PAAVAI ENGINEERNG COLLEGE (Autonomous)
M.E. - ENGINEERING DESIGN
REGULATIONS 2023
(CHOICE BASED CREDIT SYSTEM)
CURRICULUM
(For the candidates admitted during the Academic Year 2023-24)

SEMESTER - I

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	PED23101	Advanced Engineering Materials	3	0	0	3
2	PC	PED23102	Concepts of Engineering Design	3	0	0	3
3	PC	PED23103	Computer Applications in Design	3	0	0	3
4	PC	PED23104	Vibration Analysis and Control	3	1	0	4
5	MC	PEN23101	Research Methodology and IPR	3	0	0	3
6	PE	PED23***	Professional Elective I	3	0	0	3
7	AC	PAC23101	English for Research Paper Writing (Audit Course I)	2	0	0	0
Practical							
1	PC	PED23105	Computer Aided Design Laboratory	0	0	4	2
			TOTAL	**20**	**1**	**4**	**21**

SEMESTER – II

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	PED23201	Finite Element Methods in Mechanical Design	3	1	0	4
2	PC	PED23202	Integrated Product Development	3	0	0	3
3	PC	PED23203	Mechanical Behavior of Materials	3	0	0	3
4	PC	PED23204	Advanced Mechanics of Materials	3	1	0	4
5	PE	PED23***	Professional Elective II	3	0	0	3
6	PE	PED23***	Professional Elective III	3	0	0	3
7	AC	PAC23201	Pedagogy Studies (Audit Course II)	2	0	0	0
Practical							
1	PC	PED23205	Simulation and Analysis Laboratory	0	0	4	2
			TOTAL	**20**	**2**	**4**	**22**

SEMESTER - III

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	PC	PED23301	Engineering Fracture Mechanics	3	0	0	3
2	PE	PED23***	Professional Elective IV	3	0	0	3
3	PE	PED23***	Professional Elective V	3	0	0	3
4	OE	PED23***	Open Elective	3	0	0	3
Practical							
1	EE	PED23302	Project Work (Phase I)	0	0	12	6
			TOTAL	**12**	**0**	**12**	**18**

SEMESTER – IV

S.No.	Category	Course Code	Course Title	L	T	P	C
Practical							
1	EE	PED23401	Project Work (Phase II)	0	0	24	12
			TOTAL	**0**	**0**	**24**	**12**

TOTAL CREDITS: 21+22+18+12=73

PROFESSIONAL ELECTIVE COURSES

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	PE	PED23151	Design for Sustainability	3	0	0	3
2.	PE	PED23152	Mechanics of Composite Materials	3	0	0	3
3.	PE	PED23153	Design of Hydraulic and Pneumatic Systems	3	0	0	3
4.	PE	PED23154	Tribology in Design	3	0	0	3
5.	PE	PED23155	Advanced Mechanisms in Design	3	0	0	3
6.	PE	PED23156	Product Lifecycle Management	3	0	0	3
7.	PE	PED23157	Surface Engineering	3	0	0	3
8.	PE	PED23158	Optimization Techniques in Design	3	0	0	3
9.	PE	PED23159	Mechanical Measurements and Analysis	3	0	0	3
10.	PE	PED23160	Design for X	3	0	0	3
11.	PE	PED23161	Vehicle Dynamics	3	0	0	3

S.No	Category	Course Code	Course Title	L	T	P	C
12.	PE	PED23162	Wearable Technologies	3	0	0	3
13.	PE	PED23163	Solid Freeform Manufacturing	3	0	0	3
14.	PE	PED23164	Bio Materials	3	0	0	3
15.	PE	PED23165	Advanced Finite Element Analysis	3	0	0	3
16.	PE	PED23166	Design of Hybrid and Electric Vehicles	3	0	0	3
17.	PE	PED23167	Bearing Design and Rotor Dynamics	3	0	0	3
18.	PE	PED23168	Material Handling Systems and Design	3	0	0	3
19.	PE	PED23169	Artificial Intelligence and Machine Learning	3	0	0	3
20.	PE	PED23170	Industrial Internet of Things	3	0	0	3

OPEN ELECTIVE COURSES

S. No	Category	Course Code	Course Title	L	T	P	C
1	OE	PED23901	Industrial Safety	3	0	0	3
2	OE	PSE23901	Climate change and Adaptation	3	0	0	3
3	OE	PPS23901	Alternate Energy Sources	3	0	0	3
4	OE	PCS23901	Design of Digital Elements	3	0	0	3
5	OE	PCE23901	Big Data Analytics	3	0	0	3

SPECIAL ELECTIVE COURSES

S. No	Category	Course Code	Course Title	L	T	P	C
1	SPE	PMR23001	Materials Characterization Techniques	3	0	0	3
2	SPE	PMR23002	Composite Materials and Testing	3	0	0	3
3	SPE	PMR23003	Soft Computing	3	0	0	3

PED23301	ENGINEERING FRACTURE MECHANICS	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	get familiar with the mechanisms of fracture and crack growth.
2.	know about the elastic crack-tip stress field and crack tip plastic zone.
3.	understand the energy principle involving crack growth and crack- resistance.
4.	gain knowledge on elastic crack-tip stress field and crack tip plastic zone.
5.	learn the mechanism of fatigue crack propagation.

UNIT I	MECHANISMS OF FRACTURE AND CRACK GROWTH	9

Introduction-Cleavage fracture-Ductile fracture-Fatigue cracking-Environment assisted cracking-Service failure analysis.

UNIT II	ELASTIC CRACK-TIP STRESS FIELD AND CRACK TIP PLASTIC ZONE	9

The Airy stress function-Complex stress functions-Solution to crack problems-The effect of finite size-The Irwin plastic zone correction-The Dugdale approach-The shape of the plastic zone.

UNIT III	THE ENERGY PRINCIPLE	9

The energy release rate-The criterion for crack growth-The crack resistance (R curve)-Compliance-The J integral-Tearing modulus-Stability.

UNIT IV	ELASTIC-PLASTIC FRACTURE	9

Fracture beyond general yield-The crack tip opening displacement-The possible use of the CTOD criterion-Experimental determination of CTOD-Parameters affecting the critical CTOD-Limitations, fracture at general yield-Use of the 1 integral-Limitations of the 1 integral-Measurement of J_{IC} and J_R-Closure.

UNIT V	FATIGUE CRACK PROPAGATION	9

Introduction-Crack growth and the stress intensity factor-Factors affecting crack propagation-Variable amplitude service loading-Retardation models-Similitude-Small cracks-Closure.

	TOTAL PERIODS:	**45**

COURSE OUTCOMES At the end of the course, the students will be able to		**BT MAPPED** (Highest Level)
CO1	explain Ductile fracture and Fatigue cracking.	Understanding (K2)
CO2	solve the crack problems related to elastic crack-tip stress field and crack tip plastic zone.	Applying (K3)
CO3	estimate the energy release rate and explain the criterion of crack growth.	Understanding (K2)
CO4	describe elastic-plastic fracture mechanisms like CTOD.	Applying (K3)
CO5	analyze Crack growth and the stress intensity factor.	Applying (K3)

REFERENCES

1. Broek, David, "Elementary Engineering Fracture Mechanics ", Springer Netherlands, 1982.

2. Prashant Kumar, "Elements of Fracture Mechanics", Tata McGraw-Hill Publishing Company Ltd, 2009
3. Tribikram Kundu, "Fundamentals of Fracture Mechanics", Ane Books Pvt. Ltd. New Delhi/ CRC Press, 1st Indian Reprint, 2012
4. Ted L. Anderson, "Fracture Mechanics: Fundamentals and Applications", CRC Taylor and Francis, 4th Edition, 2017.
5. John M.Barson and Stanely T.Rolfe, "Fatigue and fracture control in structures", Butterworth-Heinemann; 3rd edition. 2010.

CO - PO MAPPING

Mapping of Course Outcomes 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**
CO1	3	3	2	2	2	-
CO2	3	3	-	-	2	2
CO3	3	-	2	-	2	2
CO4	3	3	2	2	2	-
CO5	2	2	2	2	3	-

PED23302	PROJECT WORK (PHASE I)	0	0	12	6

COURSE OBJECTIVES

To enable the students to

1.	enhance sufficient hands-on learning experience related to the design, development and analysis of suitable product / process
2.	develop the technical skill sets in the chosen field and also to accustom to research orientation.
3.	develop the methodology to solve the identified problem.
4.	train the students in preparing project reports and to face reviews and viva-voce examination.

SYLLABUS

The student individually works on a specific topic approved by the head of the division under the guidance of a faculty member who is familiar in this area of interest. The student can select any topic which is relevant to the area of engineering design. The topic may be theoretical 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: 180

COURSE OUTCOMES At the end of the course, the students will be able to		BT MAPPED (Highest Level)
CO1	confront challenging practical problem and explore solution by proper procedure using the technical knowledge and professional approach.	Understanding (K2)
CO2	conduct experiments / Design and Analysis / solution iterations and document the results in the form of technical report / presentation.	Applying (K3)
CO3	undertake problem identification, formulation and solution.	Applying (K3)
CO4	design engineering solutions to complex problems utilising a systems approach	Applying (K3)

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COs	Programme Outcomes(POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	3	2	2	2
CO2	2	2	3	2	2	2
CO3	2	2	3	2	2	2
CO4	2	2	3	2	2	2

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PED23401	PROJECT WORK (PHASE II)	0	0	24	12

COURSE OBJECTIVES

To enable the students to

1.	the project work shall be based on the knowledge acquired by the student during the course and preferably it should meet and contribute towards the needs of the society
2.	the project aims to provide an opportunity of designing and building complete system or subsystems based on area where the students like the acquire specialized skills.
3.	solve the identified problem based on the formulated methodology.
4.	develop skills to analyze 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 under the same supervisor. 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 based on the report submitted and the viva-voce examination by a panel of examiners including one external examiner.

	TOTAL PERIODS:	**360**

COURSE OUTCOMES At the end of the course, the students will be able to		**BT MAPPED** (Highest Level)
CO1	completion of the project work, the students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology	Understanding (K2)
CO2	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 systemic way	Applying (K3)
CO3	design engineering solutions to complex problems utilising a systems approach	Applying (K3)
CO4	demonstrate the knowledge, skills and attitudes of a professional engineer to take up any challenging practical problem in the field of engineering design and find better solutions to it.	Applying (K3)

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COs	Programme Outcomes(POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	2	2	3	2
CO2	2	3	2	2	3	2
CO3	2	3	2	2	3	2
CO4	2	3	2	2	3	2

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PED23901	INDUSTRIAL SAFETY	3	0	0	3
COURSE OBJECTIVES					
To enable the students to					
1.	give exposure to various industrial safety equipment's and methods.				
2.	understand tools used for maintenance cost and services life of equipment.				
3.	analyze the types, causes, effects of wear reduction methods.				
4.	enhance awareness of fault tracing concept and maintenance and types of faults in machine tools and their general causes.				
5.	develop rudimentary ability on periodic inspection concept and needs of various mechanical and electrical equipment's.				
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 At the end of the course, the students will be able to		**BT MAPPED** (Highest Level)
CO1	differentiate the types of accident causes and preventive steps of industrial safety.	Understanding (K2)
CO2	assess the various types and applications of tools used for maintenance and its relation with economy.	Understanding (K2)
CO3	analyze the factors affect the corrosion and its prevention methods.	Understanding (K2)
CO4	identify the types of faults in machine tools and their general causes.	Applying (K3)
CO5	analyze the various preventive maintenance of mechanical and electrical equipment's and repair cycle concepts.	Applying (K3)

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., Reprint 2010.
4. Maintenance Engineering Handbook, Higgins & Morrow, Tata MC Graw hill 2012.
5. Principles of Industrial Safety Management Understanding the Ws of Safety at Work, "Das Akhil Kumar", January 2020.

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

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