NANDHA ENGINEERING COLLEGE
(Autonomous)

Affiliated to Anna University Chennai ✤ Approved by AICTE ✤ Accredited by NBA-NewDelhi

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1.1.2 Details of Courses where syllabus revision was carried out in

B.E - Mechanical Engineering

Course Code	Course Name	% of Change
17MYB01	Calculus and Solid Geometry	70
17CYB01	Applied Chemistry	25
17ECC02	Basic Electrical, Electronics and Instrumentation Engineering	55
17MYB02	Complex Analysis and Laplace Transform	50
17PYB03	Materials Physics	30
17MEP02	Computer Aided Modeling and Drafting Laboratory	30
17MYB03	Fourier Series and Partial Differential Equation	20
17MEC04	Engineering Thermodynamics	70
17MEP04	Computer Aided Machine Drawing Laboratory	55
17MYB06	Statistics and Numerical Methods	20
17MEC08	Kinematics of Machinery	20
17MEC09	Thermal Engineering Systems	20
17MEP05	Thermal Engineering Systems Laboratory	20
17MEP11	Computer Aided Analysis Laboratory	20
17MEX06	Tribology	25
17MEX12	Internal Combustion Engines	25
17MEX14	Computational Fluid Dynamics	80
17MEX15	Solar Thermal Systems	20
	Average	**36.39 %**

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REGULATIONS - 2017 (R17) CHOICE BASED CREDIT SYSTEM (CBCS)

B.E. MECHANICAL ENGINEERING

CURRICULA : I - VIII SEMESTERS SYLLABI : I - VIII SEMESTERS

SEMESTER : I

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	17EYA01	Professional English - I	HS	-	4	2	0	2	3
2	17MYB01	Calculus and Solid Geometry	BS	-	5	3	2	0	4
3	17PYB01	Physics for Engineers	BS	-	3	3	0	0	3
4	17CYB01	Applied Chemistry	BS	-	3	3	0	0	3
5	17MEC01	Engineering Graphics	ES	-	4	2	2	0	3
6	17ECC02	Basic Electrical, Electronics and Instrumentation Engineering	ES	-	3	3	0	0	3
PRACTICALS									
7	17GYP01	Physics and Chemistry Laboratory	BS	-	4	0	0	4	2
8	17GYP02	Engineering Practices Laboratory	ES	-	4	0	0	4	2
9	17GEP01	Personal Values	HS	-	2	0	0	2	0
				TOTAL	32	16	4	12	23

SEMESTER : II

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	17EYA02	Professional English - II	HS	17EYA01	4	2	0	2	3
2	17MYB02	Complex Analysis and Laplace Transform	BS	17MYB01	5	3	2	0	4
3	17PYB03	Materials Physics	BS	17PYB01	3	3	0	0	3
4	17CYB03	Environmental Science	BS	-	3	3	0	0	3
5	17MEC02	Engineering Mechanics	ES	-	5	3	2	0	4
6	17CSC01	Problem Solving and Python Programming	ES	-	3	3	0	0	3
PRACTICALS									
7	17MEP02	Computer Aided Modeling and Drafting Laboratory	ES	17MEC01	4	0	0	4	2
8	17CSP01	Problem Solving and Python Programming Laboratory	ES	-	4	0	0	4	2
9	17GEP02	Interpersonal Values	HS	17GEP01	2	0	0	2	0
				TOTAL	33	17	4	12	24

SEMESTER : III									
Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	17MYB03	Fourier Series and Partial Differential Equations	BS	17MYB02	4	2	2	0	3
2	17MEC03	Materials Engineering and Technology	ES	-	3	3	0	0	3
3	17MEC04	Engineering Thermodynamics	PC	-	4	2	2	0	3
4	17MEC05	Fluid Mechanics and Machinery (Theory + Lab)	ES	-	5	3	0	2	4
5	17MEC06	Manufacturing Processes	PC	-	3	3	0	0	3
PRACTICALS									
6	17MEP03	Manufacturing Processes Laboratory	PC	-	4	0	0	4	2
7	17MEP04	Computer Aided Machine Drawing	ES	17MEP02	4	0	0	4	2
8	17GED01	Soft Skills - Listening and Speaking	EEC	-	2	0	0	2	0
				TOTAL	29	13	4	12	20

SEMESTER : IV									
Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	17MYB06	Statistics and Numerical Methods	BS	17MYB03	4	2	2	0	3
2	17MEC08	Kinematics of Machinery (Theory + Lab)	PC	17MEC02	5	3	0	2	4
3	17MEC09	Thermal Engineering Systems	PC	17MEC04	4	2	2	0	3
4	17MEC10	Subtractive Manufacturing Processes	PC	17MEC06	3	3	0	0	3
5	17MEC11	Strength of Materials (Theory + Lab)	ES	17MEC03	5	3	0	2	4
6	E - 1	Elective - I (PSE)	PSE	-	3	3	0	0	3
PRACTICALS									
7	17MEP05	Thermal Engineering Systems Laboratory	PC	-	4	0	0	4	2
8	17MEP06	Subtractive Manufacturing Processes Laboratory	PC	-	4	0	0	4	2
9	17GED02	Soft Skills - Reading and Writing	EEC	-	2	0	0	2	0
10	17GED03	Personality and Character Development	EEC	-	1	0	0	1	0
				TOTAL	35	16	4	15	24

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SEMESTER : V									
Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	17MEC13	Design of Machine Elements	PC	17MEC11	4	2	2	0	3
2	17MEC14	Heat and Mass Transfer (Theory + Lab)	PC	17MEC09	5	3	0	2	4
3	17MEC15	Dynamics of Machinery	PC	17MEC08	4	2	2	0	3
4	17MEC16	Fluid Power System	PC	17MEC05	3	3	0	0	3
5	E - 2	Elective - II (PSE)	PSE	-	3	3	0	0	3
6	E - 3	Elective - III (PSE)	PSE	-	3	3	0	0	3
PRACTICALS									
7	17MEP08	Dynamics of Machinery Laboratory	PC	-	4	0	0	4	2
8	17GED07	Constitution of India	EEC	-	2	2	0	0	0
				TOTAL	28	16	4	6	21

SEMESTER : VI									
Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	17MEC17	Mechatronics	PC	17MEC06	3	3	0	0	3
2	17MEC18	Design of Transmission Systems	PC	17MEC13	4	2	2	0	3
3	17MEC19	Metrology and Measurements (Theory + Lab)	PC	17MEC01 17MEC13	5	3	0	2	4
4	E – 4	Elective - IV (PSE/ OE)	PSE / OE	-	3	3	0	0	3
5	E – 5	Elective - V (PSE)	PSE	-	3	3	0	0	3
PRACTICALS									
6	17MEP09	Mechatronics Laboratory	PC	-	4	0	0	4	2
7	17GED06	Comprehension	EEC	-	2	0	0	2	0
8	17GED08	Essence of Indian Traditional Knowledge	EEC	-	2	2	0	0	0
				TOTAL	26	16	2	8	18

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SEMESTER : VII									
Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	17MEC20	CAD / CAM / CIM	PC	17MEC06	3	3	0	0	3
2	17MEC21	Finite Element Analysis	PC	17MEC11	4	2	2	0	3
3	17MEC22	Power Plant Technology	PC	17MEC04	3	3	0	0	3
4	E - 6	Elective - VI (PSE/ OE)	PSE / OE	-	3	3	0	0	3
5	E - 7	Elective - VII (OE)	OE	-	3	3	0	0	3
PRACTICALS									
6	17MEP10	CAD / CAM Laboratory	PC	-	4	0	0	4	2
7	17MEP11	Computer Aided Analysis Laboratory	PC	-	4	0	0	4	2
8	17MED01	Project Work - I	EEC	-	8	0	0	8	4
				TOTAL	**32**	**14**	**2**	**16**	**23**

SEMESTER : VIII									
Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C
THEORY									
1	E - 8	Elective - VIII (PSE)	PSE	-	3	3	0	0	3
2	E - 9	Elective - IX (OE)	OE	-	3	3	0	0	3
PRACTICALS									
3	17MED02	Project Work - II	EEC	17MED01	16	0	0	16	8
				TOTAL	**22**	**6**	**0**	**16**	**14**

Total Credits: 23 + 24 + 20 + 24 + 21 + 18 + 23 + 14 = 167

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(A) HS, BS AND ES COURSES

(a) Humanities and Social Sciences (HS)

Credit Distribution: 12 - 17 | AICTE norm: 5 - 10%

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1	17EYA01	Professional English - I	HS	-	4	2	0	2	3	I
2	17GEP01	Personal Values	HS	-	2	0	0	2	0	I
3	17EYA02	Professional English - II	HS	17EYA01	4	2	0	2	3	II
4	17GEP02	Interpersonal Values	HS	17GEP01	2	0	0	2	0	II

(b) Basic Sciences (BS)

Credit Distribution: 17 - 21 | AICTE norm: 17 - 20%

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1	17MYB01	Calculus and Solid Geometry	BS	-	5	3	2	0	4	I
2	17MYB02	Complex Analysis and Laplace Transform	BS	17MYB01	5	3	2	0	4	II
3	17MYB03	Fourier Series and Partial Differential Equations	BS	17MYB02	5	2	2	0	3	III
4	17MYB06	Statistics and Numerical Methods	BS	17MYB03	5	2	2	0	3	IV
5	17PYB01	Physics for Engineers	BS	-	3	3	0	0	3	I
6	17PYB03	Materials Physics	BS	17PYB01	3	3	0	0	3	II
7	17CYB01	Applied Chemistry	BS	-	3	3	0	0	3	I
8	17CYB03	Environmental Science	BS	-	3	3	0	0	3	II
9	17GYP01	Physics and Chemistry Laboratory	BS	-	4	0	0	4	2	I

(c) Engineering Sciences (ES)

Credit Distribution: 17 - 21 | AICTE norm: 17 - 20%

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1	17MEC01	Engineering Graphics	ES	-	4	2	2	0	3	I
2	17GYP02	Engineering Practices Laboratory	ES	-	4	0	0	4	2	I
3	17ECC02	Basic Electrical, Electronics and Instrumentation Engineering	ES	-	3	3	0	0	3	I
4	17MEP02	Computer Aided Modeling and Drafting Laboratory	ES	17MEC01	4	0	0	4	2	II
5	17CSC01	Problem Solving and Python Programming	ES	-	3	3	0	0	3	II
6	17CSP01	Problem Solving and Python Programming Laboratory	ES	-	4	0	0	4	2	II
7	17MEC02	Engineering Mechanics	ES	-	5	3	2	0	4	II

8	17MEC03	Materials Engineering and Technology	ES	-	3	3	0	0	3	III
9	17MEC05	Fluid Mechanics and Machinery (Theory + Lab)	ES	-	5	3	0	2	4	III
10	17MEC11	Strength of Materials (Theory + Lab)	ES	17MEC03	5	3	0	2	4	IV
12	17MEP04	Computer Aided Machine Drawing	ES	17MEP02	4	0	0	4	2	III

(B) PROFESSIONAL CORE COURSES (PC)			Credit Distribution: 63 - 72		AICTE norm: 30 - 40%					
Sl. No	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PREREQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**	P.S
1	17MEC04	Engineering Thermodynamics	PC	-	4	2	2	0	3	III
2	17MEC06	Manufacturing Processes	PC	-	3	3	0	0	3	III
3	17MEP03	Manufacturing Processes Laboratory	PC	-	4	0	0	4	2	III
4	17MEC08	Kinematics of Machinery (Theory + Lab)	PC	17MEC02	5	3	0	2	4	IV
5	17MEC09	Thermal Engineering Systems	PC	17MEC04	4	2	2	0	3	IV
6	17MEC10	Subtractive Manufacturing Processes	PC	17MEC06	3	3	0	0	3	IV
7	17MEP05	Thermal Engineering Systems Laboratory	PC	-	4	0	0	4	2	IV
8	17MEP06	Subtractive Manufacturing Processes Laboratory	PC	-	4	0	0	4	2	IV
9	17MEC13	Design of Machine Elements	PC	17MEC11	4	2	2	0	3	V
10	17MEC14	Heat and Mass Transfer (Theory + Lab)	PC	17MEC09	5	3	0	2	4	V
11	17MEC15	Dynamics of Machinery	PC	17MEC08	4	2	2	0	3	V
12	17MEC16	Fluid Power Systems	PC	17MEC05	3	3	0	0	3	V
13	17MEP08	Dynamics of Machinery Laboratory	PC	-	4	0	0	4	2	V
14	17MEC17	Mechatronics	PC	17MEC06	3	3	0	0	3	VI
15	17MEC18	Design of Transmission Systems	PC	17MEC13	4	2	2	0	3	VI
16	17MEC19	Metrology and Measurements (Theory + Lab)	PC	17MEC01 17MEC13	5	3	0	2	4	VI
17	17MEP09	Mechatronics Laboratory	PC	-	4	0	0	4	2	VI
18	17MEC20	CAD / CAM / CIM	PC	17MEC06	3	3	0	0	3	VII
19	17MEC21	Finite Element Analysis	PC	17MEC11	4	2	2	0	3	VII
20	17MEC22	Power Plant Technology	PC	17MEC04	3	3	0	0	3	VII
21	17MEP10	CAD / CAM Laboratory	PC	-	4	0	0	4	2	VII
22	17MEP11	Computer Aided Analysis Laboratory	PC	-	4	0	0	4	2	VII

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(C) ELECTIVE COURSES										
(a) PROGRAMME SPECIFIC ELECTIVES			Credit Distribution: 18 - 21		AICTE norm: 10 to 15%					
Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	PREREQUISITE	CONTACT PERIODS	L	T	P	C	PREFERRED SEMESTER
Design Stream										
1	17MEX01	Composite Materials and Mechanics	PSE	-	3	3	0	0	3	IV / V
2	17MEX02	Micro Electro Mechanical Systems	PSE	-	3	3	0	0	3	IV / V
3	17MEX03	Engineering Failure Analysis	PSE	-	3	3	0	0	3	V / VI
4	17MEX04	Product Design	PSE	-	3	3	0	0	3	IV / V / VI
5	17MEX05	Tool Design	PSE	-	3	3	0	0	3	VII / VIII
6	17MEX06	Tribology	PSE	-	3	3	0	0	3	IV / V / VI
7	17MEX07	Design for Manufacturing and Assembly	PSE	-	3	3	0	0	3	VII / VIII
8	17MEX08	Mechanical Vibrations	PSE	-	3	3	0	0	3	VII / VIII
9	17MEX31	New Product Development	PSE	-	3	3	0	0	3	VII / VIII
10	17MEX36	Biomechanics	PSE	-	3	3	0	0	3	V / VI / VII
11	17MEX37	Geometric Dimensioning and Tolerancing	PSE	-	3	3	0	0	3	V / VI / VII
Thermal Stream										
1	17MEX09	Fuels and Combustion	PSE	-	3	3	0	0	3	IV / V
2	17MEX10	Refrigeration and Air Conditioning	PSE	-	3	3	0	0	3	V / VI
3	17MEX11	Cryogenic Engineering	PSE	-	3	3	0	0	3	VI / VII / VIII
4	17MEX12	Internal Combustion Engines	PSE	-	3	3	0	0	3	V / VI / VII
5	17MEX13	Gas Dynamics and Jet Propulsion	PSE	-	3	3	0	0	3	VII / VIII
6	17MEX14	Computational Fluid Dynamics	PSE	-	3	3	0	0	3	VI / VII / VIII
7	17MEX15	Solar Thermal Systems	PSE	-	3	3	0	0	3	VII / VIII
8	17MEX16	Automobile Engineering	PSE	-	3	3	0	0	3	VI/ VII / VIII
9	17MEX32	Renewable Sources of Energy	PSE	-	3	3	0	0	3	IV/ V / VI
10	17MEX38	Fuel Cells and Applications	PSE	-	3	3	0	0	3	V / VI / VII
Manufacturing, Industrial Engineering and Management										
1	17MEX17	Nanotechnology	PSE	-	3	3	0	0	3	IV / V / VI
2	17MEX18	Metal Casting Technology	PSE	-	3	3	0	0	3	IV / V / VI
3	17MEX19	Metal Forming Technology	PSE	-	3	3	0	0	3	VI / VII
4	17MEX20	Welding Engineering	PSE	-	3	3	0	0	3	VII / VIII
5	17MEX21	Non-Destructive Testing and Evaluation	PSE	-	3	3	0	0	3	IV / V / VI
6	17MEX22	Additive Manufacturing Processes	PSE	-	3	3	0	0	3	V / VI / VII
7	17MEX23	Surface Engineering	PSE	-	3	3	0	0	3	VII / VIII
8	17MEX24	Process Planning and Cost Estimation	PSE	-	3	3	0	0	3	IV / V / VI

9	17MEX25	Industrial Engineering and Management	PSE	-	3	3	0	0	3	IV / V / VI
10	17GEA05	Engineering Economics and Cost Analysis	PSE	-	3	3	0	0	3	V / VI / VII
11	17MEX26	New Venture Planning and Management	PSE	-	3	3	0	0	3	VI / VII
12	17GEA03	Total Quality Management	PSE	-	3	3	0	0	3	V / VI / VII
13	17MEX27	Lean and Agile Manufacturing	PSE	-	3	3	0	0	3	V / VI / VII
14	17MEX28	Industrial Robotics	PSE	-	3	3	0	0	3	V / VI / VII
15	17MEX29	Operations Research	PSE	-	3	3	0	0	3	VII / VIII
16	17MEX30	Entrepreneurship Development	PSE	-	3	3	0	0	3	VI / VII / VIII
17	17MEX33	Artificial Intelligence and Neuro-Fuzzy Theory	PSE	-	3	3	0	0	3	VI / VII / VIII
18	17MEX34	Industrial Internet of Things	PSE	-	3	3	0	0	3	V / VI / VII
19	17MEX39	3D Printing Technology	PSE	-	3	3	0	0	3	V / VI / VII
20	17MEX40	Flexible Manufacturing Systems	PSE	-	3	3	0	0	3	V / VI / VII
21	17MEX41	Advanced Welding Processes	PSE	-	3	3	0	0	3	V / VI / VII

NB: One course from each stream of Program Specific Electives should be compulsory opted.

(b)(i) Open Electives			**AICTE Credit Distribution Norm:18**							
Sl. No.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE-REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**	**P.S**
1.	17AGZ01	Baking and Confectionery Technology	OE	-	3	3	0	0	3	VII
2.	17AGZ02	Food safety and quality control system	OE	-	3	3	0	0	3	VII
3.	17AGZ03	Farm Mechanization	OE	-	3	3	0	0	3	VIII
4.	17AGZ04	Processing of Fruits and Vegetables	OE	-	3	3	0	0	3	VIII
5.	17CHZ01	Waste Water Treatment	OE	-	3	3	0	0	3	VII
6.	17CHZ02	Piping Engineering	OE	-	3	3	0	0	3	VII
7.	17CHZ03	Process Automation	OE	-	3	3	0	0	3	VII
8.	17CHZ04	Process Instrumentation	OE	-	3	3	0	0	3	VII
9.	17CEZ01	Energy conservation in buildings	OE	-	3	3	0	0	3	VII
10.	17CEZ02	Air Pollution Management	OE	-	3	3	0	0	3	VIII
11.	17CEZ03	Building Services	OE	-	3	3	0	0	3	VIII
12.	17CEZ04	Road Safety Management	OE	-	3	3	0	0	3	VII

13	17CEZ05	Waste Management	OE	-	3	3	0	0	3	VII/VIII
14.	17CSZ01	Design Thinking	OE	-	3	3	0	0	3	VII
15.	17CSZ02	Digital Marketing	OE	-	3	3	0	0	3	VII
16.	17CSZ03	Software Engineering	OE	-	3	3	0	0	3	VIII
17.	17CSZ04	Unified Functional Testing	OE	-	3	3	0	0	3	VIII
18	17CSZ05	C Programming	OE	-	3	3	0	0	3	VI
19.	17CSZ06	Data Structures	OE	-	3	3	0	0	3	VI
20.	17ECZ01	Modern wireless communication system	OE	-	3	3	0	0	3	VII
21.	17ECZ02	Consumer Electronics	OE	-	3	3	0	0	3	VII
22.	17ECZ03	Automotive Electronics	OE	-	3	3	0	0	3	VIII
23.	17ECZ04	Electronic Testing	OE	-	3	3	0	0	3	VIII
24.	17EEZ01	Renewable Energy Technology	OE	-	3	3	0	0	3	VII
25.	17EEZ02	Smart Grid	OE	-	3	3	0	0	3	VII
26.	17EEZ03	Energy Auditing, Conservation and Management	OE	-	3	3	0	0	3	VIII
27	17EEZ04	Electrical Machines	OE	-	3	3	0	0	3	VIII
28	17EIZ01	Autotronix	OE	-	3	3	0	0	3	VII
29	17EIZ02	Industrial Automation	OE	-	3	3	0	0	3	VII
30	17EIZ03	Fiber Optic Sensors	OE	-	3	3	0	0	3	VIII
31.	17EIZ04	Ultrasonic Instrumentation	OE	-	3	3	0	0	3	VIII
32.	17ITZ01	Software Testing Tool	OE	-	3	3	0	0	3	VII
33.	17ITZ02	User Experience	OE	-	3	3	0	0	3	VII
34.	17ITZ03	Developing Mobile Apps	OE	-	3	3	0	0	3	VIII
35.	17ITZ04	Software Project Management	OE	-	3	3	0	0	3	VIII
36.	17ITZ05	Java Programming	OE	-	3	3	0	0	3	VII
37.	17MEZ01	Engineering Ergonomics	OE	-	3	3	0	0	3	VII / VIII
38.	17MEZ02	Energy Audit and Resource Management	OE	-	3	3	0	0	3	VII / VIII
39.	17MEZ03	Electric Vehicle Technology	OE	-	3	3	0	0	3	VII / VIII
40.	17MEZ04	Value Engineering	OE	-	3	3	0	0	3	VII / VIII

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41.	17MEZ05	Smart Mobility	OE	-	3	3	0	0	3	VII / VIII
42.	17MEZ06	Smart Sensor Systems	OE	-	3	3	0	0	3	VII / VIII
43.	17MYZ01	Mathematical Structures	OE	-	3	3	0	0	3	VII
44.	17MYZ02	Optimization Techniques	OE	-	3	3	0	0	3	VII
45.	17MYZ03	Statics for Engineers	OE	-	3	3	0	0	3	VII
46.	17MYZ04	Statistics for Engineers	OE	-	3	3	0	0	3	VII
47.	17PYZ01	Nanomaterials	OE	-	3	3	0	0	3	VII
48.	17PYZ02	Nuclear physics and Reactors	OE	-	3	3	0	0	3	VII
49.	17PYZ03	Space science and technology	OE	-	3	3	0	0	3	VII
50..	17CYZ01	Chemistry for Every Day Life	OE	-	3	3	0	0	3	VII
51	17CYZ02	E - Waste Management	OE	-	3	3	0	0	3	VII
52	17CYZ03	Industrial Chemistry	OE	-	3	3	0	0	3	VII
53	17EYZ01	Communicative Hindi	OE	-	3	3	0	0	3	VII
54	17EYZ02	Fundamentals of German	OE	-	3	3	0	0	3	VII
55	17EYZ03	Basics of Japanese	OE	-	3	3	0	0	3	VII
56	17EYZ04	Employability Enhancement and Analytical Skills	OE	-	3	3	0	0	3	VII
57	17EYX01	Effective Communication	OE	-	3	3	0	0	3	VII
58	17GYZ01	Biology for Engineers	OE	-	3	3	0	0	3	VII
59.	17BMZ01	Health care technology	OE	-	3	3	0	0	3	VII
60.	17BMZ02	Telemedicine	OE	-	3	3	0	0	3	VII
61.	17BMZ03	Epidemiology and Pandemic Management	OE	-	3	3	0	0	3	VII
62.	17BMZ04	Medical Ethics	OE	-	3	3	0	0	3	VII

(b) (ii) Additional Open Electives for Mechanical Engineering program

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1.	17CSX31	Problem Solving and Programming	OE	-	3	3	0	0	3	V/VI
2.	17ITX26	Problem Solving and Algorithmic Skills	OE	-	3	3	0	0	3	V/VI

(D) PROJECT			Credit Distribution: 12		AICTE norm: 7 to 12%					
Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1	17MED01	Project Work - I	EEC	-	8	0	0	8	4	VII
2	17MED02	Project Work - II	EEC	17MED01	16	0	0	16	8	VIII
(E) Skill/Proficiency based courses (Not to be included in CGPA)			Credit Distribution: Non credit		AICTE norm: 3%					
Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	PRE-REQUISITE	CONTACT PERIODS	L	T	P	C	P.S
1	17GED06	Comprehension	EEC	-	2	0	0	2	0	VI
2	17GED01	Soft Skills - Listening and Speaking	EEC	-	2	0	0	2	0	III
3	17GED02	Soft Skills - Reading and Writing	EEC	-	2	0	0	2	0	IV
4	17GED03	Personality and Character Development	EEC	-	1	0	0	1	0	IV
5	17GED07	Constitution of India	EEC	-	2	2	0	0	0	V
6	17GED08	Essence of Indian Traditional Knowledge	EEC	-	2	2	0	0	0	VI

SUMMARY

SL. No.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1	HS	3	3	0	0	0	0	0	0	6
2	BS	12	10	3	3	0	0	0	0	28
3	ES	8	11	9	4	0	0	0	0	32
4	PC	0	0	8	14	15	12	13	0	62
5	PSE	0	0	0	3	6	3	3	3	18
6	OE	0	0	0	0	0	3	3	3	9
7	EEC	0	0	0	0	0	0	4	8	12
	TOTAL	23	24	20	24	21	18	23	14	167
	Non Credit / Mandatory (EEC)			1	2	1	2			

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17MYB01 - CALCULUS AND SOLID GEOMETRY
(Common to All Branches)

L	T	P	C
3	2	0	4

PREREQUISITE : NIL | **QUESTION PATTERN: TYPE - 4**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To develop the use of matrix algebra techniques those are needed by engineers for practical applications.	1.1	Apply the concept of orthogonal reduction to diagonalise the given matrix.	a, b, c, e, g, i, k
2.0	Use the techniques, Skills and Engineering tools necessary for engineering practice, with Geometric concepts.	2.1	Have knowledge about the geometrical aspects of sphere.	a, b, c, e, f, i, k
3.0	To improve their ability in solving geometrical applications of differential calculus problems.	3.1	Find the radius of curvature, circle of curvature and centre of curvature for a given curve.	a, b, c, i, k
4.0	To learn the important role of Mathematical concepts in engineering applications with the functions of several variables.	4.1	Classify the maxima and minima for a given function with several variables, through by finding stationary points.	a, b, c, d, k
5.0	To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.	5.1	Demonstrate the use of double and triple integrals to compute area and volume.	a, b, c, d, f, i, k

UNIT I - MATRICES (9+6)

Characteristic equation - eigen values and eigen vectors of a matrix - properties (statement only) - Cayley Hamilton theorem and its applications - orthogonal transformation of a symmetric matrix to a diagonal form - quadratic form - reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT II - ANALYTICAL GEOMETRY OF THREE DIMENSIONS (9+6)

Equation of a plane - angle between two planes - equation of straight lines - coplanar lines - skew lines - equation of a sphere - orthogonal spheres.

UNIT III - GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS (9+6)

Curvature - curvature in cartesian co-ordinates - centre and radius of curvature - circle of curvature - evolutes and involutes - envelopes.

UNIT IV - FUNCTIONS OF SEVERAL VARIABLES (9+6)

Partial derivatives - Euler's theorem on homogeneous function - Jacobian - Maxima and Minima of functions of two variables - Constrained Maxima and Minima by Lagrange's multiplier method.

UNIT V - MULTIPLE INTEGRALS (9+6)

Double integration in cartesian co-ordinates - change of order of integration - area as double integral - triple integration in cartesian co-ordinates - volume as triple integrals.

TOTAL (L:45 + T:30) = 75 PERIODS

Note : Simulation of engineering problems (Qualitative analysis) using open source software

TEXTBOOKS:

1. Dr.B.S.Grewal, "Higher Engineering Mathematics", 42nd Edition, Khanna publications, 2012.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley and sons, 2013.
3. Veerarajan.T, "Engineering Mathematics for Semester I and II", 3rd Edition, Tata McGraw Hill, 2014.

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REFERENCES:

1. N.P.Bali, Manish Goyal, "A text book of Engineering Mathematics: Semester-II", 5th Edition, Laxmi Publications, 2011.
2. Kandasamy .P, Thilagavathy .K, Gunavathy .K, "Engineering Mathematics for first Year", 9th Rv. Ed., S.Chand and Co Ltd, 2013.
3. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Wiley India, 2007.

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17CYB01 – APPLIED CHEMISTRY

(Common to AGRI., CHEMICAL, CIVIL AND MECHANICAL ENGG. Branches)

L	T	P	C
3	0	0	3

PREREQUISITE : NIL | **QUESTION PATTERN: TYPE - 3**

COURSE OBJECTIVES AND OUTCOMES

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To understand the principles of water characterization and treatment methods	1.1	Apply knowledge of fundamental principles of chemistry	a, b, c, k
2.0	To introduce the basic concepts of electrode potential and batteries	2.1	Define and solve engineering problems, including the utilization of creative and innovative skills	a, d, e, g, d
3.0	To understand the principles and applications of corrosion	3.1	Gain practical experience with chemical process equipment as well as to analyze and interpret data	a, b, e, k
4.0	To gain knowledge on engineering materials and industrial importance of fuels and combustion	4.1	Understand the impact of engineering solutions in a global, economic, environmental and societal content	a, c, f, g
5.0	To understand the concept of various analytical techniques	5.1	Understand the concept of engineering materials	a, e, h, k

UNIT I - WATER TECHNOLOGY	**(9)**
Hardness - types - estimation by EDTA method - domestic water treatment - disinfection methods (chlorination, ozonation and UV treatment) - boiler troubles (scale, sludge, priming, foaming and caustic embrittlement) – internal conditioning(carbonate, phosphate and calgon) - external conditioning - demineralization process - desalination - reverse osmosis method.	
UNIT II - ELECTROCHEMISTRY	**(9)**
Electrochemistry - electrode potential - Nernst equation and problems - reference electrode - standard hydrogen electrode - calomel electrode - potentiometric titration (redox) - conductometric titration (strong acid - strong base) - Batteries - types - lead acid battery - fuel cell - hydrogen and oxygen fuel cell.	
UNIT III - CORROSION SCIENCE	**(9)**
Corrosion - definition - types - chemical and electrochemical corrosion (mechanism) - galvanic corrosion – differential aeration corrosion - pitting corrosion - factors influencing corrosion - corrosion control - sacrificial anode method.	
UNIT IV - FUELS AND COMBUSTION	**(9)**
Fuels -Solid fuels - coal - proximate analysis - metallurgical coke - manufacture by Otto-Hoffmann method - liquid fuels - synthetic petrol - Fischer Tropsch and Bergius processes - knocking - octane number - cetane number - gaseous fuels - water gas - producer gas - combustion - flue gas analysis - Orsat apparatus.	
UNIT V - ANALYTICAL TECHNIQUES	**(9)**
Colorimetry - principles - estimation of Iron by colorimetry - UV-Visible spectroscopy - principles – instrumentation (block diagram only) - IR spectroscopy - principles - instrumentation (block diagram only) - flame photometry - principles - instrumentation (block diagram only) - estimation of sodium by flame photometry - atomic absorption spectroscopy - principles - instrumentation (block diagram only) - estimation of nickel by atomic absorption spectroscopy.	
TOTAL (L:45) = 45 PERIODS	

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TEXTBOOKS:

1. P.C. Jain and Monica Jain, "Engineering Chemistry", Vol I and II, Dhanpat Rai Pub, Co., New Delhi,15th ed., 2013.
2. Dr. Ravikrishnan. A, "Engineering chemistry I and Engineering Chemistry II", Sri Krishna Hi-tech Publishing chem Co. Pvt Ltd., 13th ed., Chennai, 2014.

REFERENCES:

1. S.S. Dara, "A Text book of Engineering Chemistry", S.Chand and Co. Ltd., New Delhi, 2014.
2. N. Krishna murthy, D. Vallinayagam, "Engineering chemistry" PHI Learning Pvt Ltd., 2014.
3. B. Sivasankar, "Engineering Chemistry", Tata McGraw-Hill Pub. Co. Ltd., New Delhi (2012)

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17ECC02 - BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING
(Mechanical Engineering Branch only)

L	T	P	C
3	0	0	3

PREREQUISITE : NIL | **QUESTION PATTERN: TYPE - 3**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To impart knowledge on electric circuit laws and network theorems.	1.1	The Students will be able to solve electric circuits by using electric laws and theorems.	a, b, d, f
2.0	To impart knowledge on working principles of electrical machines.	2.1	The Students will be able to identify the electrical components and explore the characteristics of electrical machines	a, b, d, f
3.0	To impart knowledge on working of semi-conductor devices and characteristics.	3.1	The Students will be able to identify the various electronic devices and understand the principles of working of the semiconductor devices.	a, b, c, e, f
4.0	To impart knowledge on working principles of rectifiers, filters and amplifiers.	4.1	The Students will be able to explain the working of rectifiers, filters and amplifiers.	a, c, e, f
5.0	To impart knowledge on measuring instruments and transducers.	5.1	The Students will be able to choose appropriate instruments for electrical measurement for a specific application.	a, c, e, f

UNIT I - ELECTRICAL CIRCUITS	**(9)**
Basic circuit components - Ohms law - Kirchhoff's law - instantaneous power - inductors – capacitors - independent and dependent sources - nodal analysis, mesh analysis - Study of basic circuit theorems : Thevenin's theorem, Norton's theorem, Maximum power transfer theorem and Superposition theorem.	
UNIT II - ELECTRICAL MACHINES	**(9)**
DC Generator - DC Motor - Single phase transformer - Single phase and three phase induction motor, alternator: construction, principle of operation, basic equations and applications.	
UNIT III - SEMICONDUCTOR DEVICES	**(9)**
Semiconductors - intrinsic, extrinsic, energy band diagram, PN junction diode - forward bias, reverse bias, drift and diffusion current - Hall effect - current equation - switching characteristics.	
UNIT IV - RECTIFIERS, FILTERS AND AMPLIFIERS	**(9)**
Rectifiers: Half Wave, Full Wave and Bridge, Filters, Transistor as amplifier, SCR - Operational amplifier: Inverting, Non–inverting amplifier.	
UNIT V - MEASUREMENTS AND INSTRUMENTATION	**(9)**
Introduction to transducers - Classification of transducers: piezo electric transducers - resistive - inductive, capacitive - thermo electric, photo electric, LVDT and mechanical - classification of instruments - types of indicating instruments: moving coil and moving iron - oscilloscopes	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. R.Muthusubramanian, S.Salivahanan, "Basic Electrical and Electronics Engineering", Tata McGraw Hill Nineteenth reprint (2015).
2. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, "Electronic Devices and Circuits", Tata McGraw Hill 3rd Edition (2013).

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REFERENCES:

1. T.Nageswara Rao, "Circuit Theory", A.R. Publications, Chennai, 2014.
2. Mittle and V. N. Mittle, "Basic Electrical Engineering", Tata McGraw Hill Edition, New Delhi, 2005.
3. J.B.Gupta, "Electronic Devices and Circuits," S. K. Kataria and Sons, 2009.

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17MYB02 - COMPLEX ANALYSIS AND LAPLACE TRANSFORMS *(Common to All Branches)*			
L	T	P	C
3	2	0	4

PREREQUISITE : 17MYB01	QUESTION PATTERN : TYPE - 4

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To expose the concepts of differential equations.	1.1	Predict the suitable method to solve second and higher order differential equations	a, b, c, d, f, i, k
2.0	To communicate the problem solutions using correct Mathematical terminology of vector calculus.	2.1	Apply the concepts of Differentiation and Integration to Vectors.	a, b, c, f, g, k
3.0	Apply rigorous and analytic approach to analyse the conformal mapping.	3.1	Compute an analytic function, when its real or imaginary part is known.	a, b, c, d, e, i, k
4.0	Acquiring the knowledge of evaluating contour integrals using residue theorem.	4.1	Identify the Singularities and its corresponding Residues for the given function.	a, b, c, d, e, k
5.0	Apply the concepts of Laplace transforms and its applications to various problems related to Engineering.	5.1	Predict a suitable method to evaluate the Contour integration.	a, b, c, d, e, f, i, k

UNIT I - ORDINARY DIFFERENTIAL EQUATIONS	(9+6)
Higher order linear differential equations with constant coefficients - method of variation of parameters - Cauchy's and Legendre's linear equations	
UNIT II - VECTOR CALCULUS	**(9+6)**
Gradient and Directional derivative -Divergence and Curl – Irrotational,solenoidal and scalar potential –Line integral over a plane curve-Surface Integral and Volume Integral-Green's theorem in a plane-Gauss divergence theorem and Stokes Theorem (Excluding Proofs)-Simple Applications Involving Square, Rectangles, Cube and Parallelopiped.	
UNIT III - ANALYTIC FUNCTIONS	**(9+6)**
Functions of a complex variable-Analytic functions– Necessary and sufficient conditions of Cauchy's -Riemann Equations in Cartesian Coordinates (Excluding Proofs) – Properties of Analytic Functions – Harmonic conjugate – Construction of an analytic function by Milne's Thomson Method– Conformal mapping :w = c+z , cz, 1/z and Bilinear Transformation	
UNIT IV - COMPLEX INTEGRATION	**(9+6)**
Statement and Simple applications of Cauchy's integral theorem and Cauchy's integral formula(Excluding Proofs) – Taylor's and Laurent's Series Expansions - Singularities - Residues – Cauchy's Residue theorem (Statement only) – Evaluation of contour integration over unit circle and semi circle (Excluding poles on Real axis).	
UNIT V - LAPLACE TRANSFORM	**(9+6)**
Condition for existence - Transforms of Elementary functions –Basic Properties- First and Second Shifting Theorems (Statement only) –Transforms of derivatives and integrals- Transform of periodic functions - Initial and Final value Theorems. Inverse Laplace transforms -Convolution theorem (Statement only) –Solution of linear second order Ordinary differential equations with constant coefficients using Laplace transforms.	
TOTAL (L:45 + T:30) = 75 PERIODS	

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Note : Simulation of Engineering Problems (Qualitative Analysis) using open source software

TEXTBOOKS:

1. Dr.B.S.Grewal, "Higher Engineering Mathematics", 42nd Edition, Khanna publications, 2012
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley and sons, 2013
3. Veerarajan.T, "Engineering Mathematics for Semester I and II", 3rd Edition, Tata McGraw Hill, 2014

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3. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Wiley India, 2007

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17PYB03 – MATERIALS PHYSICS
(Common to Civil and Mechanical Engineering)

L	T	P	C
3	0	0	3

PREREQUISITE: 17PYB01 | **QUESTION PATTERN : TYPE - 1**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To provide the basic ideas in conduction in various materials.	1.1	Understand the electrical and thermal conduction in different materials.	a, b
2.0	To understand origin of magnetic field in materials and applications of magnetic materials as major storage devices.	2.1	Understand magnetic properties of materials and maneuver those materials for different applications.	a, b
3.0	To gain fundamental knowledge about thermal physics and that will help students to study further subjects like thermodynamics, heat and mass transfer etc	3.1	Understand the various form of heat conduction and thermal conductivity of good and bad Conductors	b, e
4.0	To update the modern techniques for the analysis of physical properties of solids.	4.1	Examine the materials using different methods during the manufacturing process	a, e
5.0	To update the recent developments in smart materials and mechanical properties.	5.1	Acquire information regarding new engineering materials and mechanical properties.	a, e

UNIT I - CONDUCTION IN MATERIALS (9)

Conductors: Electron theories of conductivity - postulates of classical free electron theory - derivation of electrical and thermal conductivity of metals - Weidman-Franz law verification - merits and demerits. **Semiconductors:** elemental and compound semiconductors - intrinsic and extrinsic semiconductors (qualitative) - Hall effect - determination of Hall coefficient - Applications.
Superconductivity: Properties - types of super conductors - BCS theory of superconductivity.

UNIT II - MAGNETIC MATERIALS (9)

Origin of magnetic moment - Bohr magneton - types of magnetic materials - Domain theory - Hysteresis - soft and hard magnetic materials. Ferrites - applications - magnetic recording and readout - tapes, floppy and magnetic disc drives.

UNIT III - THERMAL PHYSICS (9)

Mode of heat transfer - thermal conductivity - Newton's law of cooling - thermal conduction through compound media (bodies in series and parallel) - thermal conductivity of a good conductor - Forbe's method - thermal conductivity of bad conductor - Lee's disc - radial flow of heat - expression for thermal conductivity of rubber - experimental determination - practical applications of conduction.

UNIT IV - MATERIAL TESTING MECHANISMS (9)

Testing of materials - classification of tests - destructive test - tensile test on a metal - hardness test - Non Destructive Testing - Various steps involved in NDT process - X-ray radiographic technique - displacement method - merits, demerits and application of X-ray radiography - X-ray fluoroscopy - liquid penetrant method - advantages, disadvantages and application.

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UNIT V - MECHANICAL PROPERTIES OF MATERIALS AND SMART MATERIALS	(9)
Metallic glasses: preparation, properties and applications. Shape Memory Alloys (SMA): characteristics, properties of Ni-Ti alloy, application, advantages and disadvantages of SMA. **Mechanical properties of materials:** tension, compression, shear and torsional test of metals - stress-strain behavior of ferrous and non-ferrous metals, polymer and ceramics - true stress and strain relations.	
	TOTAL (L:45) = 45 PERIODS

TEXTBOOKS:

1. Rajendran.V, "Engineering Physics", Tata McGraw-Hill, New Delhi. 2011
2. Gaur.R.K and Gupta.S.L, "Engineering Physics", Dhanpat Rai Publications, 2007
3. Raghavan. V., "Material Science and Engineering", 5th ed., Prentice-Hall of India, 2004

REFERENCES:

1. SenthilKumar.G and N.Iyandurai, "Physics-II", VRB Publishers, Revised Edition, 2005-2006
2. Pillai.S.O, "Solid State Physics", New Age International Publications, New Delhi, 2010

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17MEP02 – COMPUTER AIDED MODELING AND DRAFTING LABORATORY

L	T	P	C
0	0	4	2

PREREQUISITE : 17MEC01

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To understand the fundamentals of modeling and drafting	1.1	The students will be able to create orthogonal views of given three dimensional object	a, d, f, i, k, l
2.0	To develop 2D model drawings of various 3D objects	2.1	The students will be able to make use of two dimensional model to represent three dimensional models	a, b, d, f, i, k, l
3.0	To gain knowledge on developing sectional view of various solids	3.1	The students will be able to develop sectional view of various solids using drafting software	a, d, f, i, k, l
4.0	To learn the conversion of 3D model drawings to 2D drawings	4.1	The students will be able to construct three dimensional model of simple objects	a, b, d, f, i, k, l
5.0	To model 3D drawings of machine components using modeling software	5.1	The students will be able to create 3D models of machine components	a, b, d, f, i, k, l

LIST OF THE EXPERIMENTS

1. Manual orthographic drafting of protected type Flanged Coupling assembly.
2. Manual orthographic drafting of Knuckle Joint assembly.
3. Manual orthographic drafting of Cotter Joint with sleeve assembly.
4. Computer aided drafting of front and top views of given solid models.
5. Computer aided drafting of front and top views of cylinder, cone and dimensioning of the objects.
6. Computer aided drafting of sectional views of prism and pyramid.
7. Computer aided drafting of sectional views of cylinder and cone.
8. Computer aided 3D Modeling of simple objects and obtaining 2D multi-view drawings from 3D model.
9. Computer aided 3D modeling of Nut and Bolt.
10. Computer aided 3D modeling of Geneva Gear.

TOTAL (P:60) = 60 PERIODS

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17MYB03 FOURIER SERIES AND PARTIAL DIFFERENTIAL EQUATION

(Common to Agriculture, Civil , Mechanical and Chemical Branches)

L	T	P	C
2	2	0	3

PREREQUISITE : NIL | **QUESTION PATTERN: TYPE - IV**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To acquire knowledge to solve half range Fourier series and harmonic analysis.	1.1	Ability to have fundamental understanding of Fourier series and give Fourier expansions of a given function.	a,b,c,d,k,l
2.0	To understand the concept of Fourier transforms and enhance the problem solving skill.	2.1	Apply transform techniques to solve engineering problems.	a,b,c,f,g
3.0	To introduce how to solve linear partial differential equations with different methods.	3.1	Analyze and simulate the first and second order linear partial differential equations.	a,b,c,i,k,l
4.0	To get the analytical solution for second and higher order homogeneous linear PDE's.	4.1	Demonstrate a firm understanding of the solution techniques for homogeneous linear PDE's.	a,b,c,d,e,l
5.0	To solve different forms of wave and heat equations.	5.1	Ability to apply partial differential techniques to solve the physical engineering problems.	a,b,c,d,k

UNIT - I FOURIER SERIES (6+6)

Dirichlet's conditions - Fourier series: Half range sine series - Half range cosine series - Parseval's identity for half range series - Root -Mean square value of a function - Harmonic Analysis (π, degree and T- forms).

UNIT - II FOURIER TRANSFORMS (6+6)

Fourier integral theorem (statement only) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem.

UNIT- III FIRST ORDER NON LINEAR PARTIAL DIFFERENTIAL EQUATIONS (6+6)

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solution of standard types of first order partial differential equations: (i) f(p,q)=0, (ii) Clairaut's type, (iii) f(z,p,q) = 0, (iv) f(x,p) = g(y,q).

UNIT IV LINEAR PARTIAL DIFFERENTIAL EQUATIONS (6+6)

General solution of Lagrange's linear equation Pp+Qq = R - Solutions of simultaneous equations dx/P=dy/Q =dz/R by the method of grouping and method of multipliers-Homogeneous linear partial differential equations of second and higher order with constant coefficients (R.H.S = 0, e^{ax+by}, cos(ax+by), sin(ax+by), $x^r y^s$).

UNIT- V APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (6+6)

Classification of second order quasi linear partial differential equations - Solutions of one dimensional wave equation(zero and Non-zero Boundary conditions) - One dimensional heat equation(Reduced to zero and non zero temperature)- Steady state solution of two dimensional heat equation (Finite and infinite plate).

TOTAL (L:30 +P:30) = 60 PERIODS

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TEXT BOOKS

1. Veerarajan,T. "Transforms and Partial Differential Equations", 2nd ed., Tata Mc Graw Hill, New Delhi, Second reprint, 2015.
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics; Volume III", S. Chand and Co Ltd., 2008.

REFERENCES

1. Goyal. Manish and Bali, N.P, "A Textbook of Engineering mathematics", 6th ed., Laxmi Publication (P) Ltd. New Delhi, 2012.
2. Grewal, B.S. "Higher Engineering Mathematics", 42nd ed., Khanna publishers, New Delhi, 2012.
3. Kreyszig, Erwin. "Advanced Engineering Mathematics", 9th ed., Wiley Publications, New Delhi, 2006.

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17MEC04 - ENGINEERING THERMODYNAMICS

(Use of Steam Tables and Psychrometric Chart permitted)

L	T	P	C
2	2	0	3

PREREQUISITE : NIL | **QUESTION PATTERN : TYPE - 4**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program Outcomes
1.0	To teach the basic concept of thermodynamics and applications of first law of thermodynamics	1.1	Describe the concepts of conservation of mass, conservation of energy, work interaction, heat transfer and first law of thermodynamics	a, b, d, e, f, h, j, k, l
2.0	To introduce the concept of second law of thermodynamics and entropy	2.1	Apply the concept of second law to analyze the performance of thermal equipments	a, c, e, f, k, l
3.0	To teach steps involved in analysis of gas power cycles	3.1	Determine the performance characteristics of various gas power cycles	a, c, e, f, k, l
4.0	To provide knowledge on the process of steam formation at various conditions	4.1	Demonstrate the stages in steam formation and/or analyze the properties of steam	a, c, e, f, h, k, l
5.0	To impart the knowledge in Psychrometry and Psychrometric processes	5.1	Analyze the types of Psychrometric processes under various operating conditions	a, b, c, d, e, f, j, k, l

UNIT I : BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS (6+6)

Definitions - Thermodynamic systems - macroscopic and microscopic view - thermodynamic equilibrium - properties, state, process and cycle - point and path function - temperature - Zeroth law - reversible and Irreversible processes - energy, work and heat - internal energy - First Law - energy as a property of a system - PMM 1 - application of first law to closed system and steady Flow processes - applications of steady flow energy equation - steam turbine, centrifugal compressor, nozzle - limitations of first law

UNIT II : SECOND LAW OF THERMODYNAMICS AND ENTROPY (6+6)

Second Law - performance of heat engines and reversed heat engines - reversible processes - statements of Second Law - PMM 2 - Clausius inequality - Carnot cycle - Carnot's theorem and corollary - efficiency of the reversible heat engine - entropy - entropy as a property of a system - entropy and irreversibility - change in entropy of the universe - entropy changes for a closed system and open system - Third Law of Thermodynamics

UNIT III : GAS POWER CYCLES (6+6)

Air standard efficiency - Carnot cycle - Otto cycle - Diesel cycle - dual combustion cycle - comparison of Otto, Diesel and dual combustion cycles - Brayton cycle - work ratio - pressure ratio for maximum work - calculation of air standard efficiency - mean effective pressure

UNIT IV : PROPERTIES OF PURE SUBSTANCES (6+6)

Pure substances - definition - phase change - p-T diagram - P-V-T surface - phase change terminologies - formation of steam - important terms - thermodynamic properties of steam and steam tables - external work done during evaporation - internal latent heat - internal energy of steam - Entropy of water, evaporation, wet steam, superheated steam - Mollier diagram - determination of dryness fraction of steam- working principles of tank, throttling, separating and throttling calorimeters

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UNIT V : PSYCHROMETRY	(6+6)
Concept of psychrometry and psychrometrices - definitions - psychrometric Relations - pressure, specific humidity, degree of saturation, relative humidity, enthalpy of moist air - Sling psychrometer - psychrometric charts - Psychrometric processes	
TOTAL (L: 30 + T: 30) = 60 PERIODS	

TEXTBOOKS:

1. Michael A. Boles, Yunus A. Cengel, "Thermodynamics: An Engineering Approach", 8th ed., Tata McGraw - Hill Education, 2017
2. Rajput.R.K, "A Textbook of Engineering Thermodynamics", 5th ed., Laxmi Publications, 2016

REFERENCES:

1. Nag.P.K, "Engineering Thermodynamics", 5th ed., McGraw Hill Education, 2013
2. Arora.C.P, Thermodynamics, Tata McGraw - Hill Education, 2003
3. Moran, Shapiro, Boettner and Bailey "Principles of Engineering Thermodynamics", 8th ed., Wiley India Pvt Ltd-2015
4. Holman.J.P, "Thermodynamics", 10th ed., McGraw Hill Education, 2011
5. Rao.Y.V.C, "An Introduction to Thermodynamics", Revised Edition, Orient Longman, 2009

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17MEP04 - COMPUTER AIDED MACHINE DRAWING LABORATORY

L	T	P	C
0	0	4	2

PREREQUISITE : 17MEP02

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program Outcomes
1.0	To know the specifications and symbols of standard machine components used in machine drawing	1.1	Relate the standards of engineering drawing with machines and components	a, b, f, h, i, k, l
2.0	To gain knowledge about the procedure for modeling and drafting using standard CAD packages	2.1	Develop a surface model of given product using a CAD package	a, b, f, h, i, k, l
3.0	To understand the drawings of machine components and simple assemblies using standard CAD packages	3.1	Illustrate the steps involved in creating 3D drawings	a, b, f, h, i, k, l
4.0	To understand the simple assemblies using standard CAD packages	4.1	Construct assembly drawing from the given part drawings	a, b, f, h, i, k, l
5.0	To understand the drawings of machine components and simple assembly drawings	5.1	Interpret a drawing and identify the fit, form and functional aspects	a, b, f, h, i, k, l

LIST OF THE EXPERIMENTS

1. Preparation of 3D Model of gears (Spur gear and helical gear)
2. Preparation of 3D Model of Stepped Pulley
3. Preparation of 3D Model of Piston (manual)
4. Preparation of 3D Model of Connecting Rod
5. Preparation of 3D Model of Crank Shaft (manual)
6. Preparation of 3D Model of Solid type journal bearing (manual)
7. Preparation of 3D Model and Assembly drawing of Knuckle Joint
8. Preparation of 3D Model and Assembly drawing of Universal Coupling
9. Preparation of 3D Model and Assembly drawing of Plummer Block
10. Preparation of 3D Model and Assembly drawing of Screw Jack
11. Drafting of Industrial drawings

TOTAL (P:60) = 60PERIODS

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17MYB06 STATISTICS AND NUMERICAL METHODS

(Common to Agriculture and Mechanical Branches)

[Use of Normal, t, F and Chi-square Tables permitted]

L	T	P	C
2	2	0	3

PREREQUISITE : NIL | **QUESTION PATTERN: TYPE - IV**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program outcomes
1.0	To provide students with the foundations of probabilistic and statistical analysis.	1.1	Ability to understand the common statistical techniques.	a,b,e,k,l
2.0	To understand the knowledge of design of experiments.	2.1	Apply Analysis of Variance for the data set of selected number factors for analyzing the significance	a,b,e,k,l
3.0	To understand the method of solving algebraic and transcendental equations using direct and indirect method.	3.1	Apply the suitable numerical techniques to solve practical engineering problems.	a,b,d,k,l
4.0	To understand the numerical methods of interpolation and integration.	4.1	Demonstrate the concept of interpolation and numerical integration when dealing with empirical data sets.	a,b,d,e,k,l
5.0	To introduce the numerical solution methods for solving ordinary differential equations	5.1	Make use of numerical methods in the solution of ordinary differential equations which are useful in solving engineering problems	a,b,d,g,k,l

UNIT I : STATISTICS (6+6)

Introduction of basic statistics-Probability distributions: Binomial, Poisson and Normal-Evaluation of statistical parameters for these three distributions- Regression and correlation.

UNIT II :TESTING OF HYPOTHESIS (6+6)

Introduction to Sampling distributions - Large Sample-Tests for single mean, Difference of means - Small sample-Students t-test - F-test -Chi-square test for goodness of fit - Independence of attributes using Binomial distribution.

UNIT III: SOLUTIONS OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS (6+6)

Newton Raphson method - Direct methods - Gauss Elimination method - Gauss Jordan method - Iterative methods - Gauss Jacobi and Gauss Seidel method - Matrix Inversion by Gauss Jordan method.

UNIT IV : INTERPOLATION AND NUMERICAL INTEGRATION (6+6)

Lagrange's and Newton's divided difference interpolation - Newton's forward and backward difference interpolation-Numerical Integration using Trapezoidal rule and Simpson's rule.

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UNIT V : NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS	(6+6)
Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order and simultaneous equations - Adam's and Milne's predictor and corrector methods for solving first order equations.	
	TOTAL (L: 30+T:30) = 60 PERIODS

TEXT BOOKS:

1. S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, New Delhi- 2006.
2. P.Kandasamy, K.Thilagavathy and K.Gunavathy, "Numerical Methods", S.Chand and Co. Ltd. New Delhi, 2003.

REFERENCES:

1. Spiegel, M.R. J. Schiller and Srinivasan. R.A, "Schaum's Outlines Probability and Stastistics", 3rd ed., Tata McGraw Hill, New Delhi, 2010.
2. Chapra.C, Steven and Canale. P, Raymond, "Numerical Methods for Engineers", 5th ed., Tata McGraw Hill, New Delhi, 2007.
3. T.Veerarajan and T.Ramachandran, "Numerical methods with Programming in C", 2nd edition, Tata McGraw Hill 2006, Eighth reprint-2011.
4. Jay L.DeVore,"Probability And Statistics for Engineering and the Sciences" , 8th ed, Cengage learning, 2011.

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17MEC08 - KINEMATICS OF MACHINERY

L	T	P	C
3	0	2	4

PREREQUISITE : 17MEC02	QUESTION PATTERN : TYPE - 4

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program Outcomes
1.0	To introduce the basic types of mechanisms, joints and degrees of freedom, machines	1.1	Demonstrate the working of various mechanisms and machines	a, g, j, l
2.0	To know the steps in position, velocity and acceleration analysis of mechanisms using graphical and analytical methods	2.1	Analyze the velocity and acceleration of linkages in mechanism design	a, b, c, g, j, l
3.0	To introduce the concept of kinematic analysis of cam drives and drawing profile of cams	3.1	Select a layout of cam for specified motion in power transmission of machine elements	a, b, c, j, l
4.0	To introduce the concept of power transmissions in gear drives for different applications	4.1	Investigate the gear drives with their selection for transmission of mechanical power in machines	a, b, c, g, j, l
5.0	To acquire knowledge on different types of friction and its effects	5.1	Apply the concept of friction in various engineering applications like belt, clutch, brake etc.,	a, b, c, g, j, l

UNIT I : BASICS OF MECHANISMS (9+6)

Mechanisms and its terminologies - Degree of freedom - Mobility - Kutzbach criterion - Grubler's criterion for planar mechanisms - Grashof's Law - Kinematic Inversions of Four bar chain, Single slider and Double slider crank chains - Quick return mechanisms - Mechanical advantage and Transmission angle - Classification of mechanisms

UNIT II : KINEMATIC ANALYSIS OF SIMPLE MECHANISMS (9+6)

Displacement, velocity and acceleration analysis of Four bar and Slider crank mechanisms with turning and sliding pairs - Instantaneous center method and Relative velocity method - Analytical method for slider crank mechanism

UNIT III : KINEMATICS OF CAMS (9+6)

Classifications of Cams and Followers - definitions in cam profile - derivatives of follower motion - Displacement diagrams for uniform velocity, simple harmonic motion, constant acceleration and deceleration, cycloidal motions- Graphical layout of disc cam profile for knife edge, roller and flat faced followers - Undercutting - Basics of tangent cam and circular arc cam

UNIT IV : KINEMATICS OF GEARS AND GEAR TRAINS (9+6)

Spur gear terminology and definitions - law of gearing - comparison of involute tooth and cycloidal tooth forms - interchangeable gears - gear tooth action - interference and undercutting - basics of nonstandard gear teeth - helical, bevel, worm, rack and pinion gears - Gear trains - speed ratio, train value -parallel axis gear trains - epicyclic gear trains - Sun and planet gears

UNIT V : FRICTION DRIVES (9+6)

Torque transmitted in plate clutches - calculation of torque and power - Selection of a belt drive, velocity ratio, limiting ratio of belt and rope tensions, centrifugal tensions - condition for maximum power transmission - working principle of shoe and band brakes

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LIST OF THE EXPERIMENTS

1. Experimental study of inversions of mechanisms
2. Determination of Ratio of time of cutting stroke to return stroke and Length of stroke of Quick return mechanism
3. Determination of velocity and acceleration of components using Slider crank mechanism
4. Determination of angular velocity of Rocker for the given angular position of crank using Four bar mechanism
5. Determination of jump speed the cam
6. Drawing the profile of the cam
7. Experimental study of Gears, Gear trains and Differential unit
8. Determination of moment of inertia of an object by oscillation method
9. Determination of radius of gyration using bifilar suspension system

TOTAL (L:45 + P:30) = 75 PERIODS

TEXTBOOKS:

1. John J. Uicker, Jr., Gordon R. Pennock and Joseph E. Shigley, "Theory of Machines and Mechanisms - SI Edition", 4th ed., Oxford University Press, 2014
2. Khurmi.R.S and Gupta.J.K, "Theory of Machines", 14th ed., S.Chand and Company Pvt. Ltd., 2015

REFERENCES:

1. Rattan.S.S, "Theory of Machines", 4th ed., McGraw Hill Education India Private Limited, 2017
2. Ambekar A.G, "Mechanism and Machine Theory",1st ed., Prentice Hall of India, 2013
3. Bansal.R.K and Brar.J.S, "Theory of Machines", 5th ed., Laxmi Publications, Revised 2016
4. Ghosh A. and Mallick A.K., "Theory of Mechanisms and Machines", East-West Publications, 2008
5. Kenneth J Waldron and Gary L Kinzel, "Kinematics, Dynamics, and Design of Machinery", 3rd ed., Wiley India Pvt Ltd, 2016

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17MEC09 - THERMAL ENGINEERING SYSTEMS

L	T	P	C
2	2	0	3

PREREQUISITE : 17MEC04 | **QUESTION PATTERN : TYPE - 4**

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To acquire knowledge on the principles, working and performance of IC engines	1.1	Identify the various components and working of IC engine	a, l
2.0	To know the working principles of vapour power cycles	2.1	Analyze the different properties of gas power cycles	a, b, e, f, g,h,k, l
3.0	To introduce the working principle of steam nozzles and turbines	3.1	Demonstrate the performance parameters of steam nozzles and turbines	a, b, e, f, g,h,k, l
4.0	To introduce the working principle of air compressors	4.1	Determine the various flow parameters of air compressors	a, b, e, f, g,h,k, l
5.0	To introduce the working principle of refrigeration and air conditioning systems	5.1	Solve the practical problems based on Refrigeration cycles and/or explain the working of Air Conditioning systems	a, b, e, f, g,h,k, l

UNIT I : INTERNAL COMBUSTION ENGINES (6+6)

IC engines - terminologies, classification, different parts, applications-four stroke and two stroke cycle engines - comparison - ignition and fuel injection systems - electronic fuel injection - cooling and lubrication systems - combustion phenomenon in SI and CI engines - pre-ignition, detonation, octane number, delay period, diesel knock, cetane number - supercharging

UNIT II : VAPOUR POWER CYCLES (6+6)

Carnot Cycle - Rankine Cycle - Modified Rankine Cycle - Regenerative Cycle - Reheat Cycle - Binary Vapour Cycle

UNIT III : STEAM NOZZLES AND TURBINES (6+6)

Steam nozzles - steam flow through nozzles - nozzle efficiency - concept of supersaturated expansion of steam - Steam turbines - classification - common types - method of reducing rotor speed - compounding - velocity diagrams - single stage Impulse and Reaction turbines - bleeding - energy losses - governing and control

UNIT IV : AIR COMPRESSORS (6+6)

Classification of air compressors - reciprocating compressors, construction and working of single stage compressor, equation for work with and without clearance, volumetric efficiency, actual p-V diagram, multi stage compression, efficiency, effect of clearance volume, FAD and displacement - rotary compressors - working principles of roots blower, vane type blower, centrifugal compressor

UNIT V : REFRIGERATION AND AIR CONDITIONING (6+6)

Fundamentals of refrigeration - COP - working principles of air refrigeration systems - simple vapour compression system-layout and working principle of vapour absorption system - refrigerants, classification, properties - air conditioning systems- summer, winter, year round air conditioning - central system

TOTAL (L:30 +T:30) = 60 PERIODS

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TEXTBOOKS:

1. Eastop.T.D and McConkey.A, "Applied Thermodynamics for Engineering Technologists", 5th ed., Pearson India, 2002
2. Rajput.R.K, "Thermal Engineering", 9th ed., Laxmi Publications Ltd, 2014

REFERENCES:

1. Michael A. Boles, Yunus A. Cengel, "Thermodynamics: An Engineering Approach", 8th ed., Tata McGraw - Hill Education, 2017
2. Ganesan V." Internal Combustion Engines", 3rd ed., Tata McGraw-Hill 2007
3. Manohar Prasad, "Refrigeration and Air Conditioning", 3rd ed., New Age International publications, 2015
4. Mathur.M.Land Sharma.R.P, "Internal Combustion Engines", Dhanpat Rai Publications, 2010
5. Onkar Singh, "Applied Thermodynamics", New Age International (P) Ltd., Publishers,2015
6. Rudramoorthy.R, "Thermal Engineering", Tata McGraw-Hill, New Delhi, 2003

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17MEP05 - THERMAL ENGINEERING SYSTEMS LABORATORY

L	T	P	C
0	0	4	2

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program Outcomes
1.0	To know the method to conduct performance measurement in thermal systems	1.1	Conduct the experiments on various thermal engineering systems and analyze the performance	a,b,f,h,l,k,l
2.0	To understand the properties of fuels in thermal applications	2.1	Analyze the performance of blowers, fan and internal combustion engines	a,b,f,h,l,k,l
3.0	To acquire knowledge on operating Characteristics of Internal Combustion engines	3.1	Know how to balance the heat energy available in engine cylinder after the combustion process	a,b,f,h,l,k,l
4.0	To conduct the performance test on air compressors	4.1	Estimate the performance of air compressors	a,b,f,h,l,k,l
5.0	To conduct the performance test on boiler and steam turbine	5.1	Determine performance of boiler and steam turbine	a,b,f,h,l,k,l

LIST OF THE EXPERIMENTS

1. Valve timing and Port Timing Diagrams
2. Performance test on C.I engines
3. Morse test on multi cylinder engine
4. Determination of Frictional power using retardation test
5. Determination of flash point, fire point and viscosity of fuels
6. Performance test on reciprocating air compressor
7. Performance test on air blower
8. Measurement of lift and drag force of an aero foil model
9. Performance test on Boiler and Steam turbine.
10. Performance test on air conditioning system.
11. Performance test on Refrigeration system.
12. Heat balance test on C.I engines with Data Acquisition system

TOTAL (P:60) = 60 PERIODS

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17MEP08 - DYNAMICS OF MACHINERY LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES AND OUTCOMES:

Course Objectives		Course Outcomes		Related Program Outcomes
1.0	To supplement the dynamic analysis and methods through experiment	1.1	Measure the deflection of fixed and cantilever beams under various loading conditions	a, b, j, k, l
2.0	To understand how certain measuring devices are used for dynamic testing	2.1	Determine the jump speed of given cam and plot the cam profile	a, b, j, k, l
3.0	To introduce the methods of static and dynamic balancing of rotating and reciprocating masses	3.1	Make use of experimental setups to find moment of inertia, natural frequency and whirling speed	a, b, c, j, k, l
4.0	To provide hands on experience on measurement of Whirling speed, MI, Natural frequency	4.1	Analyze the Characteristic curves of governors and/or gyroscopic couple	a, b, c, k, l
5.0	To acquire knowledge on characteristic curves of governors and gyroscopic couple	5.1	Adopt the methodology of dynamic balancing to determine the unbalance force and couple in rotating shafts	a, b, c, f, j, k, l

LIST OF THE EXPERIMENTS

1. Study of Balancing of rotating and reciprocating masses.
2. Deflection of Fixed and Cantilever beams.
3. Determination of Mass Moment of Inertia of axis symmetric bodies using Turn Table apparatus.
4. Dynamic balancing of rotating shafts.
5. Determination of natural frequency of vibration of the spring mass system.
6. Determination of whirling speed of shaft.
7. Determination of natural frequency of the free torsional vibration of the single and two rotor system.
8. Plotting the Characteristic curves for Watt governor.
9. Plotting the Characteristic curves for Porter governor.
10. Determination of gyroscopic couple using motorized gyroscope.

TOTAL (P:60) = 60 PERIODS

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17MEP11 - COMPUTER AIDED ANALYSIS LABORATORY

L	T	P	C
0	0	4	2

PREREQUISITE : NIL

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program Outcomes
1.0	To acquire skill in finite element simulations using commercially available software	1.1	Solve structural analysis problems using one dimensional and two dimensional elements	a, c, d, e, i
2.0	To know the steps involved in discretization of the CAD model using various elements	2.1	Determine numerical solution of problem using axi-symmetric condition	a, c, d, e, i
3.0	To teach the steps involved in solving structural problems with given specifications	3.1	Evaluate various model of failure of a machine component using Modal analysis	a, d, e, i, k
4.0	To gain knowledge on modal and harmonic analysis	4.1	Apply Harmonic analysis to find the response of a structural system using simulation	b, d, e, i, k
5.0	To understand the thermal analysis with given specifications	5.1	Analyse engineering heat transfer problem under given boundary conditions	c, e, f, i, k

LIST OF THE EXPERIMENTS

1. Analysis of a plate with a circular hole.
2. Analysis of bar (Straight, Stepped, Taper bar).
3. Analysis of beams (Cantilever, Simply supported, Fixed ends).
4. Analysis of truss component.
5. Analysis of an Axi-symmetric component.
6. Modal analysis of a component.
7. Harmonic analysis of a component.
8. Thermal analysis of the components (Fin and Wall).
9. Thermal mixed boundary conditions (Conduction and Convection).
10. Contact analysis experiment of beam.

TOTAL (P : 60) = 60 PERIODS

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17MEX06 – TRIBOLOGY

L	T	P	C
3	0	0	3

PREREQUISITE : NIL | **QUESTION PATTERN : TYPE – 3**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program Outcomes
1.0	To introduce the concept of tribology in design of products	1.1	Select tribological elements based on design considerations	a, c, j, k, l
2.0	To know the concepts of friction phenomena	2.1	Demonstrate the understanding of friction	b, g, j, k, l
3.0	To know the concepts of wear phenomena	3.1	Demonstrate the understanding of wear	b, g, j, k, l
4.0	To learn the properties of several lubricants	4.1	Demonstrate skills to select lubricant	a, b, j, k, l
5.0	To relate the concept of tribology to various practical applications	5.1	Apply the knowledge of wear and lubricants for different applications	a, b, c, f, j, l

UNIT I : SURFACE TOPOGRAPHY (9)

Measurement methods - statistical and fractal description - non conforming surface contact geometry - stresses in non-conforming contacts - contact of rough surfaces- adhesion - solid-solid contacts- adhesion models - influencing factors - adhesion by surface tension and contact between rough surfaces

UNIT II : FRICTION (9)

Friction measurement methods - origin of friction - friction theories - other mechanisms- Hysteresis, ratchet Mechanism, Stick-Slip, Rolling Friction - friction of metals and non-metals

UNIT III : WEAR (9)

Wear - types - adhesive, abrasive, corrosive, fatigue wear - minor forms of wear - delamination theory - debris analysis and testing methods - wear of metals, ceramics and polymers

UNIT IV : LUBRICATION AND LUBRICANTS (9)

Oil lubricants - natural and synthetic organics - greases - viscosity - effect of temperature, pressure and shear rates on viscosity, measurement of viscosity - relative density, specific heat and thermal conductivity - acidity and alkalinity - oxidation stability - flash point - foaming - pour point - demulsibility - extreme pressure properties - additives

UNIT V : APPLICATIONS OF TRIBOLOGY (9)

Study on hydrostatic, hydrodynamic bearings - Reynolds equation - design of plain slider bearing - design of multiple pad bearing

TOTAL (L:45) = 45 PERIODS

TEXTBOOKS:

1. Prasanta Sahoo, "Engineering Tribology", PHI Learning Private Limited; 2013
2. Bharat Bhushan, "Introduction to Tribology", John Wiley and Sons, 2013.

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REFERENCES:

1. Basu S. K, Sengupta S. N and Ahuja B. B, "Fundamentals of Tribology", PHI Learning Pvt. Ltd, 2010
2. Gohar Ramsey and Rahnejat Homer , "Fundamentals of Tribology", World Scientific Publishing Co. Pvt Ltd, 2008
3. Ian M. Hutchings, "Tribology: Friction and Wear of Engineering Materials", Butterworth-Heinemann Ltd, 1992
4. Kumar A , "A Textbook of Tribology", S K Kataria and Sons-New Delhi, 2014
5. Sushil Kumar Srivastava, "Tribology in Industries", S.Chand and Company Ltd, 2012

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17MEX12 - INTERNAL COMBUSTION ENGINES

L	T	P	C
3	0	0	3

PREREQUISITE : NIL | **QUESTION PATTERN : TYPE - 3**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program Outcomes
1.0	To introduce students to the working of spark ignition engines	1.1	Determine performance and combustion characteristics of SI engines	a, g, j, k, l
2.0	To introduce students to the working of compression ignition engines	2.1	Summarize the combustion characteristics of CI engines	a, b, g, j, k, l
3.0	To enhance the understanding of students in engine emissions, pollution and their control	3.1	Estimate emissions from SI and CI engines using quantitative methods	a, b, g, j, l
4.0	To know the usage of alternate fuels in IC engines	4.1	Demonstrate the performance of IC engines using alternative fuels	a, b, g, j, k, l
5.0	To introduce students to the recent trends in IC Engines like stratification, multi point injection, plasma ignition etc.,	5.1	Explain the recent trends in Internal combustion engines with applications	a, b, f, j, l

UNIT I : SPARK IGNITION ENGINES (9)

Mixture requirements - fuel injection systems - monopoint, multipoint and direct injection - stages of combustion - normal and abnormal combustion, spark knock, factors affecting knock, combustion chambers

UNIT II : COMPRESSION IGNITION ENGINES (9)

Diesel fuel injection systems - stages of combustion - knocking - factors affecting knock - direct and indirect injection systems - combustion chambers - fuel spray behaviour - spray structure and spray penetration - air motion - introduction to turbo charging

UNIT III : POLLUTANT FORMATION AND CONTROL (9)

Pollutant - sources - formation of carbon monoxide, unburnt hydrocarbon, oxides of nitrogen, smoke and particulate matter - methods of controlling emissions - catalytic converters, selective catalytic reduction and particulate traps

UNIT IV : STUDY OF FUELS (9)

Alcohol, hydrogen, compressed natural gas, liquefied petroleum gas and bio diesel - properties, suitability, merits and demerits

UNIT V : RECENT TRENDS IN IC ENGINES (9)

Air assisted combustion, homogeneous charge compression ignition engines - variable geometry turbochargers - common rail direct injection systems - hybrid electric vehicles - onboard diagnostics

TOTAL (L:45) = 45 PERIODS

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TEXTBOOKS:

1. Ganesan V, "Internal Combustion Engines", 4th ed., Tata McGraw Hill, 2012
2. Mathur R. B and Sharma R. P, "Internal Combustion Engines", Dhanpat Rai and Sons, 2002

REFERENCES:

1. John B. Heywood, "Internal Combustion Engine Fundamentals", McGraw Hill, 2000
2. Colin R.Feriguson and Allan.T.Kirkpatrik, "IC Engines : Applied Thermo sciences", 3rd Revised edition, Wiley- Blackwell, 2015
3. Gupta H.N, "Fundamentals of Internal Combustion Engines", 2nd ed., Prentice Hall India, 2012
4. Rajput R. K, "A Textbook of Internal Combustion Engines", 3rd ed., Laxmi Publications, 2016
5. Richard L Bechfold, "Alternative Fuels Guide Book", SAE International Warrendale,1997

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17MEX14 - COMPUTATIONAL FLUID DYNAMICS

L	T	P	C
3	0	0	3

PREREQUISITE : NIL | **QUESTION PATTERN : TYPE - 3**

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program Outcomes
1.0	To introduce the concept of computational fluid dynamics and governing equations	1.1	Demonstrate the governing equations for various problems	a, b, c, g, k, l
2.0	To acquire knowledge on numerical methods in computational fluid dynamics	2.1	Select a numerical method to solve CFD problems	a, b, g, k, l
3.0	To teach the application of computational fluid dynamics in heat conduction	3.1	Apply CFD concepts to solve heat conduction problems	a, b, g, j, l
4.0	To teach the application of computational fluid dynamics in heat convection	4.1	Apply CFD concepts to solve heat convection problems	a, b, g, k, l
5.0	To introduce the application of finite volume method in computational fluid dynamics	5.1	Analyze the heat transfer and fluid flow cases using finite volume method	a, b, f, j, l

UNIT I : FOUNDATIONS OF CFD	**(9)**
Basic concepts of fluid flow - derivation of the governing equations, conservation of mass, momentum and energy, turbulent – kinetic energy equations – mathematical behavior of PDEs on CFD - elliptic, parabolic and hyperbolic equations	
UNIT II : NUMERICAL METHODS FOR CFD	**(9)**
Finite difference method: a differential to algebraic formulation for governing PDE and BCs - iterative solution of system of LAEs for a flow property - numerical differentiation for local engineering-parameters - numerical integration for the total value of engineering-parameters	
UNIT III : HEAT CONDUCTION	**(9)**
Physical law based finite volume method - finite difference method for boundary - flux based solution methodology on a uniform grid: explicit method	
UNIT IV : HEAT CONVECTION	**(9)**
Physical law based finite volume method - flux based solution methodology on a uniform grid: explicit method	
UNIT V : FINITE VOLUME METHOD	**(9)**
Generalized variables for the combined heat and fluid flow - conservation laws for a control volume - algebraic formulation – approximations - approximated algebraic formulation - a staggered grid to avoid pressure-velocity decoupling - physical law based FVM for a staggered grid - introduction to CFD software packages	
TOTAL (L: 45) 45 PERIODS	

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TEXTBOOKS:

1. John D Anderson Jr, "Computational Fluid Dynamics - The Basics with Applications", 1st ed., McGraw Hill Education (India) Private Limited, 2012
2. Versteeg.H and Malalasekara.W, "An Introduction to Computational Fluid Dynamics - The Finite Volume Method", 2nd ed., Pearson India, 2009

REFERENCES:

1. Dale Anderson, John C. Tannehill and Richard H. Pletcher, "Computational Fluid Mechanics and Heat Transfer", 3rd ed., CRC Press, 2012
2. Oleg Zikanov, "Essential Computational Fluid Dynamics", Wiley India Pvt Ltd, 2012
3. Gautam Biswas and Somenath Mukherjee, Computational Fluid Dynamics, Narosa Oublishing House Pvt. Ltd, New Delhi, 2014
4. Chung.T.J, "Computational Fluid Dynamics", 2nd Revised edition, Scholastic Press, 2010
5. Suhas V Patankar, "Numerical Heat Transfer and Fluid Flow", CRC Press, 1980

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17MEX15 - SOLAR THERMAL SYSTEMS

L	T	P	C
3	0	0	3

PREREQUISITE : NIL	QUESTION PATTERN : TYPE - 3

COURSE OBJECTIVES AND OUTCOMES:

	Course Objectives		Course Outcomes	Related Program Outcomes
1.0	To enable the students understand solar radiation received on the earth and fundamentals of solar thermal engineering	1.1	Estimate solar radiation received on a surface using solar radiation measuring devices	a, b, g, j, k, l
2.0	To enable students know about solar thermal utilities like cookers, pumps, ponds etc	2.1	Identify the solar thermal utilities for heating and drying applications	a, b, g, j, k, l
3.0	To introduce students to solar flat plates and solar concentrators	3.1	Predict and analyse the performance of solar utilities under varying operating conditions	a, b, g, j, l
4.0	To teach students about solar power generation	4.1	Design a solar thermal utility working on active and passive modes	a, b, g, j, k, l
5.0	To teach students about solar power generation	5.1	Demonstrate the solar power generation principles, design and performance	a, b, f, j, l

UNIT I : SOLAR RADIATION	**(9)**
Solar radiation on the earth surface - extraterrestrial radiation characteristics, terrestrial radiation, solar insolation, Solar radiation measuring devices - Pyrheliometer and Pyranometer - spectral energy distribution of solar radiation - depletion of solar radiation - absorption, scattering	
UNIT II : SOLAR THERMAL COLLECTORS	**(9)**
Theory of flat plate collectors, evacuated tube collectors and heat pipe based collectors - performance evaluation - collector testing - natural and forced circulation - system configurations - applications	
UNIT III : SOLAR THERMAL UTILITIES – I	**(9)**
Solar air heaters - theory and applications - solar drying - theory, design, performance analysis and types - solar desalination - solar still - types - theory and performance analysis	
UNIT IV : SOLAR THERMAL UTILITIES - II	**(9)**
Solar cooking devices - solar cooling - absorption, adsorption and passive systems - solar thermal pumps - energy storage - solar ponds - solar chimney	
UNIT V : SOLAR CONCENTRATORS AND POWER GENERATION	**(9)**
Solar concentrator types - optics - performance analysis - design considerations - tracking - solar electric power generation systems - economics of solar thermal utilities	
TOTAL (L: 45): 45 PERIODS	

TEXTBOOKS:

1. Goswami Y, Kreith F and Kreider J. F, "Principles of Solar Engineering", 3rd ed., CRC Press, 2015
2. Sukhatme. S. P, "Solar Energy : Principles of Thermal Collection and Storage", Tata McGraw Hill, 3rd ed., 2008

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REFERENCES:

1. John A Duffie and William A Beckman, "Solar Engineering of Thermal Processes", 4th ed., John Wiley and Sons, 2013
2. Prakash J and Garg H, "Solar Energy : Fundamentals and Applications", 1st ed., McGraw Hill Education, 2000
3. Solanki C.S, "Solar Photovoltaics - Fundamentals, Technologies and Applications", 3rd Revised edition, Prentice Hall India, 2015
4. Tiwari G. N, "Solar Energy : Fundamentals, Design, Modelling and Application", Narosa Publishing House Pvt. Ltd., 2012
5. Neville R. C, "Solar Energy Conversion : The solar cell", 2nd ed., Elsevier Science, 1995

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