SEMESTER V

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	ME3591	Design of Machine Elements	PCC	4	0	0	4	4
2.	ME3592	Metrology and Measurements	PCC	3	0	0	3	3
3.		Professional Elective I	PEC	-	-	-	-	3
4.		Professional Elective II	PEC	-	-	-	-	3
5.		Professional Elective III	PEC	-	-	-	-	3
6.		Mandatory Course-I[&]	MC	3	0	0	3	0
PRACTICALS								
7.	ME3511	Summer Internship*	EEC	0	0	0	0	1
8.	ME3581	Metrology and Dynamics Laboratory	PCC	0	0	4	4	2
			TOTAL	-	-	-	-	**19**

***Two weeks Summer Internship carries one credit and it will be done during IV semester summer vacation and same will be evaluated in V semester.**

[&] Mandatory Course-I is a Non-credit Course (Student shall select one course from the list given under MC- I)

SEMESTER VI

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	ME3691	Heat and Mass Transfer	PCC	3	1	0	4	4
2.		Professional Elective IV	PEC	-	-	-	-	3
3.		Professional Elective V	PEC	-	-	-	-	3
4.		Professional Elective VI	PEC	-	-	-	-	3
5.		Professional Elective VII	PEC	-	-	-	-	3
6.		Open Elective – I*	OEC	3	0	0	3	3
7.		Mandatory Course-II[&]	MC	3	0	0	3	0
8.		NCC Credit Couse Level 3[#]		3	0	0	3	3#
PRACTICALS								
9.	ME3681	CAD/CAM Laboratory	PCC	0	0	4	4	2
10.	ME3682	Heat Transfer Laboratory	PCC	0	0	4	4	2
			TOTAL	-	-	-	-	**23**

***Open Elective – I shall be chosen from the emerging technologies.**

[&] Mandatory Course-II is a Non-credit Course (Student shall select one course from the list given under MC- II)

[#] NCC Credit Course level 3 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA

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MANDATORY COURSES I

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MX3081	Introduction to Women and Gender Studies	MC	3	0	0	3	0
2.	MX3082	Elements of Literature	MC	3	0	0	3	0
3.	MX3083	Film Appreciation	MC	3	0	0	3	0
4.	MX3084	Disaster Risk Reduction and Management	MC	3	0	0	3	0

MANDATORY COURSES II

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MX3085	Well Being with Traditional Practices - Yoga, Ayurveda and Siddha	MC	3	0	0	3	0
2.	MX3086	History of Science and Technology in India	MC	3	0	0	3	0
3.	MX3087	Political and Economic Thought for a Humane Society	MC	3	0	0	3	0
4.	MX3088	State, Nation Building and Politics in India	MC	3	0	0	3	0
5.	MX3089	Industrial Safety	MC	3	0	0	3	0

VERTICAL 4: DIGITAL AND GREEN MANUFACTURING

Sl. No.	Course Code	Course Title	Category	Periods Per week			Total Contact Period	Credits
				L	T	P		
1.	CME346	Digital Manufacturing and IoT	PEC	2	0	2	4	3
2.	CME347	Lean Manufacturing	PEC	3	0	0	3	3
3.	CME348	Modern Robotics	PEC	2	0	2	4	3
4.	CME349	Green Manufacturing Design and Practices	PEC	3	0	0	3	3
5.	CME350	Environment Sustainability and Impact Assessment	PEC	3	0	0	3	3
6.	CME351	Energy Saving Machinery and Components	PEC	3	0	0	3	3
7.	CME352	Green Supply Chain Management	PEC	3	0	0	3	3

VERTICAL 5: PROCESS EQUIPMENT AND PIPING DESIGN

Sl. No.	Course Code	Course Title	Category	Periods Per week			Total Contact Period	Credits
				L	T	P		
1.	CME353	Design of Pressure Vessels	PEC	3	0	0	3	3
2.	CME354	Failure Analysis and NDT Techniques	PEC	2	0	2	4	3
3.	CME355	Material Handling and Solid Processing Equipment	PEC	3	0	0	3	3
4.	CME356	Rotating Machinery Design	PEC	3	0	0	3	3
5.	CME357	Thermal and Fired Equipment Design	PEC	3	0	0	3	3
6.	CME358	Industrial Layout Design and Safety	PEC	2	0	2	4	3
7.	CME359	Design Codes and Standards	PEC	3	0	0	3	3

VERTICAL 6: CLEAN AND GREEN ENERGY TECHNOLOGIES

Sl. No.	Course Code	Course Title	Category	Periods Per week			Total contact Periods	Credits
				L	T	P		
1.	CME360	Bioenergy Conversion Technologies	PEC	3	0	0	3	3
2.	CME361	Carbon Footprint Estimation and Reduction Techniques	PEC	3	0	0	3	3
3.	CME362	Energy Conservation in Industries	PEC	3	0	0	3	3
4.	CME363	Energy Efficient Buildings	PEC	3	0	0	3	3
5.	CME364	Energy Storage Devices	PEC	3	0	0	3	3
6.	CME365	Renewable Energy Technologies	PEC	3	0	0	3	3
7.	CME366	Equipment for Pollution Control	PEC	3	0	0	3	3

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VERTICAL 7: COMPUTATIONAL ENGINEERING

Sl. No.	Course Code	Course Title	Category	Periods Per week			Total contact periods	Credits
				L	T	P		
1.	CME367	Computational Solid Mechanics	PEC	3	0	0	3	3
2.	CME368	Computational Fluid Dynamics and Heat transfer	PEC	3	0	0	3	3
3.	CME369	Theory on Computation and Visualization	PEC	3	0	0	3	3
4.	CME370	Computational Bio-Mechanics	PEC	3	0	0	3	3
5.	CME371	Advanced Statistics and Data Analytics	PEC	3	0	0	3	3
6.	CME372	CAD and CAE	PEC	2	0	2	4	3
7.	CRA342	Machine Learning for Intelligent Systems	PEC	3	0	0	3	3

VERTICAL 8: DIVERSIFIED COURSES GROUP 1

Sl. No.	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1.	CME380	Automobile Engineering	PEC	3	0	0	3	3
2.	ME3001	Measurements and Controls	PEC	3	0	0	3	3
3.	CME381	Design Concepts in Engineering	PEC	3	0	0	3	3
4.	CME382	Composite Materials and Mechanics	PEC	3	0	0	3	3
5.	CME383	Electrical Drives and Control	PEC	3	0	0	3	3
6.	CME384	Power Plant Engineering	PEC	3	0	0	3	3
7.	CME385	Refrigeration and Air Conditioning	PEC	3	0	0	3	3
8.	CAU332	Dynamics of Ground Vehicles	PEC	3	0	0	3	3

VERTICAL 9: DIVERSIFIED COURSES GROUP 2

Sl. No.	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1.	CAE353	Turbo Machines	PEC	3	0	0	3	3
2.	CME387	Non-traditional Machining Processes	PEC	3	0	0	3	3
3.	CME388	Industrial safety	PEC	3	0	0	3	3
4.	CME389	Design of Transmission System	PEC	3	0	0	3	3
5.	CME390	Thermal Power Engineering	PEC	3	0	0	3	3
6.	CME391	Design for Manufacturing	PEC	3	0	0	3	3
7.	CME392	Power Generation Equipment Design	PEC	3	0	0	3	3

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OPEN ELECTIVES

(Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories)

OPEN ELECTIVE I AND II
(EMERGING TECHNOLOGIES)

To be offered other than Faculty of Information and Communication Engineering

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OCS351	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2.	OCS352	IoT Concepts and Applications	OEC	2	0	2	4	3
3.	OCS353	Data Science Fundamentals	OEC	2	0	2	4	3
4.	CCS333	Augmented Reality / Virtual Reality	OEC	2	0	2	4	3

OPEN ELECTIVES – III

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OCE353	Lean Concepts, Tools And Practices	OEC	3	0	0	3	3
2.	OHS351	English for Competitive Examinations	OEC	3	0	0	3	3
3.	OMG352	NGOs and Sustainable Development	OEC	3	0	0	3	3
4.	OMG353	Democracy and Good Governance	OEC	3	0	0	3	3
5.	OME354	Applied Design Thinking	OEC	3	0	0	3	3
6.	MF3003	Reverse Engineering	OEC	3	0	0	3	3
7.	OPR351	Sustainable Manufacturing	OEC	3	0	0	3	3
8.	AU3791	Electric and Hybrid Vehicles	OEC	3	0	0	3	3
9.	OAS352	Space Engineering	OEC	3	0	0	3	3
10.	OIM351	Industrial Management	OEC	3	0	0	3	3
11.	OIE354	Quality Engineering	OEC	3	0	0	3	3
12.	OSF351	Fire Safety Engineering	OEC	3	0	0	3	3
13.	OAE352	Fundamentals of Aeronautical engineering	OEC	3	0	0	3	3
14.	OML351	Introduction to non-destructive testing	OEC	3	0	0	3	3
15.	OMR351	Mechatronics	OEC	3	0	0	3	3
16.	ORA351	Foundation of Robotics	OEC	3	0	0	3	3

UNIT – II DYNAMICS LABORATORY 30

List of Experiments:

1. Study of gear parameters.
2. Epicycle gear Train.
3. Determination of moment of inertia of flywheel and axle system.
4. Determination of mass moment of inertia of a body about its axis of symmetry.
5. Undamped free vibrations of a single degree freedom spring-mass system.
6. Torsional Vibration (Undamped) of single rotor shaft system.
7. Dynamic analysis of cam mechanism.
8. Experiment on Watts Governor.
9. Experiment on Porter Governor.
10. Experiment on Proell Governor.
11. Experiment on motorized gyroscope.
12. Determination of critical speed of shafts.

TOTAL:60 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. The students able to measure the gear tooth dimensions, angle using sine bar, straightness.
2. Determine mass moment of inertia of mechanical element, governor effort and range of sensitivity.
3. Determine the natural frequency and damping coefficient, critical speeds of shafts,

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1		2	2	3		2	2		1	2	2		3	2	2
2		2	2	3		2	2		1	2	2		2	2	2
3		2	2	3		2	2		1	2	2		3	2	2
Avg	-	2	2	3	-	2	2	-	1	2	2	-	2.6	2	2
Low (1) ; Medium (2) ; High (3)															

ME3691 HEAT AND MASS TRANSFER

L	T	P	C
3	1	0	4

COURSE OBJECTIVES

1 To Learn the principal mechanism of heat transfer under steady state and transient conditions.
2 To learn the fundamental concept and principles in convective heat transfer.
3 To learn the theory of phase change heat transfer and design of heat exchangers.
4 To study the fundamental concept and principles in radiation heat transfer.
5 To develop the basic concept and diffusion, convective di mass transfer.

UNIT – I CONDUCTION 12

General Differential equation – Cartesian, Cylindrical and Spherical Coordinates – One Dimensional Steady State Heat Conduction –– plane and Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Semi Infinite and Infinite Solids –Use of Heisler's charts – Methods of enhanced thermal conduction

UNIT – II CONVECTION 12

Conservation Equations, Boundary Layer Concept – Forced Convection: External Flow – Flow over Plates, Cylinders Spheres and Bank of tubes. Internal Flow – Entrance effects. Free Convection – Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Cylinders and Spheres. Mixed Convection.

UNIT – III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS 12

Nusselt's theory of condensation- Regimes of Pool boiling and Flow boiling - Correlations in boiling and condensation. Heat Exchanger Types – TEMA Standards - Overall Heat Transfer Coefficient – Fouling Factors. LMTD and NTU methods. Fundamentals of Heat Pipes and its applications.

UNIT – IV RADIATION **12**

Introduction to Thermal Radiation - Radiation laws and Radiative properties - Black Body and Gray body Radiation - Radiosity - View Factor Relations. Electrical Analogy. Radiation Shields.

UNIT – V MASS TRANSFER **12**

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state and Transient Diffusion - Stefan flow –Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy – Convective Mass Transfer Correlations.

TOTAL: 60 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Apply heat conduction equations to different surface configurations under steady state and transient conditions and solve problems.
2. Apply free and forced convective heat transfer correlations to internal and external flows through/over various surface configurations and solve problems.
3. Explain the phenomena of boiling and condensation, apply LMTD and NTU methods of thermal analysis to different types of heat exchanger configurations and solve problems.
4. Explain basic laws for Radiation and apply these principles to radiative heat transfer between different types of surfaces to solve problems.
5. Apply diffusive and convective mass transfer equations and correlations to solve problems for different applications.

TEXT BOOKS:

1. R.C. Sachdeva, "Fundamentals of Engineering Heat & Mass transfer", New Age International Publishers, 2009
2. Yunus A. Cengel, "Heat Transfer A Practical Approach" – Tata McGraw Hill, 5th Edition – 2013

REFERENCES:

1. Frank P. Incropera and David P. Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley & Sons, 7th Edition, 2014.
2. Holman, J.P., "Heat and Mass Transfer", Tata McGraw Hill, 2010
3. Kothandaraman, C.P., "Fundamentals of Heat and Mass Transfer", New Age International, New Delhi, 2012
4. Ozisik, M.N., "Heat Transfer", McGraw Hill Book Co., 1994.
5. S.P. Venkateshan, "Heat Transfer", Ane Books, New Delhi, 2014

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	2					1			1	3	2	1
2	3	3	3	3					1			1	3	2	1
3	3	3	3	2					1			1	3	2	1
4	3	3	3	2					1			1	3	2	1
5	3	3	3	2					1			1	3	2	1
Low (1) ; Medium (2) ; High (3)															

NCC Credit Course Level 3*

NX3651	(ARMY WING) NCC Credit Course - III	L T P C 3 0 0 3
PERSONALITY DEVELOPMENT		**9**
PD 3	Group Discussion: Team Work	2
PD 4	Career Counselling, SSB Procedure & Interview Skills	3
PD 5	Public Speaking	4
BORDER & COASTAL AREAS		**4**
BCA 2	Security Setup and Border/Coastal management in the area	2
BCA 3	Security Challenges & Role of cadets in Border management	2
ARMED FORCES		**3**
AF 2	Modes of Entry to Army, CAPF, Police	3
COMMUNICATION		**3**
C 1	Introduction to Communication & Latest Trends	3
INFANTRY		**3**
INF 1	Organisation of Infantry Battalion & its weapons	3
MILITARY HISTORY		**23**
MH 1	Biographies of Renowned Generals	4
MH 2	War Heroes - PVC Awardees	4
MH 3	Study of Battles - Indo Pak War 1965, 1971 & Kargil	9
MH 4	War Movies	6

TOTAL: 45 PERIODS

NCC Credit Course Level 3*

NX3652	(NAVAL WING) NCC Credit Course - III	L T P C 3 0 0 3
PERSONALITY DEVELOPMENT		**9**
PD 3	Group Discussion: Team Work	2
PD 4	Career Counselling, SSB Procedure & Interview Skills	3
PD 5	Public Speaking	4
BORDER & COASTAL AREAS		**4**
BCA 2	Security Setup and Border/Coastal management in the area	2
BCA 3	Security Challenges & Role of cadets in Border management	2
NAVAL ORIENTATION		**6**
NO 3	Modes of Entry - IN, ICG, Merchant Navy	3
AF 2	Naval Expeditions & Campaigns	3
NAVAL COMMUNICATION		**2**
NC 1	Introduction to Naval Communications	1
NC 2	Semaphore	1
NAVIGATION		**2**
N 1	Navigation of Ship - Basic Requirements	1
N 2	Chart Work	1
SEAMANSHIP		**15**
MH 1	Introduction to Anchor Work	2
MH 2	Rigging Capsule	6
MH 3	Boatwork - Parts of Boat	2
MH 4	Boat Pulling Instructions	2
MH 5	Whaler Sailing Instructions	3
FIRE FIGHTING FLOODING & DAMAGE CONTROL		**4**

FFDC 1	Fire Fighting	2
FFDC 2	Damage Control	2
SHIP MODELLING		**3**
SM	Ship Modelling Capsule	3

TOTAL : 45 PERIODS

NCC Credit Course Level 3*

NX3653	**(AIR FORCE WING) NCC Credit Course Level - III**	**L T P C** **3 0 0 3**
PERSONALITY DEVELOPMENT		**9**
PD 3	Group Discussion: Team Work	2
PD 4	Career Counselling, SSB Procedure & Interview Skills	3
PD 5	Public Speaking	4
BORDER & COASTAL AREAS		**4**
BCA 2	Security Setup and Border/Coastal management in the area	2
BCA 3	Security Challenges & Role of cadets in Border management	2
AIRMANSHIP		**1**
A 1	Airmanship	1
BASIC FLIGHT INSTRUMENTS		**3**
FI 1	Basic Flight Instruments	3
AERO MODELLING		**3**
AM 1	Aero Modelling Capsule	3
GENERAL SERVICE KNOWLEDGE		**2**
GSK 4	Latest Trends & Acquisitions	2
AIR CAMPAIGNS		**6**
AC 1	Air Campaigns	6
PRINCIPLES OF FLIGHT		**6**
PF 1	Principles of Flight	3
PF 2	Forces acting on Aircraft	3
NAVIGATION		**5**
NM 1	Navigation	2
NM 2	Introduction to Met and Atmosphere	3
AERO ENGINES		**6**
E 1	Introduction and types of Aero Engine	3
E 2	Aircraft Controls	3

TOTAL : 45 PERIODS

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ME3681	CAD/CAM LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

1 To gain practical experience in handling 2D drafting and 3Dmodelling software systems
2 Designing 3 Dimensional geometric model of parts, sub-assemblies, assemblies and exporting it to drawing
3 Programming G & M Code programming and simulate the CNC program and Generating part programming data through CAM software

3D GEOMETRIC MODELLING **30**

1.CAD Introduction

Sketch:
Solid modeling: Extrude, Revolve, Sweep, Variational sweep and Loft.
Surface modeling: Extrude, Sweep, Trim, Mesh of curves and Free form.
Feature manipulation: Copy, Edit, Pattern, Suppress, History operations.
Assembly: Constraints, Exploded Views, Interference check
Drafting: Layouts, Standard & Sectional Views, Detailing & Plotting

2. Creation of 3D assembly model of following machine elements using 3D Modelling software

1. Flange Coupling
2. Plummer Block
3. Screw Jack
4. Lathe Tailstock
5. Universal Joint
6. Machine Vice
7. Stuffing box
8. Crosshead
9. Safety Valves
10. Non-return valves
11. Connecting rod
12. Piston
13. Crankshaft

* Students may also be trained in manual drawing of some of the above components (specify the number – progressive arrangement of 3D)

30

MANUAL PART PROGRAMMING

1. CNC Machining Centre

i) Linear Cutting.
ii) Circular cutting.
iii) Cutter Radius Compensation.
iv) Canned Cycle Operations.

2. CNC Turning Centre

i) Straight, Taper and Radial Turning.
ii) Thread Cutting.
iii) Rough and Finish Turning Cycle.
iv) Drilling and Tapping Cycle.

3. COMPUTER AIDED PART PROGRAMMING

i) Generate CL Data and Post process data using CAM packages for Machining and Turning Centre.
ii) Application of CAPP in Machining and Turning

TOTAL:60 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Design experience in handling 2D drafting and 3D modelling software systems
2. Design 3 Dimensional geometric model of parts, sub-assemblies, assemblies and export it to drawing
3. Demonstrate manual part programming and simulate the CNC program and Generate part programming using G and M code through CAM software.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	2	2	3				2			1	3	3	1
2	2	2	2	2	3				2			1	3	3	1
3	2	2	2	2	3				2			1	3	3	1
Low (1) ; Medium (2) ; High (3)															

Attested

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ME3682 **HEAT TRANSFER LABORATORY**

L	T	P	C
0	0	4	2

COURSE OBJECTIVES

1 To gain experimental knowledge of Predicting the thermal conductivity of solids and liquids.
2 To gain experimental knowledge of Estimating the heat transfer coefficient values of various fluids.
3 To gain experimental knowledge of Testing the performance of tubes in tube heat exchangers

LIST OF EXPERIMENTS:

1. Thermal conductivity measurement of pipe insulation using lagged pipe apparatus.
2. Determination of thermal conductivity of a composite wall, insulating powder, oils, and water.
3. Determination of heat transfer coefficient of air under natural convection and forced convection.
4. Heat transfer from pin-fin under natural and forced convection.
5. Determination of heat flux under pool boiling and flow boiling in various regimes.
6. Determination of heat transfer coefficient in film-wise and drop-wise condensation.
7. Determination of friction factor, heat transfer coefficient of cold/hot fluid and effectiveness of a tube-in-tube heat exchanger.
8. Determination of Stefan – Boltzmann constant.
9. Determination of emissivity of a grey surface.
10. Calibration of thermocouples / RTDs at standard reference temperatures.

TOTAL : 60 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Conduct experiment on Predict the thermal conductivity of solids and liquids
2. Conduct experiment on Estimate the heat transfer coefficient values of various fluids.
3. Conduct experiment on Test the performance of tubes in tube heat exchangers

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	1	3	2					1			1	2	2	3
2	1	1	3	2					1			1	2	2	3
3	1	1	3	2					1			1	2	2	3
Low (1) ; Medium (2) ; High (3)															

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