PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018

(AUTONOMOUS)

M.E. STRUCTURAL ENGINEERING

ACADEMIC REGULATIONS 2019

(CHOICE BASED CREDIT SYSTEM)

CURRICULUM

SEMESTER III

S. No	Course Code	Course Title	L	T	P	C
Theory						
1	PSE1955*	Elective V	3	0	0	3
2	********	Open Elective	3	0	0	3
Dissertation						
3	PSE19301	Dissertation Phase I	0	0	20	10
		Total	**6**	**0**	**20**	**16**

SEMESTER IV

S. No	Course Code	Course Title	L	T	P	C
Dissertation						
1	PSE19401	Dissertation Phase II	0	0	24	16
		Total	**0**	**0**	**24**	**16**

TOTAL CREDITS: 68

ELECTIVE V

Category	Course Code	Course Title	L	T	P	C
PE	PSE19551	Prestressed Concrete Structures	3	0	0	3
PE	PSE19552	Analysis of Laminated Composite Plates	3	0	0	3
PE	PSE19553	Fracture Mechanics	3	0	0	3
PE	PSE19554	Wind and Cyclone Effects on Structures	3	0	0	3

LIST OF OPEN ELECTIVES

Category	Course Code	Course Title	L	T	P	C
OE	PMA19901	Operations Research	3	0	0	3
OE	PCE19901	Business Analytics	3	0	0	3
OE	PED19901	Industrial safety	3	0	0	3
OE	PED19902	Composite Materials	3	0	0	3
OE	PED19903	Waste to Energy	3	0	0	3
OE	PSE19901	Cost Management of Engineering Projects	3	0	0	3

SEMESTER III

PSE19301 **DISSERTATION PHASE I** **0 0 12 10**

COURSE OBJECTIVES

To enable the students to

- apply the fundamental knowledge for understanding state of the art information about any topic relevant to curriculum
- identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literatures.
- develop the methodology to solve the identified problems.
- prepare the project reports and face reviews and viva-voce examination.

SYLLABUS

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

TOTAL PERIODS: 300

COURSE OUTCOMES

Upon the completion of this course, the students will be able to

- reviewed civil engineering problems available in literature
- select appropriate techniques to analyse the complex civil engineering problems
- apply engineering and management principles through efficient handling of project have a clear idea of his/her area of work and they are in a position to carry out the work in a systematic way.
- write a detailed report about the topic in the prescribed format

Co-Po Mapping:

Mapping of Course Objectives with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	3	-	2	1	2	3	2	1	3	3	3
CO2	3	3	1	3	-	-	1	-	3	-	1	3	3	3
CO3	2	2	2	-	-	2	1	2	2	2	1	3	3	3

SEMESTER IV

PSE19401 **DISSERTATION PHASE II** **0 0 24 16**

COURSE OBJECTIVES

To enable the students to

- carry out analytical and/or experimental research oriented work in the field of structural engineering.
- formulate / define the problem for dissertation.
- solve the identified problem based on the formulated methodology.
- develop skills to analyse and discuss the test results and make conclusions.

SYLLABUS

The student should continue the phase I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.

TOTAL PERIODS: 480

COURSE OUTCOMES

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

- take up any challenging practical problem and find better solutions.
- interpret, discuss, debate and draw conclusions
- implement concepts, tools and techniques to do quality projects
- testing, analyse and prepare the report for a given project, write and present technical paper based on the research work.

Co-Po Mapping:

Mapping of Course Objectives with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	3	-	2	1	2	3	2	1	3	3	3
CO2	3	3	1	3	-	-	1	-	3	-	1	3	3	3
CO3	2	2	2	-	-	2	1	2	2	2	1	3	3	3
CO4	3	3	1	3	-	-	1	-	3	-	1	3	3	3
CO5	3	3	2	-	-	2	1	2	2	2	1	3	3	3

LIST OF ELECTIVES

ELECTIVE V

PSE19551 PRESTRESSED CONCRETE STRUCTURES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- impart knowledge on the basic principles of prestressed concrete structures
- understand the flexure and shear design for prestressed concrete beams
- gain knowledge of factors influencing deflection and anchorage zone design
- understand the performance of composite members
- gain knowledge on various prestressed concrete structural elements

Prerequisite: Nil

UNIT I INTRODUCTION 9

Historical developments; Basic principles of prestressing; Classification and types; Advantages over ordinary reinforced concrete; Materials – High strength concrete, High tensile steel; Systems and Methods of prestressing; Analysis of sections- stress concept, strength concept and load balancing concept; Losses of prestress in post-tensioned and pre-tensioned members.

UNIT II DESIGN FOR FLEXURE AND SHEAR 9

Basic assumptions for calculating flexural stresses; Permissible stresses in steel and concrete as per I.S.1343 Code; Design of sections of Type I and Type II post – tensioned and pre–tensioned beams; Check for strength limit based on I.S. 1343 Code; Design for shear based on I.S. 1343 Code.

UNIT III DEFLECTION AND DESIGN OF ANCHORAGE ZONE 9

Deflection – Factors influencing deflections; Effect of tendon profile on deflections; Short and long term deflections; Check for serviceability limit state of deflection; Anchorage zone – Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and I.S. 1343 code; Design of anchorage zone reinforcement.

UNIT IV COMPOSITE BEAMS AND CONTINUOUS BEAMS 9

Analysis and design of composite beams; Shrinkage strain and its importance; Methods of achieving continuity in continuous beams; Analysis for secondary moments; Concordant cable and linear transformation; Calculation of stresses; Principles of design.

UNIT V MISCELLANEOUS STRUCTURES 9

Design of tension and compression members; Design of tanks, pipes and sleepers; Partial prestressing – Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon the completion of this course, the students will be able to

- select various types of prestressing methods
- design for flexure and shear on prestressed concrete beams.
- design of anchorage zone reinforcement.
- design of composite and continuous beams.
- describe the various prestressed concrete structural elements.

REFERENCES

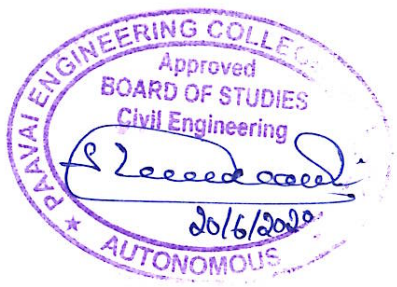
1. Krishna Raju N., "Prestressed concrete", Tata McGraw Hill Company, Fifth Edition, 2012.
2. Pandit.G.S. and Gupta.S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt Ltd., Second edition, 2014
3. Rajagopalan.N, Prestressed Concrete, Narosa Publishing House, 2010
4. Dayaratnam.P and Sarah P, "Prestressed Concrete Structures", Seventh Edition, Oxford and IBH 2017
5. Lin T.Y. and Ned.H. Burns, "Design of prestressed Concrete Structures", Wiley India Pvt Ltd, New Delhi, 2013.
6. IS1343 – 1980 – IS Code of Practice for Prestressed Concrete.
7. IS784 – 2001 – IS Specification for Prestressed Concrete Pipes
8. IS3370 – 1999 – Part III – IS Code of Practice for Concrete Structures for the storage of liquids
9. IS1678 – 1998 – Specification for Prestressed Concrete Pole for overhead Power Traction and Telecommunication lines.

Co-Po Mapping:

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	-	1	-	1	1	2	1	-	1	-	-
CO2	3	2	3	-	2	-	1	1	1	1	-	1	1	1
CO3	3	2	3	-	2	-	1	1	1	1	-	1	1	-
CO4	2	2	3	-	2	1	1	1	1	1	-	1	-	1
CO5	2	2	3	-	2	1	1	1	1	1	-	1	-	2



PSE19552 ANALYSIS OF LAMINATED COMPOSITE PLATES 3 0 0 3

COURSE OBJECTIVES

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

- understand the theories for rectangular composite plates.
- analyse the composite plates using advanced methods.
- develop the computer programs for the analysis of composite plates using analytical methods.
- gain the knowledge on finite element solutions.
- know the analytical method of composite plates.

Prerequisite: Nil

UNIT I INTRODUCTION 9

Laminated plates – geometric and physical definitions, natural and man-made composites, types & classification of composites with its applications; Displacement field approximations for Classical laminated plate theory (CLPT) and First order shear deformation theory (FSDT)

UNIT II ANALYTICAL SOLUTIONS FOR BENDING OF RECTANGULAR LAMINATED PLATES (USING CLPT) 9

Governing equations, Navier solutions of cross-ply and angle-ply laminated simply-supported plates, Determination of stresses; Levy solutions for plates with other boundary conditions.

UNIT III ANALYTICAL SOLUTIONS FOR BENDING OF RECTANGULAR LAMINATED PLATES (USING FSDT) 9

Governing equations, Navier solutions of cross-ply and angle-ply laminated simply-supported plates, Determination of stresses; Levy solutions for plates with other boundary conditions.

UNIT IV FINITE ELEMENT SOLUTIONS FOR BENDING OF RECTANGULAR LAMINATED PLATES (USING CLPT) 9

Introduction to Finite Element method, Rectangular elements, formation of stiffness matrix, formation of load vector, Numerical integration, Post computation of stresses.

UNIT V FINITE ELEMENT SOLUTIONS FOR BENDING OF RECTANGULAR LAMINATED PLATES (USING FSDT) 9

Finite element model, C_0 element formulation, Post computation of stresses; Analyze the rectangular composite plates using the analytical methods.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon the completion of this course, the students will be able to

- explain the classical laminated theory and first order shear deformation theory.
- analyse the rectangular composite plates using CLPT.

- analyse the rectangular composite plates using FSDT.
- describe the finite element solutions for rectangular laminated plates using CLPT.
- describe the finite element solutions for rectangular laminated plates using FSDT.

REFERENCES

1. "Mechanics of Laminated Composites Plates and Shells", Reddy J. N., CRC Press.
2. "Finite Element modeling of Composites and Sandwich Laminates" by S.K. Singh and A. Chakrabarti, Lambert Academic Publishing, ISBN: 978-3-659-23481-1, 2012.
3. Bairagi, "Plate Analysis", Khanna Publishers, 1996.
4. "Stresses in plates and shells" by A.C.Ugural, Mc-graw hill publication, 1999.
5. "Analysis of Plates" by T.K.Varadhan and K.Bhaskar,Narosa Publishing house, 1999.

Co-Po Mapping:

Mapping of Course Objectives with Program Outcomes (1/2/3 indicates the strength of correlation) 3-Strong, 2-Medium, 1- Weak														
COs	**Program outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	3	2	1	-	1	1	2	1	-	1	-	-
CO2	3	2	3	2	2	-	1	1	1	1	-	1	1	1
CO3	3	2	3	2	2	-	1	1	1	1	-	1	1	-
CO4	2	2	3	2	2	1	1	1	1	1	-	1	-	1
CO5	2	2	3	2	2	1	1	1	1	1	-	1	-	2

PSE19553 **FRACTURE MECHANICS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- able to finding out damage tolerance by using any one of the parameters.
- manage singularity at crack tip using complex variable
- understand the important role played by plastic zone at the crack tip.
- study modern fatigue and will able to calculate the fatigue life of a component.
- study modern sophisticated experimental techniques to determine stress intensity factor.

Prerequisite: Nil

UNIT I INTRODUCTION **9**

Crack in a Structure – Griffth Criterion; Basic Fracture Mechanics - Modes of fracture failure, crack resistance- stable and unstable crack growth; Cleavage Fracture- Ductile Fracture, Fatigue Cracking.

UNIT II ELASTIC CRACK AND STRESS INTENSITY FACTOR **9**

Stress and displacement fields - edge cracks , embedded cracks ;Elastic Crack tip stress field -Solution to crack problems; Effect of finite size stress intensity factor - Special cases , Irwin plastic zone correction; Actual shape of plastic zone - Plane stress , Plane strain.

UNIT III PLASTICITY AND CRACK DETECTION TECHNIQUES **9**

Shape and size of plastic zone - effective crack length, effect of plate thickness, Crack tip opening displacement; Crack propagation - effect of an overload , crack closure, variable amplitude fatigue load; Environment - assisted cracking, Dynamic mode crack initiation and growth - various crack detection techniques.

UNIT IV CRITICAL ENERGY AND FATIGUE FAILURE **9**

Test methods for determining critical energy release rate - critical stress intensity factor, J-Integral techniques; Concept of CTOD and CMD, Fatigue Crack Growth; Fatigue Crack Growth Test- Stress Intensity Factor, Factors Affecting Stress Intensity Factor.

UNIT V APPLICATION OF FRACTURE MECHANICS **9**

Fracture design - Selection of materials, fatigue crack growth rate curve; Stress intensity factor range; Use of crack growth law.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon the completion of this course, the students will be able to

- specify design parameters against fracture
- ascertain whether the design is safe against fracture
- suggest methods to prevent fracture

- predict fatigue life cycles
- suggest life enhancement methods under fatigue load

REFERENCES

1. Broke D, "Elementary engineering fracture mechanics"4/e 4th edition, 2017
2. Fracture Mechanics: An Introduction (Solid Mechanics and Its Applications), E.E.Gdoutos, second edition,springer, 2006
3. A Nadai, W. S. Hemp, "Theory of flow and fracture of solids", McGraw Hill Book Company, 1950
4. Fracture Mechanics, Suri C. T. and Jin Z.H., 1st Edition, Elsevier Academic Press, 2012.
5. Fracture Mechanics – Applications to Concrete, Victor, Li C., Bazant Z. P., ACI SP 118, ACI Detroit, 1989

Co-Po Mapping:

Mapping of Course Objectives with Program Outcomes (1/2/3 indicates the strength of correlation) 3-Strong, 2-Medium, 1- Weak														
COs	**Program outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	3	2	1	-	1	1	2	1	-	1	-	-
CO2	3	2	3	2	2	-	1	1	1	1	-	1	1	1
CO3	3	2	3	2	2	-	1	1	1	1	-	1	1	-
CO4	2	2	3	2	2	1	1	1	1	1	-	1	-	1
CO5	2	2	3	2	2	1	1	1	1	1	-	1	-	2

PSE19554 WIND AND CYCLONE EFFECTS ON STRUCTURES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- study the concept of wind and cyclone effects for analysis and design of structures
- know the usage of codal provisions for the wind and cyclone design of structures
- study the static and dynamic on tall buildings
- design the special structures based on wind effects
- analyse the cyclone effects on tall buildings

Prerequisite: Nil

UNIT I INTRODUCTION 9

Wind – introduction, types of wind, Characteristics of wind, wind velocity, method of measurement, variation of speed with height, shape factor, aspect ratio, drag effects; Dynamic nature of wind; Pressure and suctions - Spectral studies, Gust factor.

UNIT II WIND TUNNEL STUDIES 9

Wind tunnel studies - Types of tunnels, modeling requirements, interpretation of results, aero dynamic and aero-elastic models.

UNIT III WIND EFFECT ON STRUCTURES 9

Classification of structures – Rigid and Flexible; Effect of wind on structures - Static and dynamic effects on Tall buildings, chimneys.

UNIT IV DESIGN OF SPECIAL STRUCTURES 9

Design of Structures for wind loading – as per IS-875, ASCE and NBC code provisions; design of Tall Buildings – Chimneys, Transmission towers and steel monopoles, Industrial sheds (Roofs & Shelters)

UNIT V CYCLONE EFFECTS 9

Cyclone effect on – low rise structures, sloped roof structures, Tall buildings; claddings - Effect of cyclone on claddings, design of cladding, use of code provisions in cladding design, Analytical procedure and modeling of cladding.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon the completion of this course, the students will be able to

- explain the characteristics of wind
- evaluate the intensity of wind on structures
- design some special structures subjected to wind loading
- design of structures for cyclone
- model and analyse a structure in a wind tunnel

REFERENCES

1. Cook.N.J., "The Designer's Guide to Wind Loading of Building Structures", Butterworths,1989
2. Kolousek.V, Pirner.M, Fischer.O and Naprstek.J, "Wind Effects on Civil Engineering Structures", Elsevier Publications, 1984
3. Lawson T.V., "Wind Effects on Building Vol. I and II", Applied Science Publishers, London,1980
4. Peter Sachs, "Wind Forces in Engineering", Pergamon Press, New York, 1978.
5. Wind Loading of Structures by D.Holmes, CRB Press, 2015.

Co-Po Mapping:

Mapping of Course Objectives with Program Outcomes

(1/2/3 indicates the strength of correlation) 3-Strong, 2-Medium, 1- Weak

COs	Program outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	1	1	3	1	2	1	-	1	2	1
CO2	3	2	3	2	2	1	3	1	1	1	-	1	2	1
CO3	3	2	3	2	2	1	3	1	1	1	-	1	2	-
CO4	2	2	3	2	2	1	3	1	1	1	-	1	2	1
CO5	2	2	3	2	2	1	3	1	1	1	-	1	2	2

PMA19901 **OPERATIONS RESEARCH** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the mathematical formulation of real-world problems as a linear programming model and apply the theoretical workings of the graphical and simplex method.
- develop various constructive techniques of Transportation and Assignment models to make effective business decisions.
- introduce the concepts of nonlinear programming problem to develop the quantitative tools for identifying, analyzing and practicing strategic decisions.
- develop various constructive techniques for the field of inventory and production management.
- impart knowledge to manage the project analysis by network models and organize the tools and techniques of CPM and PERT.

UNIT-I LINEAR PROGRAMMING **9**

Principal components of decision problem, modeling phases, LP Formulation and graphic solution, Resource allocation problems, Simplex method.

UNIT-II TRANSPORTATION AND ASSIGNMENT MODELS **9**

Mathematical formulation of transportation problem; Methods for finding initial basic feasible solution, optimum solution, degeneracy; Mathematical formulation of assignment models - Hungarian Algorithm, variants of the Assignment problem.

UNIT-III CLASSICAL OPTIMISATION THEORY **9**

Nonlinear programming problem, Kuhn-Tucker conditions min cost flow problem, max flow problem.

UNIT-IV INVENTORY MODELS **9**

Inventory models, Economic order quantity models, Quantity discount models, Stochastic inventory models, Multi product models, Inventory control models in practice.

UNIT-V NETWORKING MODELS **9**

Network diagram representation, Critical path method, Time charts and resource levelling, PERT.

TOTAL PERIODS: 45

COURSE OUTCOMES

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

- demonstrate the mathematical formulation of real-world problems as a linear programming model and apply the theoretical workings of the graphical and simplex method.

- determine the optimal solution of maximizing the profit and minimizing the cost of both transportation and assignment problems.
- develop mathematical skills to analyse and solve Nonlinear programming problem.
- determine the optimization concepts in inventory control models.
- use CPM and PERT techniques to plan, schedule and Control project activities.

REFERENCE BOOKS

1. Taha H.A., "Operations Research: An Introduction " 10th Edition, Pearson Education, 2017.
2. A.M.Natarajan, P.Balasubramani, A.Tamilarasi, "Operations Research", Pearson Education, Asia, 2013.
3. Prem Kumar Gupta, D.S. Hira, "Operations Research", S.Chand & Company Ltd, New Delhi, 3rd Edition, 2013.
4. John W. Chinneck "Feasibility and Infeasibility in Optimization Algorithms and Computational Methods", Springer, 2013.
5. Ravindran, Phillips, Solberg, "Operations Research: Principles and Practice", 2nd Edition, JohnWiley & Sons, 2012.

Co-Po Mapping:

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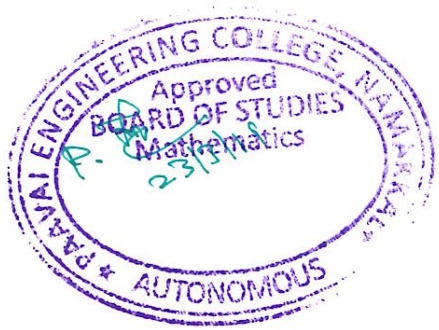
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	2	3	2	2	-	-	-	-	-	-	-	2	3	3
CO3	3	3	3	3	-	-	-	-	-	-	-	2	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	3	-	-	-	-	-	-	-	3	3	3



PCE19901 BUSINESS ANALYTICS 3 0 0 3

COURSE OBJECTIVES

To enable the students to,

- analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
- gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- become familiar with processes needed to develop, report, and model business data.
- analyze and solve problems from different industries such as manufacturing, service, retail, banking and finance, sports, pharmaceutical, aerospace etc.
- use decision-making tools/operations research techniques.

Prerequisite: Nil

UNIT I INTRODUCTION 9

Business analytics- Overview of business analytics, scope of business analytics, business analytics process, relationship of business analytics process and organization, competitive advantages of business analytics; Statistical Tools- Statistical notation, descriptive statistical methods- data mining introduction.

UNIT II ANALYSIS 9

Trendiness and Regression Analysis- Modeling relationships and trends in data, business analytics personnel, data and models for business analytics, problem solving, visualizing and exploring data, business analytics technology.

UNIT III MODELLING 9

Organization Structures of Business analytics; Team management; Management Issues; Designing Information Policy; Outsourcing; Ensuring Data Quality; Measuring contribution of Business analytics; Managing Changes.

UNIT IV FORECASTING 9

Forecasting Techniques- Qualitative and Judgmental Forecasting, statistical forecasting models, forecasting models for stationary time series, forecasting time series with seasonality, regression forecasting with casual variables. Monte Carlo Simulation - Monte carlo simulation using analytic solver platform, new-product development model, newsvendor model, overbooking model, cash budget model

UNIT V DECISION MAKING 9

Decision Analysis- Formulating decision problems, decision strategies with the without outcome probabilities, decision trees, value of information, utility and decision making.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon the completion of this course, the students will be able to

- understand the knowledge of data analytics.
- demonstrate the ability of think critically in making decisions based on data and deep analytics.
- demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
- demonstrate the ability to translate data into clear, actionable insights.
- understand the concept of decision making.

REFERENCES

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dar G.Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.
3. The PMI guide to Business Analysis
4. Business Analysis for Practitioners: Practice Guide
5. Agile and Business Analysis Practical guidance for IT Professionals

Co-Po Mapping:

Mapping of Course Objectives with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak**														
Cos	**Programme Outcomes(POs)**													
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CO1	2	2	2	1	1	1	-	1	2	-	1	2	1	-
CO2	2	2	2	1	1	1	-	1	2	-	-	2	2	-
CO3	2	2	2	3	1	1	-	1	2	-	-	2	2	2
CO4	2	2	2	3	1	1	-	1	2	-	-	2	2	1
CO5	2	2	2	2	1	1	-	1	2	-	-	2	2	1

PED19901 **INDUSTRIAL SAFETY** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- give exposure to various industrial safety equipment's and methods.
- understand tools used for maintenance cost and services life of equipment.
- analyze the types, causes, effects of wear reduction methods.
- enhance awareness of fault tracing concept and maintenance and types of faults in machine tools and their general causes.
- develop rudimentary ability on periodic inspection concept and needs of various mechanical and electrical equipment's.

Prerequisite: Nil

UNIT I INDUSTRIAL SAFETY **9**

Accident, causes, types, results and control, mechanical and electrical hazards; types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety; wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes; Fire prevention and firefighting, equipment and methods.

UNIT II FUNDAMENTALS OF MAINTENANCE ENGINEERING **9**

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department; Types of maintenance - Types and applications of tools used for maintenance; Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT III WEAR AND CORROSION AND THEIR PREVENTION **9**

Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications; i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication; Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT IV FAULT TRACING **9**

Fault tracing-concept and importance, decision tree concept, need and applications; sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive; thermal and electrical equipment's like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT V PERIODIC AND PREVENTIVE MAINTENANCE **9**

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes; overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor; repair

complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment; advantages of preventive maintenance. Repair cycle concept and importance.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon the completion of this course, the students will be able to

- differentiate the types of accident causes and preventive steps of industrial safety.
- assess the various types and applications of tools used for maintenanceand its relation with economy.
- analyze the factors affect the corrosion and its prevention methods.
- identify the types of faults in machine tools and their general causes.
- analyze the various preventive maintenance of mechanical and electrical equipment's and repair cycle concepts.

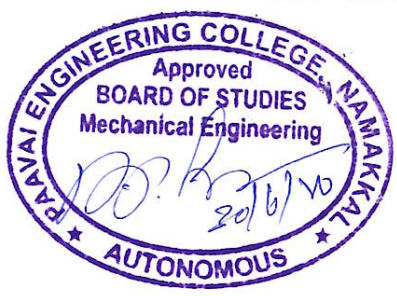
REFERENCES

1. Foundation Engineering Handbook, Hans F.Winterkorn, Hsai-yang fang, Chapman & Hall publishers London 2010.
2. Pump-hydraulic Compressors, Audels, Tata MC Graw hill Publication 2003.
3. Industrial Maintenance , H. P. Garg, S. Chand Ltd., 1987.
4. Maintenance Engineering Handbook, Higgins & Morrow, Tata MC Graw hill 1977.

Co-Po Mapping:

Mapping of Course Objectives with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	-	-	3	-	3	2	-	-	-	2	-
CO2	3	-	2	3	-	2	-	3	3	-	-	-	2	-
CO3	3	-	2	3	3	3	-	3	-	-	-	-	2	-
CO4	3	-	2	3	-	3	-	3	-	-	-	-	2	-
CO5	3	-	2	3	3	3	-	3	-	3	-	-	2	-



PED19902 **COMPOSITE MATERIALS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to,

- give exposure on composite materials and functional requirements of reinforcement matrix.
- understand the mechanical behavior of composites and its preparation methods.
- understand various manufacturing methods of metal matrix composites.
- develop the different preparation of moulding methods.
- enhance the awareness of laminar failure criteria

Prerequisite: Nil

UNIT I INTRODUCTION **9**

Definition – Classification and characteristics of Composite materials; Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT II REINFORCEMENTS **9**

Preparation-layup, curing, properties and applications of glass fibers; carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers; particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT III MANUFACTURING OF METAL MATRIX COMPOSITES **9**

Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing; Properties and applications. Manufacturing of Ceramic Matrix Composites; Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites; Knitting, Braiding, Weaving. Properties and applications.

UNIT IV MANUFACTURING OF POLYMER MATRIX COMPOSITES **9**

Preparation of Moulding compounds and prepregs; hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT V STRENGTH **9**

Laminar Failure Criteria-strength ratio, maximum stress criteria; maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon the completion of this course, the students will be able to

- apply the effect of reinforcement on overall composite performance.
- assess the mechanical behavior of composites, reinforcement properties and its applications.
- analyze the properties and applications of different metal matrix composites manufacturing.

- implement various manufacturing methods of polymer matrix composites and its applications.
- identify the various failure appeared in the composite laminate.

REFERENCES

1. Composite Materials Design and Applications – Danial Gay, 3rd edition, CRC press, taylor and francise grove 2014.
2. Composite Materials Science and Applications – Deborah D.L. Chung, 2nd edition, springer 2010.
3. Composite Materials – Science and Engineering K.K.Chawla, 2nd edition, springer, 1998
4. Hand Book of Composite Materials-edited by George Lubin , 1st edition , van Nostrandreinhold company inc 1982.

Co-Po Mapping:

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	2	-
CO2	3	2	3	-	-	2	-	-	-	-	-	1	3	-
CO3	3	2	2	-	2	-	-	-	-	-	-	1	3	-
CO4	3	2	2	-	2	-	-	-	-	-	-	1	3	-
CO5	3	2	2	-	-	-	-	-	-	-	-	1	3	-

PED19903 **WASTE TO ENERGY** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to,

- give exposure on energy from industrial waste.
- understand the manufacture of charcoal and pyrolytic oil and gases.
- develop biomass gasification design, construction and operation.
- enhance the knowledge in fluidized bed combustors and operation of biomass combustors.
- impart the knowledge on biogas plant technology and biomass conversion processes.

Prerequisite: Nil

UNIT I INTRODUCTION TO ENERGY FROM WASTE **9**

Classification of waste as fuel – Agro based, Forest residue, Industrial waste; MSW – Conversion devices – Incinerators, gasifiers, digestors.

UNIT II BIOMASS PYROLYSIS **9**

Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application –manufacture of pyrolytic oils and gases; yields and applications.

UNIT III BIOMASS GASIFICATION **9**

Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers; Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power; Equilibrium and kinetic consideration in gasifier operation.

UNIT IV BIOMASS **9**

Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors; Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation; Operation of all the above biomass combustors.

UNIT V BIO GAS **9**

Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features; Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification; pyrolysis and liquefaction - biochemical conversion - anaerobic digestion; Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon the completion of this course, the students will be able to

- differentiate the types of conversion devices and energy from waste.
- assess the various methods of manufacturing of pyrolytic oils and its applications.

- analyze the different biomass gasifier and factor considered in gasifier operations.
- identify the operations, types and design consideration of fluidized bed combustor.
- analyze the different bio gas plant, application and urban waste energy conversion.

REFERENCES

1. Non Conventional Energy, Ashok V., Desai, New age international, 1990.
2. Biogas Technology - A Practical Hand Book –K.C. Khandelwal, and S.S.Mahdi, Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1989.
3. Food, Feed and Fuel from Biomass, Devindersingh.Chahal, IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, Charles. Y. WereKo-Brobby and Essel. B. Hagan, John Wiley & Sons, Newyork 1996.

Co-Po Mapping:

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3–Strong, 2–Medium, 1–Weak

Cos	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	3	3	-	-	-	-	2	3	-
CO2	-	-	3	3	-	3	3	-	-	-	-	2	3	-
CO3	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO4	-	-	3	2	-	3	3	-	-	-	-	2	3	-
CO5	-	-	3	2	-	3	3	-	-	-	-	2	3	-

PSE19901 COST MANAGEMENT OF ENGINEERING PROJECTS 3 0 0 3

COURSE OBJECTIVES

To enable the students to,

- understand the costing concepts and their role in decision making
- apply project management concepts while selecting various projects
- interpret costing concepts with project execution
- analyze costing techniques and various budgetary control techniques which used in service sector
- compute solution for quantitative techniques in cost management

Prerequisite: Nil

UNIT I INTRODUCTION 9

Costing System- Objectives of a Costing System, Cost concepts in decision-making, Relevant cost, Differential cost, Incremental cost and Opportunity cost; Creation of a Database for operational control.

UNIT II PROJECT MANAGEMENT 9

Project - meaning, Different types, why to manage, cost overruns centres, various stages of project execution, conception to commissioning; Project execution as conglomeration of technical and nontechnical activities, Detailed Engineering activities, Pre project execution main clearances and documents; Project team- Role of each member; Importance Project site- Data required with significance, Project contracts.

UNIT III PROJECT EXECUTION AND COSTING CONCEPT 9

Project execution - Project cost control, Bar charts and Network diagram, Project commissioning; mechanical and process, Cost Behavior and Profit Planning - Marginal Costing, Distinction between Marginal Costing and Absorption Costing, Break-even Analysis, Cost-Volume-Profit Analysis, Various decision-making problems; Pricing strategies- Pareto Analysis, Target costing, Life Cycle Costing.

UNIT IV COSTING OF SERVICE SECTOR AND BUDGETERY CONTROL 9

Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Activity- Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis; Budgetary Control- Flexible Budgets; Performance budgets; Zero-based budgets.

UNIT V QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT 9

Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon the completion of this course, the students will be able to

- apply the costing concepts in decision making
- select various projects based on project management concepts

- execute the project with optimum costing concept
- use costing techniques and various budgetary control techniques in service sector
- solve quantitative techniques CPM/PERT in cost management.

REFERENCES

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi, 2018.
2. Charles T. Horngren and George Foster, Advanced Management Accounting, Prentice Hall of India, 2011.
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting, e-book.
4. Vohra N.D., Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd, 2007.
5. Cost management by Dr. J. Made Gowda, Himalaya Publishing House, 2013.

Co-Po Mapping:

Mapping of Course Objectives with Programme Outcomes:

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CO1	2	1	2	-	2	-	-	2	3	-	3	2	1	-
CO2	2	2	2	-	2	-	-	-	2	-	3	3	-	2
CO3	3	1	3	-	3	1	-	-	-	-	3	3	-	1
CO4	3	2	3	-	3	-	3	-	-	-	3	2	1	2
CO5	3	2	2	-	3	1	2	-	-	-	3	3	1	2