
2. To think in terms of multi-disciplinary environment and apply it.
3. To apply multi- disciplinary technical knowledge into project.
4. To take on the challenges of recent scenario work, prepare a presentation in a professional manner, and document all aspects of design/carried out work.

Syllabus

To guide the student in such a way so that they carry out on a topic as a forerunner to full-fledged work to be taken subsequently in Major project, a multidisciplinary project is to be taken up by a team/individual (as per the university guidelines). Development of prototype product, a 3D model, simulation, analysis of particular technical problem etc. blueprint for a larger project and any other development work are permitted. The contribution of the individuals in the project should be clearly brought out. A combined report is to be submitted. Also, a presentation* is to be made for the reviewers* on the work done by the candidate.

*Review or evaluation/ report preparation/presentation will be as per guidelines of university/institute/head.

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