GOVERNMENT COLLEGE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University)
Coimbatore - 641 013

Curriculum For

M. E. ENGINEERING DESIGN

2023

Regulations

OFFICE OF THE CONTROLLER OF EXAMINATIONS
GOVERNMENT COLLEGE OF TECHNOLOGY
THADAGAM ROAD, COIMBATORE - 641 013
PHONE 0422 - 2433355
E.mail: gctcoe@gct.ac.in

VISION

To create outstanding Mechanical Engineers with strong domain knowledge and skills capable of working in an Interdisciplinary environment with exemplary ethical values contributing to society through Innovation, Entrepreneurship and Leadership.

MISSION

- To develop in each student, a strong theoretical and practical knowledge, a global outlook for a sustainable future and problem solving skills.

- To make productive members of interdisciplinary teams, capable of adapting to changing environments of Engineering, technology and society.

- To inculcate critical thinking abilities among students to enhance innovative ideas and entrepreneurial skills, leadership qualities.

- To imbibe moral and ethical values along with leadership qualities in students.

FIRST SEMESTER

S. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY COURSES										
1.	23EDFCZ1	RESEARCH METHODOLOGY AND IPR	FC	40	60	100	3	0	0	3
2.	23EDFC02	APPLIED MATHEMATICS FOR ENGINEERING DESIGN	FC	40	60	100	3	1	0	4
3.	23EDPC01	APPLIED MECHANICS OF MATERIAL	PC	40	60	100	3	1	0	4
4.	23EDPC02	VIBRATION ANALYSIS AND CONTROL	PC	40	60	100	3	1	0	4
5.	23EDPC03	GEOMETRIC DIMENSIONING AND TOLERANCING	PC	40	60	100	3	0	0	3
6.	23EDPEXX	PROFESSIONAL ELECTIVE I	PE	40	60	100	3	0	0	3
7.	23EDACXX	AUDIT COURSE – I	AC	40	60	100	2*	0	0	0
PRACTICAL COURSES										
8.	23EDPC04	VIBRATION LAB	PC	60	40	100	0	0	4	2
TOTAL				**340**	**460**	**800**	**20**	**3**	**4**	**23**

SECOND SEMESTER

S. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY COURSES										
1.	23EDPC05	FINITE ELEMENT METHODS IN MECHANICAL DESIGN	PC	40	60	100	3	1	0	4
2	23EDPC06	COMPUTER APPLICATIONS IN DESIGN	PC	40	60	100	3	0	0	3
3.	23EDPC07	TRIBOLOGY IN DESIGN	PC	40	60	100	3	1	0	4
4.	23EDPEXX	PROFESSIONAL ELECTIVE II	PE	40	60	100	3	0	0	3
5.	23EDPEXX	PROFESSIONAL ELECTIVE III	PE	40	60	100	3	0	0	3
6.	23EDACXX	AUDIT COURSE – II	AC	40	60	100	2	0	0	0
PRACTICAL COURSES										
7.	23EDPC08	SIMULATION LAB	PC	60	40	100	0	0	4	2
8.	23EDEE01	MINI PROJECT	EEC	40	60	100	0	0	4	2
TOTAL				**340**	**460**	**800**	**17**	**2**	**8**	**21**

THIRD SEMESTER

S. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY COURSES										
1	23EDPEXX	PROFESSIONAL ELECTIVE IV	PE	40	60	100	3	0	0	3
2	23EDOEXX	OPEN ELECTIVE	OE	40	60	100	3	0	0	3
PRACTICAL COURSES										
3	23EDEE02	INTERNSHIP / INDUSTRIAL TRAINING	EEC	100	-	100	-	-	*	2
4	23EDEE03	PROJECT PHASE I	EEC	100	100	200	0	0	12	6
TOTAL				**280**	**220**	**500**	**6**	**0**	**12**	**14**

* - FOUR WEEKS OF INTERNSHIP / INDUSTRIAL TRAINING

FOURTH SEMESTER

S. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
PRACTICAL COURSES										
1	23EDEE04	PROJECT PHASE II	EEC	200	200	400	0	0	24	12
TOTAL				**200**	**200**	**400**	**0**	**0**	**24**	**12**

Note:* No Credit Courses **TOTAL CREDITS : 70**

LIST OF PROFESSIONAL ELECTIVES										
S. No	**Course Code**	**Course Title**	**Category**	**CA Marks**	**End Sem Marks**	**Total Marks**	**L**	**T**	**P**	**C**
PROFESSIONAL ELECTIVE I										
1.	23EDPE01	DESIGN FOR SUSTAINABILITY	PE	40	60	100	3	0	0	3
2.	23EDPE02	COMPOSITE MATERIALS AND MECHANICS	PE	40	60	100	3	0	0	3
3.	23EDPE03	DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS	PE	40	60	100	3	0	0	3
4.	23EDPE04	QUALITY CONCEPTS IN DESIGN	PE	40	60	100	3	0	0	3
5.	23EDPE05	SURFACE ENGINEERING	PE	40	60	100	3	0	0	3
PROFESSIONAL ELECTIVE II										
6.	23EDPE06	DESIGN FOR X	PE	40	60	100	3	0	0	3
7.	23EDPE07	DESIGN OF MACHINE TOOL	PE	40	60	100	3	0	0	3
8.	23EDPE08	PRODUCT LIFE CYCLE MANAGEMENT	PE	40	60	100	3	0	0	3
9	23EDPE09	OPTIMIZATION TECHNIQUES IN DESIGN	PE	40	60	100	3	0	0	3
10	23EDPE10	BIO MATERIALS	PE	40	60	100	3	0	0	3
PROFESSIONAL ELECTIVE III										
11	23EDPE11	MECHANICAL MEASUREMENTS AND ANALYSIS	PE	40	60	100	3	0	0	3
12	23EDPE12	VIBRATION CONDITION MONITORING AND CONTROL	PE	40	60	100	3	0	0	3
13	23EDPE13	VEHICLE DYNAMICS	PE	40	60	100	3	0	0	3
14	23EDPE14	ENGINEERING FRACTURE MECHANICS FOR DESIGN	PE	40	60	100	3	0	0	3
15	23EDPE15	WEARABLE DEVICES AND TECHNOLOGIES	PE	40	60	100	3	0	0	3
PROFESSIONAL ELECTIVE IV										
16	23EDPE16	MATERIAL HANDLING SYSTEMS AND DESIGN	PE	40	60	100	3	0	0	3
17	23EDPE17	BEARING DESIGN AND ROTOR DYNAMICS	PE	40	60	100	3	0	0	3
18	23EDPE18	DESIGN OF HYBRID AND ELECTRIC VEHICLES	PE	40	60	100	3	0	0	3
19	23EDPE19	CREATIVITY AND INNOVATION	PE	40	60	100	3	0	0	3
20	23EDPE20	DESIGN OF PRESSURE VESSELS AND PIPING	PE	40	60	100	3	0	0	3

LIST OF OPEN ELECTIVE COURSES

Sl. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	23SEOE01	BUILDING BYE-LAW AND CODES OF PRACTICE	OE	40	60	100	3	0	0	3
2	23SEOE02	PLANNING OF SMART CITIES	OE	40	60	100	3	0	0	3
3	23SEOE03	GREEN BUILDING	OE	40	60	100	3	0	0	3
4	23EEOE04	ENVIRONMENT HEALTH AND SAFETY MANAGEMENT	OE	40	60	100	3	0	0	3
5	23EEOE05	CLIMATE CHANGE AND ADAPTATION	OE	40	60	100	3	0	0	3
6	23EEOE06	WASTE TO ENERGY	OE	40	60	100	3	0	0	3
7	23GEOE07	ENERGY IN BUILT ENVIRONMENT	OE	40	60	100	3	0	0	3
8	23GEOE08	EARTH AND ITS ENVIRONMENT	OE	40	60	100	3	0	0	3
9	23GEOE09	NATURAL HAZARD AND MITIGATION	OE	40	60	100	3	0	0	3
10	23EDOE10	BUSINESS ANALYTICS	OE	40	60	100	3	0	0	3
11	23EDOE11	INTRODUCTION TO INDUSTRIAL SAFETY	OE	40	60	100	3	0	0	3
12	23EDOE12	OPERATIONS RESEARCH	OE	40	60	100	3	0	0	3
13	23MFOE13	OCCUPATIONAL HEALTH AND SAFETY	OE	40	60	100	3	0	0	3
14	23MFOE14	COST MANAGEMENT OF ENGINEERING PROJECTS	OE	40	60	100	3	0	0	3
15	23MFOE15	COMPOSITE MATERIALS	OE	40	60	100	3	0	0	3
16	23TEOE16	GLOBAL WARMING SCIENCE	OE	40	60	100	3	0	0	3
17	23TEOE17	INTRODUCTION TO NANO ELECTRONICS	OE	40	60	100	3	0	0	3
18	23TEOE18	GREEN SUPPLY CHAIN MANAGEMENT	OE	40	60	100	3	0	0	3
19	23PSOE19	DISTRIBUTION AUTOMATION SYSTEM	OE	40	60	100	3	0	0	3
20	23PSOE20	ELECTRICITY TRADING & ELECTRICITY ACTS	OE	40	60	100	3	0	0	3
21	23PSOE21	MODERN AUTOMOTIVE SYSTEMS	OE	40	60	100	3	0	0	3
22	23PEOE22	VIRTUAL INSTRUMENTATION	OE	40	60	100	3	0	0	3
23	23PEOE23	ENERGY MANAGEMENT SYSTEMS	OE	40	60	100	3	0	0	3
24	23PEOE24	ADVANCED ENERGY STORAGE TECHNOLOGY	OE	40	60	100	3	0	0	3
25	23AEOE25	DESIGN OF DIGITAL SYSTEMS	OE	40	60	100	3	0	0	3
26	23AEOE26	BASICS OF NANO ELECTRONICS	OE	40	60	100	3	0	0	3
27	23AEOE27	ADVANCED PROCESSOR	OE	40	60	100	3	0	0	3
28	23VLOE28	HDL PROGRAMMING LANGUAGES	OE	40	60	100	3	0	0	3
29	23VLOE29	CMOS VLSI DESIGN	OE	40	60	100	3	0	0	3
30	23VLOE30	HIGH LEVEL SYNTHESIS	OE	40	60	100	3	0	0	3
31	23CSOE31	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	OE	40	60	100	3	0	0	3
32	23CSOE32	COMPUTER NETWORK ENGINEERING	OE	40	60	100	3	0	0	3
33	23CSOE33	BIG DATA ANALYTICS	OE	40	60	100	3	0	0	3

LIST OF AUDIT COURSES

(Common to all branches)

S. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	HOURS			
							L	T	P	C
1	23EDACZ1	ENGLISH FOR RESEARCH PAPER WRITING	AC	40	60	100	2	0	0	0
2	23EDACZ2	DISASTER MANAGEMENT	AC	40	60	100	2	0	0	0
3	23EDACZ3	VALUE EDUCATION	AC	40	60	100	2	0	0	0
4	23EDACZ4	CONSTITUTION OF INDIA	AC	40	60	100	2	0	0	0
5	23EDACZ5	PEDAGOGY STUDIES	AC	40	60	100	2	0	0	0
6	23EDACZ6	STRESS MANAGEMENT BY YOGA	AC	40	60	100	2	0	0	0
7	23EDACZ7	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	AC	40	60	100	2	0	0	0
8	23EDACZ8	SANSKRIT FOR TECHNICAL KNOWLEDGE	AC	40	60	100	2	0	0	0

SUMMARY OF CREDIT DISTRIBUTION

S.No	Course / Subject Area	Credits					Percentage
		I SEM	IISEM	IIISEM	IVSEM	Total	
1.	FC	7	0	0	0	07	**10 %**
2.	PC	13	13	0	0	26	**37.14%**
3.	PE	3	6	3	0	12	**17.14 %**
4.	OE	0	0	3	0	03	**4.29 %**
5.	AC	0	0	0	0	(Non Credit)	**0%**
6.	EEC	0	2	8	12	22	**31.42 %**
Total Credits		**23**	**21**	**14**	**12**	**70**	**100.00%**

CATEGORY-WISE CREDIT DISTRIBUTION

FUNDAMENTAL COURSE (FC)

S. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1.	23EDFCZ1	RESEARCH METHODOLOGY AND IPR	FC	40	60	100	3	0	0	3
2.	23EDFC02	APPLIED MATHEMATICS FOR ENGINEERING DESIGN	FC	40	60	100	3	1	0	4
Total				**80**	**120**	**200**	**6**	**1**	**0**	**7**

PROFESSIONAL CORE (PC)

S. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1.	23EDPC01	APPLIED MECHANICS OF MATERIAL	PC	40	60	100	3	1	0	4
2.	23EDPC02	VIBRATION ANALYSIS AND CONTROL	PC	40	60	100	3	1	0	4
3.	23EDPC03	GEOMETRIC DIMENSIONING AND TOLERANCING	PC	40	60	100	3	0	0	3
4.	23EDPC04	VIBRATION LAB	PC	60	40	100	0	0	4	2
5.	23EDPC05	FINITE ELEMENT METHODS IN MECHANICAL DESIGN	PC	40	60	100	3	1	0	4
6.	23EDPC06	COMPUTER APPLICATIONS IN DESIGN	PC	40	60	100	3	0	0	3
7.	23EDPC07	TRIBOLOGY IN DESIGN	PC	40	60	100	3	1	0	4
8.	23EDPC08	SIMULATION LAB	PC	60	40	100	0	0	4	2
Total				**360**	**440**	**800**	**18**	**4**	**8**	**26**

PROFESSIONAL ELECTIVE (PE)

S. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1.	23EDPEXX	PROFESSIONAL ELECTIVE I	PE	40	60	100	3	0	0	3
2.	23EDPEXX	PROFESSIONAL ELECTIVE II	PE	40	60	100	3	0	0	3
3.	23EDPEXX	PROFESSIONAL ELECTIVE III	PE	40	60	100	3	0	0	3
4.	23EDPEXX	PROFESSIONAL ELECTIVE IV	PE	40	60	100	3	0	0	3
Total				**160**	**240**	**400**	**12**	**0**	**0**	**12**

OPEN ELECTIVE (OE)

S. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1.	23EDOEXX	OPEN ELECTIVE	OE	40	60	100	3	0	0	3
Total				**40**	**60**	**100**	**3**	**0**	**0**	**3**

AUDIT COURSE (AC)

S. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1.	23EDACXX	AUDIT COURSE - I	AC	40	60	100	2	0	0	0
2.	23EDACXX	AUDIT COURSE - II	AC	40	60	100	2	0	0	0
Total				**80**	**120**	**200**	**4**	**0**	**0**	**0**

EMPLOYABILITY ENHANCEMENT COURSE (EEC)

S. No	Subject Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
1	23EDEE01	MINI PROJECT	EEC	40	60	100	0	0	4	2
2	23EDEE02	INDUSTRIAL TRAINING	EEC	100	0	100	0	0	**	2
3	23EDEE03	PROJECT PHASE - I	EEC	100	100	200	0	0	12	6
4	23EDEE04	PROJECT PHASE - II	EEC	200	200	400	0	0	24	12
				440	**360**	**800**	**0**	**0**	**40**	**22**

**4 WEEKS OF INTERNSHIP / INDUSTRIAL TRAINING

23EDFCZ1	RESEARCH METHODOLOGY AND IPR (Common to all branches)	I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	FC	3	0	0	3

Course Objectives	1.To impart knowledge on research methodology ,Quantitative methods for problem solving, data interpretation and report writing 2. To know the importance of IPR and patent rights.	
UNIT – I	**INTRODUCTION**	**9 Periods**
Definition and objectives of Research – Types of research, Various Steps in Research process, Mathematical tools for analysis, Developing a research question-Choice of a problem Literature review, Surveying, synthesizing, critical analysis, reading materials, reviewing, rethinking, critical evaluation, interpretation, Research Purposes, Ethics in research – APA Ethics code.		
UNIT – II	**QUANTITATIVE METHODS FOR PROBLEM SOLVING**	**9 Periods**
Statistical Modelling and Analysis, Time Series Analysis Probability Distributions, Fundamentals of Statistical Analysis and Inference, Multivariate methods, Concepts of Correlation and Regression, Fundamentals of Time Series Analysis and Spectral Analysis, Error Analysis, Applications of Spectral Analysis.		
UNIT – III	**DATA DESCRIPTION AND REPORT WRITING**	**9 Periods**
Tabular and graphical description of data: Tables and graphs of frequency data of one variable, Tables and graphs that show the relationship between two variables , Relation between frequency distributions and other graphs, preparing data for analysis. Structure and Components of Research Report, Types of Report, Layout of Research Report, Mechanism of writing a research report, referencing in academic writing.		
UNIT – IV	**INTELLECTUAL PROPERTY**	**9 Periods**
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.		
UNIT – V	**PATENT RIGHTS**	**9 Periods**
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.		
Lecture: 45 Periods Tutorial:0 Periods Practical: 0 Periods Total:45 Periods		

REFERENCES

1	*Stuart Melville and Wayne Goddard,* ***"Research methodology: an introduction for science & engineering students",*** *Juta Academic, 1996.*
2	*Donald H.McBurney and Theresa White,* ***"Research Methods",*** *9th Edition, engageLearning, 2013.*
3	*RanjitKumar,* ***"Research Methodology: A Step by Step Guide for Beginners",*** *5th Edition, 2014.*
4	*Dr. C. R. Kotharia and GauravGarg,* ***"Research Methodology: Methods and Trends",*** *New age international publishers, Fourth Edition, 2018.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Formulate research question for conducting research.	K4
CO2	Analyze qualitative and quantitative data.	K4
CO3	Interpret research findings and give appropriate conclusions.	K4
CO4	Develop a structured content to write technical report.	K4
CO5	Summarize the importance of IPR and protect their research work through intellectual property.	K4

Course Articulation Matrix					
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1	2	1	1	2
CO2	2	-	-	-	-
CO3	3	3	3	2	2
CO4	2	2	2	2	2
CO5	1	1	1	1	1
23EDFCZ1	2	2	1	2	2
1 – Slight, 2 – Moderate, 3 – Substantial					

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	40	40	20	-	-	-	100
CAT2	40	40	20	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	50	30	20	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	50	30	20	-	-	100
ESE	30	30	20	20	-	-	100

23EDFC02	APPLIED MATHEMATICS FOR ENGINEERING DESIGN	I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	FC	3	1	0	4

Course Objectives	1. To gain the concepts of Correlation and Regression. 2. To gain the knowledge of test of hypothesis applicable to small and large samples. 3. To be familiar with numerical solutions of algebraic, transcendental equation and system of linear equations. 4. To acquire knowledge of numerical solution to first order ordinary differential equations using single and multi-step techniques. 5.To gain the knowledge of numerical solution to second order partial differential equations using explicit and implicit methods.	
UNIT – I	**CORRELATION AND REGRESSION**	**9 Periods**
Correlation coefficients- Equation of the lines of regression, Regression coefficients, Regression curves-Multiple and Partial correlation, Partial regression.		
UNIT – II	**TESTING OF HYPOTHESIS**	**9 Periods**
Large samples: Tests for Mean and proportions, Small samples: Tests for Mean, Variance and Attributes using t, F, Chi–Square distribution.		
UNIT – III	**NUMERICAL SOLUTION OF EQUATIONS, LINEAR SYSTEM AND INVERSE OF MATRIX**	**9 Periods**
Newton-Raphson method for single variable and simultaneous equations with two variables- Solution of linear system by Gauss elimination, Gauss-Jordan, Crout's and Gauss Seidal Methods – Matrix inversion: Gauss elimination and Gauss-Jordan methods.		
UNIT – IV	**NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**	**9 Periods**
Single step methods: Taylor's series method – Euler's method – Modified Euler's method – Runge - Kutta method of fourth order - Multi step methods: Miline's Predictor and Corrector methods: Adam Bashforth predictor and corrector method. Numerical solution of ordinary differential equation by finite difference method.		
UNIT – V	**NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS**	**9 Periods**
Finite difference solution for two-dimensional Laplace equation: Gauss Jacobi and Gauss Seidal methods – Poisson equation. Finite difference method for one dimensional heat equation: Parabolic equation – Hyperbolic Equation.		
Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods		

REFERENCES

1	*VeerarajanT.,* ***Probability and Statistics, Random Processes and Queuing Theory (First edition)****, Graw Hill Education(India) Pvt Ltd., New Delhi, Fourth Edition,2018.*
2	*P. Kandasamy, K. Thilagavathy, K. Gunavathi,* ***Numerical Methods****, S. Chand & Company, 3nd Edition, Reprint 2013.*
3	*Trivedi K.S,* ***Probability and Statistics with Reliability, Queuing and Computer Science Applications****, Prentice Hall of India, New Delhi.*
4.	*P. Kandasamy, K. Thilagavathy, K. Gunavathi,* ***Numerical Methods****, S. Chand & Company, 3nd Edition, Reprint 2013.*

5.	*S.S. Sastry,* ***Introductory methods of numerical analysis****, PHI, New Delhi, 5th Edition, 2015. Ward Cheney.*
6.	*S. Larsson, V. Thomee,* ***Partial Differential Equations with Numerical Methods****, Springer, 2003.*
7.	*B.S.Grewal,* ***Higher Engineering Mathematics****, Khanna Publishers, New Delhi, 44thEdition, 2018.*
8.	*Gupta S.C and Kapoor V.K.,* ***Fundamentals of Mathematical Statistics****, Sultan Chand & Sons, New Delhi, 2015.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Describe how correlation is used to identify relationships between variables and how regression analysis is used to predict outcomes.	K5
CO2	Test for significance of hypothesis connected to small and large samples using different parameters.	K5
CO3	Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to polynomial and transcendental equations, the solution of system linear equations.	K5
CO4	Construct one-step and multistep methods for the numerical solution of initial-value problems for ordinary differential equations and systems of such equations.	K5
CO5	To acquire the knowledge of principles for designing numerical schemes for PDEs in particular finite difference schemes, interpret solutions in a physical context of wave and heat equation in specified techniques.	K5

Course Articulation Matrix					
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	1		
CO2	3	2	1		
CO3	3	2	1		
CO4	3	2	1		
CO5	3	2	1		
23EDFC02	3	2	1		
1 – Slight, 2 – Moderate, 3 – Substantial					

Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	20	30	20	15	15		100
CAT2	20	30	15	15	20		100
Assignment 1		30	25	20	25		100
Assignment 2		30	20	30	20		100
ESE	10	30	20	10	30		100

23EDPC01	APPLIED MECHANICS OF MATERIALS	I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	1	0	4

Course Objectives	1. To learn the concepts of theory of elasticity in three-dimensional stress system. 2. To study the shear center of various cross-sections and deflections in beams subjected to unsymmetrical bending. 3. To learn the stresses in flat plates and curved members. 4. To study torsional stress of non-circular sections. 5. To learn the stresses in rotating members, contact stresses in point and line contact applications.	
UNIT – I	**ELASTICITY**	**9 Periods**
Stress-Strain relations and general equations of elasticity in Cartesian, Polar and curvilinear coordinates, differential equations of equilibrium-compatibility-boundary conditions-representation of three-dimensional stress of a tension generalized hook's law - St. Venant's principle - plane stress - Airy's stress function. Energy methods.		
UNIT – II	**SHEAR CENTER AND UNSYMMETRICAL BENDING**	**9 Periods**
Location of shear center for various sections - shear flows. Stresses and deflections in beams subjected to unsymmetrical loading-kern of a section		
UNIT – III	**CURVED FLEXIBLE MEMBERS AND STRESSES IN FLAT PLATES**	**9 Periods**
Circumference and radial stresses - deflections-curved beam with restrained ends-closed ring subjected to concentrated load and uniform load-chain links and crane hooks. Stresses in circular and rectangular plates due to various types of loading and end conditions, buckling of plates.		
UNIT – IV	**TORSION OF NON-CIRCULAR SECTIONS**	**9 Periods**
Torsion of rectangular cross section - St.Venants theory - elastic membrane analogy Prandtl's stress function.		
UNIT – V	**STRESSES DUE TO ROTARY SECTIONS AND CONTACT STRESSES**	**9 Periods**
Radial and tangential stresses in solid disc and ring of uniform thickness and varying thickness. Methods of computing contact stress-deflection of bodies in point and line contact applications.		
Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total:60 Periods		

REFERENCES

1	*Seely and Smith,"**Advanced Mechanics of Materials**", John Wiley International Edn.*
2	*Sadhusingh, "**Theory of Elasticity**",Khanna Publishers, 2003.*
3	*Timoshenko and Goodier, "**Theory of Elasticity**", McGraw Hill, 2010*
4	*Wang, "**Applied Elasticity**", McGraw Hill, 2007*
5	*J.Case,L.Chilver and Carl T.F "**Strength of Materials and structures**", Arnold publisher 1999.*
	*Robert D. Cook, Warren C. Young, "**Advanced Mechanics of Materials**", Mc-millan pub. Co., 1985.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Apply the concepts of theory of elasticity in three-dimensional stress system.	K4
CO2	Determine the shear centre of various cross-sections and deflections in beams subjected to unsymmetrical bending.	K4
CO3	Evaluate the stresses in flat plates and curved members.	K4
CO4	Calculate torsional stress of non-circular sections.	K4
CO5	Determine the stresses in rotating members, contact stresses in point and line contact applications.	K4

Course Articulation Matrix

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1	2	2	-	-
CO2	-	2	2	-	-
CO3	1	2	2	1	1
CO4	1	2	2	-	-
CO5	-	2	2	1	1
23EDPC01	1	2	2	1	1
1 – Slight, 2 – Moderate, 3 – Substantial					

Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	25	25	25	25			100
CAT2	20	25	25	30			100
Assignment 1	25	30	25	20			100
Assignment 2	30	20	30	20			100
ESE	20	30	20	30			100

23EDPC02	VIBRATION ANALYSIS AND CONTROL	I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	1	0	4

Course Objectives	1.To appreciate the basic concepts of vibration in damped and undamped systems. 2.To calculate the natural frequencies and mode shapes of the two-degree freedom systems. 3.To determine the natural frequencies and mode shapes of the multi degree freedom and continuous systems. 4.To learn the fundamentals of control techniques of vibration and noise levels. 5.To use the instruments for the measuring and analyzing the vibration levels in a body.	
UNIT – I	**FUNDAMENTALS OF VIBRATION**	**9 Periods**
Introduction -Sources of Vibration-Mathematical Models- Displacement, velocity and Acceleration-Review of Single Degree Freedom Systems -Vibration isolation Vibrometers and accelerometers -Response to Arbitrary and non- harmonic Excitations – Transient Vibration – Impulse loads -Critical Speed of Shaft-Rotor systems.		
UNIT – II	**TWO DEGREE OF FREEDOM SYSTEM**	**9 Periods**
Simple harmonic motion, definition of terminologies, Newton's Laws, D'Alembert's principle, Energy methods. Free vibrations, free damped vibrations, and forced vibrations with and without damping, base excitation.		
UNIT – III	**MULTI-DEGREES OF FREEDOM SYSTEMS**	**9 Periods**
Two degrees of freedom systems, Static and dynamic couplings, eigen values, eigen vectors and orthogonality conditions of eigen vectors, Vibration absorber, Principal coordinates, Principal modes. Hamilton's Principle, Lagrangian equation and their applications.		
UNIT – IV	**VIBRATION CONTROL**	**9 Periods**
Specification of Vibration Limits –Vibration severity standards- Vibration as condition Monitoring tool - Vibration Isolation methods - Dynamic Vibration Absorber, Torsional and Pendulum Type Absorber, Damped Vibration absorbers - Static and Dynamic Balancing- Balancing machines - Field balancing – Vibration Control by Design Modification- - Active Vibration Control		
UNIT – V	**EXPERIMENTAL METHODS IN VIBRATION ANALYSIS**	**9 Periods**
Vibration Analysis Overview - Experimental Methods in Vibration Analysis - Vibration Measuring Instruments - Selection of Sensors - Accelerometer Mountings. Vibration Exciters - Mechanical, Hydraulic, Electromagnetic and Electrodynamics – Frequency Measuring Instruments - System Identification from Frequency Response - Testing for resonance and mode shapes.		
Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total:60 Periods		

REFERENCES:

1	*Timoshenko, S. **"Vibration Problems in Engineering**", John Wiley & Sons, Inc., 1987.*
2	*Meirovitch, L. "**Elements of Vibration Analysis**", McGraw-Hill Inc., 1986.*
3	*Thomson W.T, Marie Dillon Dahleh, "**Theory of Vibrations with Applications**", Prentice Hall, 1997.*
4	*F.S. Tse., I.F. Morse and R.T. Hinkle, "**Mechanical Vibrations**", Prentice-Hall of India, 1985.*
5	*Rao.J.S. and Gupta.K. "**Theory and Practice of Mechanical Vibrations**", Wiley Eastern Ltd., New Delhi, 1999.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Understand the basics of vibration and its importance in engineering field.	K4
CO2	Apply the basic concepts of vibration in damped and undamped systems.	K4
CO3	Identify the reasons for vibrations in engineering systems.	K4
CO4	Design and analyze two and multi-degree vibratory systems.	K4
CO5	Apply vibration measuring instruments, vibration control and analysis techniques in the engineering field.	K4

Course Articulation Matrix					
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1	2	2	-	-
CO2	1	2	2	-	-
CO3	2	2	-	-	-
CO4	1	2	2	2	-
CO5	1	2	2	1	-
23EDPC02	1	2	2	2	-
1 – Slight, 2 – Moderate, 3 – Substantial					

Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	25	25	25	25			100
CAT2	20	25	25	30			100
Assignment 1	25	30	25	20			100
Assignment 2	30	20	30	20			100
ESE	20	30	20	30			100

23EDPC03	GEOMETRIC DIMENSIONING AND TOLERANCING	I

PREREQUISITES	CATEGORY	L	T	P	C
Machine Drawing	PC	3	0	0	3

Course Objectives	1. GD&T, as well as selecting the appropriate symbols and applying general design principles for manufacturability. 2. Datum concept in the field of GD&T. 3.Determining the material conditions and material boundary. 4.Knowledge of the various tolerance types. 5.Knowledge of profile and run out tolerances.	
UNIT – I	**DIMENSIONING, TOLERANCING AND INTRODUCTION TO SYMBOLS, TERMS**	**9 Periods**
Dimensioning Units, Fundamental Dimensioning Rules, Definitions Related to Tolerancing, Single Limits, Maximum Material Condition (MMC), Least Material Condition (LMC), Extreme Form Variation, Basic Fits of Mating Parts, Clearance Fit, Allowance, Clearance, Force Fit, Chain Dimensioning, Baseline Dimensioning, Direct Dimensioning, Alternate Dimensioning Practices. Geometric Dimensioning and Tolerancing for CADD/CAM. Dimensioning Symbols-Dimensioning and Tolerancing Templates. Datum Feature Symbols, Datum Target Symbols, Geometric Characteristic Symbols, Material Boundary Symbols. Feature Control Frame Basic Dimensions Additional Symbols.		
UNIT – II	**DATUMS**	**9 Periods**
Datum Feature Symbol, Reference Frame Concept, Datum Target Symbols, Partial Datum Surface, Coplanar Surface Datums, Datum Axis, Movable Datum Target Symbols and Datum Target Points, Movable Datum Target Symbols and Datum Target Spheres, Datum Center Plane, The Center of a Pattern of Features as the Datum Axis, applying a Translation Modifier to a Datum Reference Using a Contoured Surface as a Datum Feature.		
UNIT – III	**MATERIAL CONDITION AND MATERIAL BOUNDARY**	**9 Periods**
Features of Size, Conventional Tolerance. Limits of Size, Perfect Form Boundary. Regardless of Feature Size (RFS) and Regardless of Material Boundary (RMB). Maximum Material Condition (MMC). Least Material Condition (LMC). Primary Datum Feature, Secondary and Tertiary Datum Feature. Datum Precedence and Material Condition. Placing the MMB value in the Feature Control Frame Material Condition Analysis and Applications Material Boundary Calculation Examples.		
UNIT – IV	**FORM, ORIENTATION AND LOCATION TOLERANCES**	**10 Periods**
Straightness, Flatness, Circularity. Free State Variation. Cylindricity, Applying Form Control to a Datum Feature. Orientation Tolerances -Parallelism, Perpendicularity Tolerance. Combination of Parallelism and Perpendicularity Tolerances. Angularity Tolerance. Application of Orientation Tolerances at RFS, MMC, and Zero Tolerance at MMC. Location Tolerances-Positional Tolerance. Locating Multiple Features, Positional Tolerancing of Coaxial Features, Positional Tolerancing of Nonparallel Holes. Locating Slotted Features, Positional Tolerancing of Spherical Features. Location Tolerances and Virtual Condition. Fasteners, Projected Tolerance Zone, Virtual Condition, Concentricity Tolerance, Positional Tolerancing for Coaxially.		
UNIT – V	**PROFILE TOLERANCES AND RUNOUT TOLERANCES**	**8 Periods**
Profile Tolerances -Non-Uniform Profile Tolerance Zone, Specifying Basic Dimensions in a Note, Combination of Geometric Tolerances. Runout Tolerances-Combination of Geometric Tolerances, Specifying Independency.		
Lecture:45 Periods Tutorial: 0 Periods Practical: 0Periods Total: 45 Periods		

REFERENCES:

1	*Alex Krulikowski,* ***"Fundamentals of Geometric Dimensioning and Tolerancing",*** *Delmar Cengage Learning, 2012.*
2	*P.S.Gill,* ***"Geometric Dimensioning and Tolerancing",****S.K.Kataria& sons, 2013*
3	*Bruce A.Wilson,****"GD&T- Application and Interpretation",****Goodeheart-Willcox, 2019*
4	*James D Meadows,****"Geometric Dimensioning and Tolerancing Handbook",*** *JamesD. Meadows & Associates, 2009.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Select relevant process; apply the general design principles for manufacturability; GD&T	K4
CO2	Applying the concept of datums in GD&T	K4
CO3	Understanding about the material condition and material boundary	K4
CO4	Know the various types of tolerances	K4
CO5	Know about the profile and runout tolerances	K4

Course Articulation Matrix					
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	-	-	2	-
CO2	2	-	2	-	-
CO3	2	2	2	1	2
CO4	-	2	-	2	2
CO5	2	2	-	-	2
23EDPC03	2	2	2	2	2
1 – Slight, 2 – Moderate, 3 – Substantial					

Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	25	25	25	25			100
CAT2	20	25	25	30			100
Assignment 1	25	30	25	20			100
Assignment 2	30	20	30	20			100
ESE	20	30	20	30			100

23EDPC04	VIBRATION LAB	I

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	0	0	4	2

Course Objectives	To supplement the principles learnt in vibration and dynamics of machinery and expose to various measuring devices for vibration analysis.
1	Modal analysis of Simply Supported beam
2	Modal analysis of Cantilever beam
3	Natural frequency and modal analysis of Disc.
4	Amplitude and frequency of simple harmonic motion.
5	Verify the laws of gyroscopic and determination of gyroscopic couple.
6	Find the Whirling speed of given shaft.
7	Governors – determination of sensitivity, effort for Watt, Porter, Proell, governors
8	Determination of Cam jump and generation of Cam profile.
9	Vibrating system – spring mass system analysis.
10	Determination of damping co-efficient of rotary system.
Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total:45 Periods	

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Use signal analyzers for vibrating systems.	K6
CO2	Demonstrate the use of gyroscope and governors.	K6
CO3	Use the knowledge for balancing of machine components.	K6
CO4	Depict the results of experiments in written and graphical format.	K6
CO5	Respond as instructed while working in groups.	K6

Course Articulation Matrix

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	1	2	2	-	1
CO2	1	2	2	1	-
CO3	1	2	2	-	1
CO4	1	2	2	1	-
CO5	1	2	2	-	1
23EDPC04	1	2	2	1	1
1 – Slight, 2 – Moderate, 3 – Substantial					

23EDPE01	DESIGN FOR SUSTAINABLITY	SEMESTER

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	1. GD&T, as well as selecting the appropriate process and applying general design principles for manufacturability. 2. Designing cast and welded components with design concerns in mind. 3. Designing formed and machined components with design concerns in mind. 4. Consider design factors when putting together a system. 5. Consider environmental factors when designing.	
UNIT – I	**INTRODUCTION**	**9 Periods**
Introduction - Economics of process selection - General design principles for manufacturability; Geometric Dimensioning &Tolerance (GD&T) – Form tolerancing: straightness, flatness, circularity, cylindricity – Profile tolerancing: profile of a line, and surface – Orientation tolerancing: angularity, perpendicularity, parallelism – Location tolerancing: position, concentricity, symmetry – run out tolerancing: circular and total – Supplementary symbols.		
UNIT – II	**CAST & WELDED COMPONENTS DESIGN**	**9 Periods**
Design considerations for: Sand cast – Die cast – Permanent mold parts. Arc welding – Design considerations for: Cost reduction – Minimizing distortion – Weld strength – Weldment. Resistance welding – Design considerations for: Spot – Seam – Projection – Flash &Upset weldment.		
UNIT – III	**FORMED & MACHINED COMPONENTS DESIGN**	**9 Periods**
Design considerations for: Metal extruded parts – Impact/Cold extruded parts – Stamped parts –Forged parts. Design considerations for: Turned parts – Drilled parts – Milled, planned, shaped and slotted parts– Ground parts.		
UNIT – IV	**DESIGN FOR ASSEMBLY**	**9 Periods**
Design for assembly – General assembly recommendations – Minimizing the no. of parts – Design considerations for: Rivets – Screw fasteners – Gasket & Seals – Press fits – Snap fits – Automatic assembly – Computer Application for DFMA		
UNIT – V	**DESIGN FOR ENVIRONMENT**	**9 Periods**
Introduction – Environmental objectives – Global issues – Regional and local issues – Basic DFE methods – Design guide lines – Example application – Lifecycle assessment – Basic method – AT&T's environmentally responsible product assessment - Weighted sum assessment method – Lifecycle assessment method – Techniques to reduce environmental impact – Design to minimize material usage – Design for disassembly – Design for recyclability – Design for manufacture – Design for energy efficiency – Design to regulations and standards		
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total:45 Periods		

REFERENCES:

1	*Boothroyd, G, Heartz and Nike,* ***"Product Design for Manufacture",*** *Marcel Dekker, 1994*
2	*Bralla,* ***"Design for Manufacture handbook",*** *McGraw hill, 1999*
3	*Dickson, John. R, and Corroda Poly,* ***"Engineering Design and Design for Manufacture and Structural Approach",*** *Field Stone Publisher, USA, 1995*
4	*Fixel,* ***"J. Design for the Environment",*** *McGraw Hill., 1996*
5	*Kevin Otto and Kristin Wood,* ***"Product Design. Pearson Publication",*** *2009.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Select relevant process; apply the general design principles for manufacturability; GD&T	K4
CO2	Apply design considerations while designing the cast and welded components	K4
CO3	Apply design considerations while designing the formed and machined components	K4
CO4	Apply design considerations for assembled systems.	K4
CO5	Apply design considerations for environmental issues	K4

Course Articulation Matrix					
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1	1	2	2	1
CO2	1	2	2	2	1
CO3	1	2	2	1	1
CO4	2	1	3	2	1
CO5	1	1	1	2	3
23EDPE01	1	1	2	2	1
1 – Slight, 2 – Moderate, 3 – Substantial					

Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	25	25	25	25			100
CAT2	20	25	25	30			100
Assignment 1	25	30	25	20			100
Assignment 2	30	20	30	20			100
ESE	20	30	20	30			100

23EDPE02	COMPOSITE MATERIALS AND MECHANICS	SEMESTER

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	1. The study of various composite materials and the determination of their mechanical strength. 2. Different manufacturing technologies are used to fabricate FRP and other composites. 3. Fiber reinforced stress analysis Laminates for various combinations of plies with various fiber orientations. 4. Stresses in the laminate's lamina calculated using various failure theories 5. The Classical Laminate Theory was used to calculate residual stresses in various types of laminates under thermo-mechanical load.

UNIT – I	INTRODUCTION TO COMPOSITE MATERIALS	9 Periods

Definition-Matrix materials-polymers-metals-ceramics - Reinforcements: Particles, whiskers, inorganic fibers, metal filaments- ceramic fibers- fiber fabrication- natural composite wood, Jute -Advantages and drawbacks of composites over monolithic materials. Mechanical properties and applications of composites, Particulate-Reinforced composite Materials, Dispersion-Strengthened composite, Fiber-reinforced composites Rule of mixtures-Characteristics of fiber-Reinforced composites, Manufacturing fiber and composites,

UNIT – II	MANUFACTURING OF COMPOSITES	9 Periods

Manufacturing of Polymer Matrix Composites (PMCs)-handlay-up, spray technique, filament winding, Pultrusion, Resin Transfer Moulding (RTM)-, bag moulding, injection moulding, Sandwich Mould Composites (SMC) - Manufacturing of Metal Matrix Composites (MMCs) - Solid state, liquid state, vapour state processing, Manufacturing of Ceramic Matrix Composites (CMCs) –hot pressing-reaction bonding process-infiltration technique, direct oxidation- interfaces

UNIT – III	LAMINA CONSTITUTIVE EQUATIONS	9 Periods

Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix, Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

UNIT – IV	LAMINA STRENGTH ANALYSIS AND ANALYSIS OF LAMINATED FLAT PLATES	9 Periods

Introduction - Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies

UNIT – V	THERMO-STRUCURAL ANALYSIS	9 Periods

Fabrication stresses/Residual stresses in FRP laminated composites- Co-efficient of Thermal Expansion (C.T.E.) - Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E's -Stress and Moment Resultants due cooling of the laminates during fabrication-Calculations for thermo-mechanical stresses in FRP laminates

Case studies: Implementation of CLT for evaluating residual stresses in the components made with different isotropic layers such as electronic packages etc.

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total:45 Periods

REFERENCES:

1	*Agarwal BD and Broutman LJ,* ***"Analysis and Performance of Fiber Composites"****, John Wiley and Sons, New York, 1990.*
2	*Gibson R F,* ***Principles of Composite Material Mechanics****, McGraw-Hill, 1994.CRC press, 4th Edition, 2016.*
3	*Hyer MW and Scott R White,* ***"Stress Analysis of Fiber – Reinforced Composite Materials"****, McGraw-Hill, 1998.*
4	*Issac M Daniel and OriIshai,* ***"Engineering Mechanics of Composite Materials",*** *Oxford University Press-2006, First Indian Edition - 2007*
5	*MadhujitMukhopadhyay,* ***"Mechanics of Composite Materials and Structures",*** *University Press (India) Pvt. Ltd., Hyderabad, 2004 (Reprinted 2008)*
6	*Mallick PK,* ***Fiber – Reinforced Composites: Materials, Manufacturing and Design****, CRC Press, 3rd Edition,2019.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Calculate for mechanical strength of the composite material	K4
CO2	Fabricate the FRP and other composites by different manufacturing methods	K4
CO3	Analyze fiber reinforced Laminates for different combinations of plies with different orientations of the fiber.	K4
CO4	Evaluate the stresses in the lamina of the laminate using different failure theories	K4
CO5	Analyze thermo-mechanical behavior and evaluate residual stresses in different types of laminates using the Classical Laminate Theory.	K4

Course Articulation Matrix					
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1	1	1	1	-
CO2	-	-	-	1	-
CO3	-	1	-	2	3
CO4	1	2	1	-	-
CO5	-	1	3	-	-
23EDPE02	1	1	2	1	3
1 – Slight, 2 – Moderate, 3 – Substantial					

Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	25	25	25	25			100
CAT2	20	25	25	30			100
Assignment 1	25	30	25	20			100
Assignment 2	30	20	30	20			100
ESE	20	30	20	30			100

23EDPE03	DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS	SEMESTER

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	1. To provide an overview of the various components of hydraulic systems, as well as their design and selection techniques. 2. To develop a comprehensive grasp of the necessity for and use of different control and regulating components in hydraulic systems. 3. To allow them to construct hydraulic circuits for industrial applications on their own. 4. To familiarize them with the various components of pneumatic systems and to teach them how to construct basic pneumatic systems. 5. To persuade them of the need of integrating electronics, developing low-cost systems, and developing solutions for basic industrial applications.	
UNIT – I	**OIL HYDRAULIC SYSTEMS AND HYDRAULIC ACTUATORS**	**9 Periods**
Hydraulic Power Generators – Selection and specification of pumps, pump characteristics. Linear and Rotary Actuators – selection, specification and characteristics, Hydrostatic drives, types, selection.		
UNIT – II	**CONTROL AND REGULATION ELEMENTS**	**9 Periods**
Pressure - direction and flow control valves - relief valves, non-return and safety valves - actuation systems, Proportional Electro hydraulic servo valves.		
UNIT – III	**HYDRAULIC CIRCUITS**	**9 Periods**
Reciprocation, quick return, sequencing, synchronizing circuits - accumulator circuits - industrial circuits - press circuits - hydraulic milling machine - grinding, planning, copying, - forklift, earth mover circuits design methodology- design and selection of components - safety and emergency mandrels – Cascade method.		
UNIT – IV	**PNEUMATIC SYSTEMS AND CIRCUITS**	**9 Periods**
Pneumatic fundamentals - control elements, position and pressure sensing, Pneumatic equipment's-selection of components - design calculations - logic circuits - switching circuits - fringe conditions modules and these integration - sequential circuits - cascade methods - mapping methods - step counter method - compound circuit design - combination circuit design- Karnaugh - Veitch map.		
UNIT – V	**ELECTROMAGNETIC & ELECTRONIC CONTROL OF HYDRAULICS & PNEUMATIC CIRCUIT**	**9 Periods**
Electrical control of pneumatic circuits – use of relays, counters, timers, ladder diagrams, use of microprocessor in circuit design – use of PLC in hydraulic and pneumatic circuits – Fault finding– application -fault finding - hydro pneumatic circuits - use of microprocessors for sequencing - PLC, Lowcost automation - Robotic circuits.		
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total:45 Periods		

REFERENCES:

1	*Jagadeesha T,* ***"Pneumatics Concepts, Design and Applications ",*** *Universities Press, 2015*
2	*Majumdar, S.R.,* ***"Oil Hydraulics Systems – Principles and Maintenance",*** *Tata McGraw Hill, 2001.*
3	*ShanmugaSundaram.K,* ***"Hydraulic and Pneumatic Controls",****Chand& Co, 2006.*
4	*Anthony Esposito,* ***"Fluid Power with Applications",*** *Prentice Hall, 2009.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Design and select appropriate pumps in industries based on need.	K4
CO2	Select correct sizing and rating of control elements in hydraulics.	K4
CO3	Design basic circuits (hydraulic) for industrial applications.	K4
CO4	Design basic pneumatic circuits for industrial applications.	K4
CO5	Identify and provide solution for troubleshooting and design low cost automation for industrial application.	K4

Course Articulation Matrix					
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	-	1	1	-	-
CO2	-	1	2	1	-
CO3	-	-	1	-	-
CO4	1	-	2	1	1
CO5	-	-	1	-	1
23EDPE03	1	1	1	1	1
1 – Slight, 2 – Moderate, 3 – Substantial					

Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	25	25	25	25			100
CAT2	20	25	25	30			100
Assignment 1	25	30	25	20			100
Assignment 2	30	20	30	20			100
ESE	20	30	20	30			100

23EDPE04	QUALITY CONCEPTS IN DESIGN	SEMESTER

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	1. To teach diverse engineering design ideas, material choices, and production procedures. 2. To study the fundamentals of employing various tools to implement quality in a product or service. 3. To employ failure mode effect analysis to improve product quality and apply ways to maintain the six-sigma status 4. Using multiple design-of-experiment principles to create a solid product or services 5. Maintaining product quality through the use of statistical tools and enforcing measures to increase product reliability.	
UNIT – I	**DESIGN FUNDAMENTALS, METHODS AND MATERIAL SELECTION**	**9 Periods**
Morphology of Design – The Design Process – Computer Aided Engineering – Concurrent Engineering – Competition Bench Marking – Creativity – Theory of Problem solving (TRIZ) – Value Analysis - Design for Manufacture, Design for Assembly – Design for casting, Forging, Metal Forming, Machining and Welding.		
UNIT – II	**DESIGN FOR QUALITY**	**9 Periods**
Quality Function Deployment -House of Quality-Objectives and functions-Targets-Stakeholders-Measures and Matrices-Design of Experiments –design process-Identification of control factors, noise factors, and performance metrics - developing the experimental plan- experimental design – testing noise factors- Running the experiments –Conducting the analysis-Selecting and conforming factor-Set points-reflecting and repeating.		
UNIT – III	**FAILURE MODE EFFECTS ANALYSIS AND DESIGN FOR SIX SIGMA**	**9 Periods**
Basic methods: Refining geometry and layout, general process of product embodiment - Embodiment checklist- Advanced methods: systems modeling, mechanical embodiment principles-FMEA method-linking fault states to systems modeling - Basis of SIX SIGMA – Project selection for SIX SIGMA- SIX SIGMA problem solving- SIX SIGMA in service and small organizations - SIX SIGMA and lean production –Lean SIX SIGMA and services.		
UNIT – IV	**DESIGN OF EXPERIMENTS**	**9 Periods**
Importance of Experiments, Experimental Strategies, Basic principles of Design, Terminology, ANOVA, Steps in Experimentation, Sample size, Single Factor experiments – Completely Randomized design, Randomized Block design, Statistical Analysis, Multifactor experiments - Two and three factor full Factorial experiments, 2K factorial Experiments, Confounding and Blocking designs, Fractional factorial design, Taguchi's approach - Steps in experimentation, Design using Orthogonal Arrays, Data Analysis, Robust Design- Control and Noise factors, S/N ratios		
UNIT – V	**STATISTICAL CONSIDERATION AND RELIABILITY**	**9 Periods**
Frequency distributions and Histograms- Run charts –stem and leaf plots- Pareto Diagrams-Cause and Effect Diagrams-Box plots- Probability Distribution-Statistical Process control–Scatter diagrams – Multivariable charts –Matrix plots and 3-D plots. -Reliability-Survival and Failure-Series and parallel systems-Mean time between failure-Weibull distributions.		
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total:45 Periods		

REFERENCES:

1	*AmitavaMitra,* ***"Fundamentals of Quality control and improvement",*** *John Wiley & Sons, 2016.*
2	*George E. Dieter, Linda C. Schmidt,* ***"Engineering Design",*** *McGraw Hill Education Pvt. Ltd., 2013*
3	*Karl T. Ulrich, Steven D. Eppinger,* ***"Product Design And Development",*** *Tata Mcgraw-Hill Education, 2015*
4	*Montgomery, D.C.,* ***"Design and Analysis of experiments",*** *John Wiley and Sons, 2017.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Apply fundamentals of design process and material selection for developing a quality product	K4
CO2	Apply the quality concepts to develop a robust product	K4
CO3	Perform Failure Mode Effect Analysis on a product and use six sigma principles to enhance its quality	K4
CO4	Apply different experimental design methods in product development	K4
CO5	Implement various statistical tools to improve its quality and reliability	K4

Course Articulation Matrix					
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1	3	3	2	2
CO2	1	2	2	1	2
CO3	2	1	1	-	1
CO4	1	1	2	-	1
CO5	2	2	3	1	2
23EDPE04	1	2	2	1	2
1 – Slight, 2 – Moderate, 3 – Substantial					

Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	25	25	25	25			100
CAT2	20	25	25	30			100
Assignment 1	25	30	25	20			100
Assignment 2	30	20	30	20			100
ESE	20	30	20	30			100

23EDPE05	SURFACE ENGINEERING	SEMESTER

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PE	3	0	0	3

Course Objectives	1. The goal of this course is to learn about the fundamentals of surface characteristics and different forms of friction in metals and non-metals. 2. To investigate the various types of wear mechanisms and the worldwide standards for measuring friction and wear. 3. To investigate the various forms of corrosion and the steps that may be taken to avoid it. 4. To investigate the many forms of surface treatments and surface modification methods. 5. To investigate the various materials utilized in friction and wear applications.	
UNIT – I	**FRICTION**	**9 Periods**
Topography of Surfaces – Surface features – Properties and measurement – Surface interaction – Adhesive Theory of Sliding Friction – Rolling Friction – Friction properties of metallic and nonmetallic materials – Friction in extreme conditions – Thermal considerations in sliding contact.		
UNIT – II	**WEAR**	**9 Periods**
Introduction – Abrasive wear, Erosive, Cavitation, Adhesion, Fatigue wear and Fretting Wear Laws of wear – Theoretical wear models – Wear of metals and non-metals – International standards in friction and wear measurement.		
UNIT – III	**CORROSION**	**9 Periods**
Introduction – Principle of corrosion – Classification of corrosion – Types of corrosion – Factors influencing corrosion – Testing of corrosion – In-service monitoring, Simulated service, Laboratory testing – Evaluation of corrosion – Prevention of Corrosion – Material selection, Alteration of environment, Design, Cathodic and Anodic Protection, Corrosion inhibitors.		
UNIT – IV	**SURFACE TREATMENTS**	**9 Periods**
Introduction – Surface properties, Superficial layer – Changing surface metallurgy – Wear resistant coatings and Surface treatments – Techniques – PVD – CVD – Physical CVD – Ion implantation – Surface welding – Thermal spraying – Laser surface hardening and alloying, laser re-melting, and laser cladding. Applications of coatings and surface treatments in wear and friction control – Characteristics of Wear resistant coatings – New trends in coating technology – DLC – CNC – Thick coatings – Nano-engineered coatings – Other coatings, Corrosion resistant coating.		
UNIT – V	**ENGINEERING MATERIALS**	**9 Periods**
Introduction – Advanced alloys – Super alloys, Titanium alloys, Magnesium alloys, Aluminium alloys, and Nickel based alloys – Ceramics – Polymers – Biomaterials – Applications – Bio Tribology Nano Tribology.		
Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total:45 Periods		

REFERENCES:

1	*G.W.Stachowiak& A.W .Batchelor , **"Engineering Tribology",** Butterworth-Heinemann, UK,2005*
2	*Rabinowicz.E, **"Friction and Wear of materials",** John Willey &Sons,UK,1995*
3	*Halling, J. , **"Principles of Tribology ",**Macmillian – 1984*
4	*Williams J.A. **"Engineering Tribology",** Oxford Univ. Press, 1994*
5	*S.K.Basu, S.N.Sengupta&B.B.Ahuja, **"Fundamentals of Tribology",** Prentice –Hall of India Pvt. Ltd , New Delhi, 2005*
6	*Fontana G., **"Corrosion Engineering",** McGraw Hill, 1985.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Understand the basics of surface features, laws of friction, and different types of friction.	K4
CO2	Develop the knowledge of various wear mechanism and its measurement.	K4
CO3	Understand the types of corrosion and its preventive measures.	K4
CO4	Familiarize the types of surface properties and various surface modification techniques.	K4
CO5	Ability to understand the different types of materials used in the friction and wear applications.	K4

Course Articulation Matrix					
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1	1	2	1	2
CO2	-	1	2	1	-
CO3	1	2	3	-	1
CO4	-	1	2	1	1
CO5	-	-	1	-	-
23EDPE05	1	1	2	1	1
1 – Slight, 2 – Moderate, 3 – Substantial					

Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	25	25	25	25			100
CAT2	20	25	25	30			100
Assignment 1	25	30	25	20			100
Assignment 2	30	20	30	20			100
ESE	20	30	20	30			100

23EDACZ1	ENGLISH FOR RESEARCH PAPER WRITING *(Common to all branches)*	SEMESTER

PREREQUISITES	CATEGORY	L	T	P	C
NIL	AC	2	0	0	0

Course Objectives	The objective of the course is to make the learners understand the format and intricacies involved in writing a research paper.	
UNIT – I	**PLANNING AND PREPARATION**	**6 Periods**
Need for publishing articles, Choosing the journal, Identifying a model journal paper, Creation of files for each section, Expectations of Referees, Online Resources		
UNIT – II	**SENTENCES AND PARAGRAPHS**	**6 Periods**
Basic word in English, Word order in English and Vernacular, placing nouns, Verbs, Adjectives, and Adverb suitably in a sentence, Using Short Sentences, Discourse Markers and Punctuations- Structure of a Paragraph, Breaking up lengthy Paragraphs		
UNIT – III	**ACCURACY, BREVITY AND CLARITY (ABC) OF WRITING**	**6 Periods**
Accuracy, Brevity and Clarity in Writing, Reducing the linking words, Avoiding redundancy, Appropriate use of Relative and Reflexive Pronouns, Monologophobia, verifying the journal style, Logical Connections between others author's findings and yours		
UNIT – IV	**HIGHLIGHTING FINDINGS, HEDGING AND PARAPHRASING**	**6 Periods**
Making your findings stand out, Using bullet points headings, Tables and Graphs- Availing non-experts opinions, Hedging, Toning Down Verbs, Adjectives, Not over hedging, Limitations of your research.		
UNIT – V	**SECTIONS OF A PAPER**	**6 Periods**
Titles, Abstracts, Introduction, Review of Literature, Methods, Results, Discussion, Conclusions, References		
Contact Periods: **Lecture: 30 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 30Periods**		

REFERENCES:

1	*Goldbort R,* ***"Writing for Science",*** *Yale University Press (available on GoogleBooks), 2006.*
2	*Day R,* ***"How to Write and Publish a Scientific Paper"****, Cambridge University Press, 2006.*
3	*Highman N****, "Handbook of Writing for the Mathematical Sciences"****, SIAM. Highman's book, 1998.*
4	*Adrian Wallwork****, "English for Writing Research Papers"****, Springer New York Dordrecht Heidelberg London, 2011.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Understand the need for writing good research paper.	K2
CO2	Practice the appropriate word order, sentence structure and paragraph writing	K4
CO3	Practice unambiguous writing	K3
CO4	Avoid wordiness in writing	K2
CO5	Exercise the elements involved in writing journal paper.	K3

Course Articulation Matrix					
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	1	1	1
CO2	3	3	1	1	1
CO3	3	3	1	1	1
CO4	3	3	1	1	1
CO5	3	3	1	1	1
23EDACZ1	**3**	**3**	**1**	**1**	**1**
1 – Slight, 2 – Moderate, 3 – Substantial					

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	40	40	20	-	-	-	100
CAT2	40	40	20	-	-	-	100
Individual Assessment 1/Case Study 1/Seminar 1/Project 1	-	50	50	-	-	-	100
Individual Assessment 2/Case Study 2/Seminar 2/Project 2	-	50	50	-	-	-	100
ESE	30	30	40	-	-	-	100

23EDACZ2	DISASTER MANAGEMENT *(Common to all branches)*	SEMESTER

PREREQUISITES	CATEGORY	L	T	P	C
NIL	AC	2	0	0	0

Course Objectives	1. To become familiar in key concepts and consequences about hazards, disaster and area of occurrence. 2. To know the various steps in disaster planning. 3. To create awareness on disaster preparedness and management.	
UNIT – I	**INTRODUCTION**	**6 Periods**
Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude. Areas prone to Earthquakes, Floods , Droughts, Landslides ,Avalanches ,Cyclone and Coastal Hazards with Special Reference to Tsunami.		
UNIT – II	**REPERCUSSIONS OF DISASTERS AND HAZARDS**	**6 Periods**
Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.		
UNIT – III	**DISASTER PLANNING**	**6 Periods**
Disaster Planning-Disaster Response Personnel roles and duties, Community MitigationGoals, Pre-Disaster Mitigation Plan, Personnel Training, Comprehensive Emergency Management, Early Warning Systems.		
UNIT – IV	**DISASTER PREPAREDNESS AND MANAGEMENT**	**6 Periods**
Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and other Agencies, Media Reports: Governmental and Community Preparedness.		
UNIT – V	**RISK ASSESSMENT**	**6 Periods**
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment, Strategies for Survival.		
Lecture:30 Periods Tutorial: 0 Periods Practical: 0Periods Total: 30 Periods		

REFERENCES:

1	*R. Nishith, Singh AK, **"Disaster Management In India: Perspectives, Issues And Strategies"**, New Royal book Company, 2007.*
2	*Sahni, PardeepEt.Al. (Eds.), **"Disaster Mitigation Experiences And Reflections"**, Prentice Hall Of India, New Delhi, 2010*
3	*Goel S. L, **"Disaster Administration And Management Text And Case Studies"**, Deep &Deep Publication Pvt. Ltd., New Delhi, 2008.*
4	*Jagbir Singh, **"Disaster Management: Future Challenges And Opportunities"**, I.K. International Publishing House Pvt. Ltd., New Delhi, 2007.*
5	*Damon Coppola **"Introduction To International Disaster Management"**, Butterworth-Heinemann, 2015*
6	*Ryan Lanclos **"Dealing With Disasters: Gis For Emergency Management"**,ESRI Press 2021.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Differentiate hazard and disaster with their significance.	K4
CO2	Analyse the causes and impact of natural and manmade disaster.	K4
CO3	Execute the steps involved in disaster planning.	K4
CO4	Predict vulnerability of disaster and to prevent, mitigate their impact.	K4
CO5	Prepare risk assessment strategy for national and global disaster.	K4

Course Articulation Matrix					
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	1	1	2	2
CO2	1	2	1	1	1
CO3	1	1	1	2	2
CO4	1	1	1	2	2
CO5	2	1	1	2	2
23EDACZ2	1	1	1	2	2
1 – Slight, 2 – Moderate, 3 – Substantial					

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1	50	50					100
CAT2			100				100
Individual Assessment 1/Case Study 1/Seminar 1/Project 1	50	50					100
Individual Assessment 2/Case Study 2/Seminar 2/Project 2			100				100
ESE	25	25	50				100

23EDACZ3	VALUE EDUCATION *(Common to all branches)*	SEMESTER

PREREQUISITES	CATEGORY	L	T	P	C
NIL	AC	2	0	0	0

Course Objectives	1. Value of education and self- development. 2. Requirements of good values in students. 3. Importance of character.	
UNIT – I	**ETHICS AND SELF-DEVELOPMENT**	**6 Periods**
Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non-moral valuation. Standards and principles. Value judgements.		
UNIT – II	**PERSONALITY AND BEHAVIOR DEVELOPMENT**	**6 Periods**
Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance.		
UNIT – III	**VALUES IN HUMAN LIFE**	**6 Periods**
Importance of cultivation of values, Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature,Discipline.		
UNIT – IV	**VALUES IN SOCIETY**	**6 Periods**
True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.		
UNIT – V	**POSITIVE VALUES**	**6 Periods**
Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.		
Lecture:30 Periods Tutorial: 0 Periods Practical: 0Periods Total: 30 Periods		

REFERENCES:

1	*Chakroborty, S.K.* ***"Values and Ethics for organizations Theory and practice"****, Oxford University Press, New Delhi,1998*
2	*Dr.Yogesh Kumar Singh,* ***"Value Education"****, A.P.H Publishing Corporation,New Delhi,2010*
3	*R.P Shukla,* ***"Value Education and Human Rights"****, Sarup and Sons, NewDelhi,2004*
4	*https://nptel.ac.in/courses/109104068/36*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Know the values and work ethics.	K3
CO2	Enhance personality and behaviour development.	K3
CO3	Apply the values in human life.	K3
CO4	Gain Knowledge of values in society.	K3
CO5	Know the importance of positive values in human life.	K3

Course Articulation Matrix					
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1	1	1	2	2
CO2	1	2	1	1	2
CO3	1	2	1	2	2
CO4	1	1	1	2	2
CO5	1	1	2	2	2
23EDACZ3	1	1	1	2	2
1 – Slight, 2 – Moderate, 3 – Substantial					

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1			100				100
CAT2			100				100
Individual Assessment 1/Case Study 1/Seminar 1/Project 1			100				100
Individual Assessment 2/Case Study 2/Seminar 2/Project 2			100				100
ESE			100				100

23EDACZ4	CONSTITUTION OF INDIA *(Common to all branches.)*	SEMESTER

PREREQUISITES	CATEGORY	L	T	P	C
NIL	AC	2	0	0	0

Course Objectives	1. To address the importance of constitutional rights and duties 2. To familiarize about Indian governance and local administration. 3. To know about the functions of election commission.	
UNIT – I	**INDIAN CONSTITUTION**	**6 Periods**
History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working) - Philosophy of the Indian Constitution: Preamble Salient Features.		
UNIT – II	**CONSTITUTIONAL RIGHTS & DUTIES**	**6 Periods**
Contours of Constitutional Rights & Duties: Fundamental Rights , Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.		
UNIT – III	**ORGANS OF GOVERNANCE**	**6 Periods**
Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.		
UNIT – IV	**LOCAL ADMINISTRATION**	**6 Periods**
Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayat raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.		
UNIT – V	**ELECTION COMMISSION**	**6 Periods**
Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.		
Lecture:30 Periods Tutorial: 0 Periods Practical: 0Periods Total: 30 Periods		

REFERENCES:

1	***"The Constitution of India"**, 1950 (Bare Act), Government Publication.*
2	*Dr. S. N. Busi, Dr. B. R. Ambedkar**"Framing of Indian Constitution",** 1st Edition, 2015.*
3	*M. P. Jain, **"Indian Constitution Law",** 7th Edn., Lexis Nexis, 2014.*
4	*D.D. Basu, **"Introduction to the Constitution of India",** Lexis Nexis, 2015.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		Bloom's Taxonomy Mapped
CO1	Discuss the growth of the demand for civil rights in India.	K2
CO2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.	K2
CO3	Know the various organs of Indian governance.	K2
CO4	Familiarize with the various levels of local administration.	K2
CO5	Gain knowledge on election commission of India.	K2

Course Articulation Matrix					
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1	1	1	2	2
CO2	1	1	2	1	2
CO3	1	2	1	1	2
CO4	1	1	1	2	2
CO5	1	1	1	2	2
23EDACZ4	1	1	1	2	2
1 – Slight, 2 – Moderate, 3 – Substantial					

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1		100					100
CAT2		100					100
Individual Assessment 1/Case Study 1/Seminar 1/Project 1		100					100
Individual Assessment 2/Case Study 2/Seminar 2/Project 2		100					100
ESE		100					100

23EDACZ5	**PEDAGOGY STUDIES** *(Common to all branches)*	**SEMESTER**

PREREQUISITES	CATEGORY	L	T	P	C
NIL	AC	2	0	0	0

Course Objectives	1. To Understand of various theories of learning, prevailing pedagogical practices and design of curriculum in engineering studies. 2. Application of knowledge in modification of curriculum, its assessment and introduction of innovation in teaching methodology.	
UNIT – I	**INTRODUCTION**	**6 Periods**
Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.		
UNIT – II	**PEDAGOGICAL PRACTICES**	**6 Periods**
Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education. Evidence on the effectiveness of pedagogical practices Methodology for the in depth stage: quality assessment of included studies.		
UNIT – III	**PEDAGOGICAL APPROACHES**	**6 Periods**
How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teacher's attitudes and beliefs and Pedagogic strategies.		
UNIT – IV	**PROFESSIONAL DEVELOPMENT**	**6 Periods**
Professional development: alignment with classroom practices and follow-up support. Peer support Support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources and large class sizes.		
UNIT – V	**CURRICULUM AND ASSESSMENT**	**6 Periods**
Research gaps and future directions Research design Contexts Pedagogy Teacher education Curriculum and assessment Dissemination and research impact.		
Lecture:30 Periods Tutorial: 0 Periods Practical: 0Periods Total: 30 Periods		

REFERENCES:

1	*Ackers J, Hardman F ,**Classroom interaction in Kenyan primary schools,Compare**, 31 (2): 245-261, 2001.*
2	*Alexander RJ ,**Culture and pedagogy: International comparisons in primary education**. Oxford and Boston: Blackwell, 2001*
3	*Akyeampong K, Lussier K, Pryor J, Westbrook J,**Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count?** International Journal Educational Development, 33 (3): 272–282, 2013.*
4	*Agrawal M ,**Curricular reform in schools: The importance of evaluation**, Journal of Curriculum Studies, 36 (3): 361-379, 2004*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Explain the concept of curriculum, formal and informal education systems and teacher education.	K3
CO2	Explain the present pedagogical practices and the changes occurring in pedagogical approaches	K3
CO3	Know the relation between teacher and community, support from various levels of teachers to students and limitation in resources and size of the class.	K3
CO4	Perform research in design a problem in pedagogy and curriculum development.	K3

Course Articulation Matrix					
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	1	2	1	2	2
CO2	1	1	2	1	1
CO3	1	2	1	1	1
CO4	1	2	1	1	1
23EDACZ5	1	2	1	1	1
1 – Slight, 2 – Moderate, 3 – Substantial					

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1			100				100
CAT2			100				100
Individual Assessment 1/Case Study 1/Seminar 1/Project 1			100				100
Individual Assessment 2/Case Study 2/Seminar 2/Project 2			100				100
ESE			100				100

23EDACZ6	**STRESS MANAGEMENT BY YOGA** *(Common to all branches)*	**SEMESTER**

PREREQUISITES	**CATEGORY**	**L**	**T**	**P**	**C**
NIL	**AC**	**2**	**0**	**0**	**0**

Course Objectives	1. To create awareness on the benefits of yoga and meditation. 2. To understand the significance of Asana and Pranayama.	
UNIT – I	**PHYSICAL STRUCTURE AND ITS FUNCTIONS**	**6 Periods**
Yoga - Physical structure, Importance of physical exercise, Rules and regulation of simplified physical exercises, hand exercise, leg exercise, breathing exercise, eye exercise, kapalapathy, maharasana, body massage, acupressure, body relaxation.		
UNIT – II	**YOGA TERMINOLGIES**	**6 Periods**
Yamas - Ahimsa, satya, astheya, bramhacharya, aparigrahaNiyamas- Saucha, santosha, tapas, svadhyaya, Ishvarapranidhana.		
UNIT – III	**ASANA**	**6 Periods**
Asana - Rules & Regulations – Types & Benefits		
UNIT – IV	**PRANAYAMA**	**6 Periods**
Regularization of breathing techniques and its effects-Types of pranayama		
UNIT – V	**MIND**	**6 Periods**
Bio magnetism& mind - imprinting & magnifying – eight essential factors of living beings, Mental frequency and ten stages of mind, benefits of meditation, such as perspicacity, magnanimity, receptivity, adaptability, creativity.		
Lecture:30 Periods Tutorial: 0 Periods Practical: 0Periods Total: 30 Periods		

REFERENCES:

1	*Janardan Swami Yogabhyasi Mandal,* ***"Yogic Asanas for Group Tarining-Part-I"****, Nagpur.*
2	*Swami Vivekananda, "****Rajayoga or conquering the Internal Nature****", AdvaitaAshrama (Publication Department), Kolkata.*
3	*PanditShambuNath,* ***"Speaking of Stress Management Through Yoga and Meditation"****,New Dawn Press, New Delhi, 2016.*
4	*K. N. Udupa,* ***"Stress and its management by Yoga"****, MotilalBanarsidassPublishers,New Delhi, 2007.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Practice physical exercises and maintain good health.	K3
CO2	Attain knowledge on the various concepts of Yoga.	K3
CO3	Perform various Asanas with an understanding on their benefits.	K3
CO4	Practice breathing techniques in a precise manner.	K3
CO5	Attain emotional stability and higher level of consciousness.	K3

Course Articulation Matrix					
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	-	-	-	2	2
CO2	-	-	-	2	1
CO3	-	-	-	1	2
CO4	-	-	-	2	1
CO5	-	-	-	1	2
23EDACZ6	-	-	-	2	2
1 – Slight, 2 – Moderate, 3 – Substantial					

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1		50	50				100
CAT2			100				100
Individual Assessment 1/Case Study 1/Seminar 1/Project 1		50	50				100
Individual Assessment 2/Case Study 2/Seminar 2/Project 2			100				100
ESE		50	50				100

23EDACZ7	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS *(Common to all branches)*	SEMESTER

PREREQUISITES	CATEGORY	L	T	P	C
NIL	AC	2	0	0	0

Course Objectives	1. To familiar with Techniques to achieve the highest goal in life. 2. To become a person with stable mind, pleasing personality and determination.	
UNIT – I		**6 Periods**
Neetisatakam-Holistic development of personality-Verses- 19,20,21,22 (wisdom)-Verses29,31,32 (pride & heroism)-Verses- 26,28,6.		
UNIT – II		**6 Periods**
Verses- 52,53,59 (dont's)-Verses- 71,73,75,78 (do's). - Approach to day to day work and duties.- Shrimad BhagwadGeeta - Chapter 2-Verses 41, 47,48,		
UNIT – III		**6 Periods**
Shrimad BhagwadGeeta -Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,- Chapter 18-Verses 45, 46, 48.		
UNIT – IV		**6 Periods**
Statements of basic knowledge.-Shrimad BhagwadGeeta: -Chapter2-Verses 56, 62, 68 -Chapter 12 -Verses 13, 14, 15, 16,17, 18-Personality of Role model.		
UNIT – V		**6 Periods**
Shrimad BhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39-Chapter18 – Verses 37,38,63.		
Lecture:30 Periods Tutorial: 0 Periods Practical: 0Periods Total: 30 Periods		

REFERENCES:

1	*Swami SwarupanandaAdvaita Ashram **"Srimad Bhagavad Gita"**, AdvaitaAshrama , Kolkata,2016*
2	*P.Gopinath, Rashtriya Sanskrit Sansthanam**"Bhartrihari's Three Satakam"** (Niti-sringar-vairagya), New Delhi, 1986.*
3	*Swami Mukundananda, JagadguruKripalujiYog**"Bhagavad Gita: The Song Of God"**, USA,2019*
4	*A.C. Bhaktivedanta Swami Prabhupada**"Bhagavad-Gita As It Is"**,Bhaktivedanta Book Trust Publications,2001.*

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Apply the Holistic development in life.	K4
CO2	Effective Planning of day to day work and duties.	K4
CO3	Identify mankind to peace and prosperity.	K4
CO4	Develop versatile personality.	K4

Course Articulation Matrix					
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	-	-	-	1	1
CO2	-	-	-	2	1
CO3	-	-	-	1	1
CO4	-	-	-	2	1
23EDACZ7	-	-	-	2	1
1 – Slight, 2 – Moderate, 3 – Substantial					

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1				100			100
CAT2				100			100
Individual Assessment 1/Case Study 1/Seminar 1/Project 1				100			100
Individual Assessment 2/Case Study 2/Seminar 2/Project 2				100			100
ESE				100			100

23EDACZ8	SANSKRIT FOR TECHNICAL KNOWLEDGE *(Common to all branches)*	SEMESTER

PREREQUISITES	CATEGORY	L	T	P	C
NIL	AC	2	0	0	0

Course Objectives	1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world. 2. Learning of Sanskrit to improve brain functioning. 3. Enhancing the memory power. 4. Learning of Sanskrit to develop the logic in mathematics, science & other subjects.	
UNIT – I	**BASICS OF SANSKRIT**	**6 Periods**
Alphabets in Sanskrit, Past/Present/Future Tense.		
UNIT – II	**SENTENCES AND ROOTS**	**6 Periods**
Simple Sentences - Order, Introduction of roots.		
UNIT – III	**SANSKRIT LITERATURE**	**6 Periods**
Technical information about Sanskrit Literature		
UNIT – IV	**TECHNICAL CONCEPTS -1**	**6 Periods**
Technical concepts of Engineering-Electrical, Mechanical		
UNIT – V	**TECHNICAL CONCEPTS -2**	**6 Periods**
Technical concepts of Engineering-Architecture, Mathematics		
Lecture:30 Periods Tutorial: 0 Periods Practical: 0Periods Total: 30 Periods		

REFERENCES:

1	Dr.Vishwas, "**Abhyaspustakam",** Samskrita-Bharti Publication, New Delhi, 2020.
2	Prathama DeekshaVempatiKutumbshastri, "**Teach Yourself Sanskrit**", Rashtriya Sanskrit Sansthanam, New Delhi, Publication, 2009.
3	Suresh Soni, **"India's Glorious Scientific Tradition**", Ocean books (P) Ltd., New Delhi,2006.

COURSE OUTCOMES: Upon completion of the course, the students will be able to:		**Bloom's Taxonomy Mapped**
CO1	Recognize ancient literature and their basics	K3
CO2	Formulate the sentences with order and understand the roots of Sanskrit	K3
CO3	Acquire familiarity of the major traditions of literatures written in Sanskrit	K3
CO4	Distinguish the Technical concepts of Electrical & Mechanical Engineering	K3
CO5	Categorize the Technical concepts of Architecture & Mathematics	K3

Course Articulation Matrix

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	1	2	1	2	2
CO2	1	2	-	1	2
CO3	1	1	1	1	2
CO4	2	1	1	1	1
CO5	1	2	1	1	1
23EDACZ8	1	2	1	1	2

1 – Slight, 2 – Moderate, 3 – Substantial

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	**Remembering (K1) %**	**Understanding (K2) %**	**Applying (K3) %**	**Analyzing (K4) %**	**Evaluating (K5) %**	**Creating (K6) %**	**Total %**
CAT1		50	50				100
CAT2		50	50				100
Individual Assessment 1/Case Study 1/Seminar 1/Project 1		50	50				100
Individual Assessment 2/Case Study 2/Seminar 2/Project 2		50	50				100
ESE		50	50				100