## NOIDA INSTITUTE OF ENGG. & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR (AN AUTONOMOUS INSTITUTE)



## Affiliated to

## DR.A.P.J. ABDUL KALAMTECHNICAL UNIVERSITY UTTAR PRADESH, LUCKNOW



## **Evaluation Scheme & Syllabus**

For

Bachelor of Technology Mechanical Engineering Third Year

(Effective from the Session: 2022-23)

## NOIDA INSTITUTE OF ENGG. & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR (AN AUTONOMOUS INSTITUTE)

## Bachelor of Technology Mechanical Engineering EVALUATION SCHEME

## **SEMESTER-V**

SI No	Subject	Subject		Peri	ods	Evaluation Scheme		E Some	End	Total	Credit		
51.110.	Codes	Subject	L	Т	Р			TE	PE	Total	crean		
1	AME0501	Heat and Mass Transfer	3	1	0	30	20	50		100		150	4
2	AME0502	Theory of Machines	3	1	0	30	20	50		100		150	4
3	AME0503	Applied Industrial IOT	3	0	0	30	20	50		100		150	3
4	ACSE0503	Design Thinking-II	2	1	0	30	20	50		100		150	3
5		Departmental Elective -I	3	0	0	30	20	50		100		150	3
6		Departmental Elective -II	3	0	0	30	20	50		100		150	3
7	AME0551	Heat and Mass Transfer Lab	0	0	2				25		25	50	1
8	AME0552	Theory of Machines Lab	0	0	2				25		25	50	1
9	AME0553	Applied Industrial IOT Lab	0	0	2				25		25	50	1
10	AME0559	Internship Assessment-II	0	0	2				50			50	1
11	ANC0501 / ANC0502	Constitution of India, Law and Engineering / Essence of Indian Traditional Knowledge	2	0	0	30	20	50		50		100	
		MOOCs (For B.Tech. Hons, Degree)											
		Total										1100	24

#### List of MOOCs (Coursera) Based Recommended Courses for Third Year(Semester-V) B. Tech. Students

S.No.	Subject Code	Course Name	University/Industry Partner Name	No of Hours	Credits
1	AMC0093	Machine Learning with Python	IBM	23	1.5
2	AMC0097	Advanced Manufacturing Enterprise.	University at Buffalo, The State University of New York.	18	1

#### PLEASE NOTE:-

• Internship (3-4 weeks) shall be conducted during summer break after semester-V and will be assessed during semester-VI

#### • Compulsory Audit Courses (Non Credit - ANC0501/ANC0502)

- > All Compulsory Audit Courses (a qualifying exam) has no credit.
- > Total and obtained marks are not added in the Grand Total.

#### Abbreviation Used: -

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

Sl. No.	Departmental Electives	Subject Codes	Subject Name	Bucket Name	Branch	Semester
1	Elective-I	AME0511	Internal Combustion Engine	Automotive	ME	5
2	Elective-II	AME0513	Power Plant Engineering	Engineering	ME	5
3	Elective-I	AME0512	Mechatronics Systems	Industry 4.0	ME	5
4	Elective-II	AME0514	Computer Aided Engineering	industry 4.0	ME	5

List of Departmental Electives

## NOIDA INSTITUTE OF ENGG. & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR (AN AUTONOMOUS INSTITUTE)

## Bachelor of Technology Mechanical Engineering <u>EVALUATION SCHEME</u> SEMESTER-VI

	Subject		1	Pariods Evaluation Scheme		E	nd						
SI. No.	Codes	Subject	J	ren	ous	1	Lyanaaton Scheme				ester	Total	Credit
	Coues	Subject	L	Т	P	СТ	TA	TOTAL	PS	ТЕ	PE		
1	AME0601	Design of Machine Elements	3	1	0	30	20	50		100		150	4
2	AME0602	Refrigeration and Air-Conditioning	3	1	0	30	20	50		100		150	4
3	AME0603	Industrial Engineering	3	0	0	30	20	50		100		150	3
4		Departmental Elective-III	3	0	0	30	20	50		100		150	3
5		Departmental Elective-IV	3	0	0	30	20	50		100		150	3
6		Open Elective-I	3	0	0	30	20	50		100		150	3
7	AME0651	Machine Design Lab	0	0	2				25		25	50	1
8	AME0652	Refrigeration and Air-Conditioning Lab	0	0	2				25		25	50	1
9	AME0654	AI & ML Lab	0	0	2				25		25	50	1
10	AME0659	Mini Project	0	0	2				50			50	1
11	ANC0602 / ANC0601	Essence of Indian Traditional Knowledge / Constitution of India, Law and Engineering	2	0	0	30	20	50		50		100	
		MOOCs (Essential for Hons. degree)											
		Total										1100	24

#### List of MOOCs (Coursera) Based Recommended Courses for Third Year (Semester-VI) B. Tech. Students

S.No.	Subject Code	Course Name	University/Industry Partner Name	No of Hours	Credits
1	AMC0072	Design-Led Strategy: Design thinking for business strategy and entrepreneurship	The University of Sydney.	20	1.5
2	AMC0087	Introduction to Machine Learning	Duke University.	26	2

#### PLEASE NOTE:-

- Compulsory Audit Courses (Non Credit ANC0601/ANC0602)
  - > All Compulsory Audit Courses (a qualifying exam) has no credit.
  - > Total and obtained marks are not added in the Grand Total.

#### Abbreviation Used: -

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

List	of Depa	rtmental	Electives
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Sl. No.	Departmental Electives	Subject Codes	Subject Name	Bucket Name	Branch	Semester
1	Elective-III	AME0611	Hybrid Vehicles and Propulsion	Automotive	ME	6
2	Elective-IV	AME0613	Vehicle Body Engineering	Engineering	ME	6
3	Elective-III	AME0612	Rapid Prototyping and Manufacturing	Inductory 4.0	ME	6
4	Elective-IV	AME0614	Product Lifecycle Management	industry 4.0	ME	6

## NOIDA INSTITUTE OF ENGG. & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR

#### (AN AUTONOMOUS INSTITUTE)

## **Bachelor of Technology Mechanical Engineering**

#### **AICTE Guidelines in Model Curriculum:**

A student will be eligible to get Under Graduate degree with Honours only, if he/she completes the additional MOOCs courses such as Coursera certifications, or any other online courses recommended by the Institute (Equivalent to 20 credits). During Complete B. Tech. Program Guidelines for credit calculations are as follows.

1.	For 6 to 12 Hours	=0.5 Credit
2.	For 13 to18	=1 Credit
3.	For 19 to 24	=1.5 Credit
4.	For 25 to 30	=2 Credit
5.	For 31 to 35	=2.5 Credit
6.	For 36 to 41	=3 Credit
7.	For 42 to 47	=3.5 Credit
8.	For 48 and above	=4 Credit

For registration to MOOCs Courses, the students shall follow Coursera registration details as per the assigned login and password by the Institute these courses may be cleared during the B. Tech degree program (as per the list provided). After successful completion of these MOOCs courses, the students shall provide their successful completion status/certificates to the Controller of Examination (COE) of the Institute through their coordinators/Mentors only.

The students shall be awarded Honours Degree as per following criterion.

- i. If he / she secures 7.50 as above CGPA.
- ii. Passed each subject of that degree program in the single attempt without any grace.
- iii. Successful completion of MOOCs based 20 credits.

	Mechanical Engineering Third Year						
Course Code	AME0501	L	Т	Р	Credit		
Course Title	Irse Title HEAT AND MASS TRANSFER 3 1						
<b>Course objectiv</b>	e:			I			
1	Learn the concept of heat transfer.			K1			
2	Learn about heat loss from a surface.			K4			
3	Learn about radiation and how to minimize the effect of radiation	on.		K4			
4	Learn about the boiling, condensation and application of heat exindustry.	xcha	nger in	K4			
5	Learn about mass diffusion and its application in health eq	quipr	nent's.	K5			
Pre-requisites:	Basic of Thermodynamics, Differentiation, Integration						
	Course Contents / Syllabus						
UNIT-I Co	onduction			10	hours		
Introduction to Heat Transfer:Thermodynamics and Heat Transfer. Modes of Heat Transfer: Conduction, convection and radiation. Effectof temperature on thermal conductivity of materials.Conduction:General differential heat conduction equation in the rectangular, cylindrical and spherical coordinatesystems. Initial and boundary conditions.Steady State one-dimensional Heat conduction:Simple and Composite Systems in rectangular, cylindrical and spherical coordinates with and withoutenergy generation; Concept of thermal resistance. Analogy between heat and electricity flow; Thermalcontact resistance and over all heat transfer coefficient; Critical radius of insulation.UNIT-IIFins and Transient Heat conduction7 hours							
thermometer wells Transient Conduct conduction in one	s. tion: Transient heat conduction; Lumped capacitance method; Tim dimension only. Heisler charts.	ne co	nstant; U	nsteady	v state heat		
UNIT-III	Convection				10 hours		
Free and Forced Convection: Basic concepts; Hydrodynamic boundary layer; Thermal boundary layer; Approximate integral boundary layer analysis; Analogy between momentum and heat transfer in turbulent flow over a flat surface; Mixed boundary layer; Flow over a flat plate; Flow across a single cylinder and a sphere; Flow inside ducts; Thermal entrance region, Empirical heat transfer relations, Liquid metal heat transfer Natural Convection: Physical mechanism of natural convection; Buoyant force; Empirical heat transfer relations for natural convection over vertical planes and cylinders, horizontal plates and cylinders, and sphere, combined free and forced convection							
UNIT-IV	Thermal Radiation				10 hours		
Basic radiation concepts; Radiation properties of surfaces; Black body radiation Planck's law, Wein's displacement law, Stefan Boltzmann law, Kirchhoff's law; Gray body; Shape factor; Black body-radiation; Radiation exchange between diffuse nonblack bodies in an enclosure; Radiation shields; Radiation combined with conduction and convection; Error in temperature measurement; Absorption and emission in gaseous medium; Solar radiation.							
UNIT-V M	iscellaneous Heat Transfer				11 hours		
Heat Exchanger Types of heat excl	rs: nangers; Fouling factors; Overall heat transfer coefficient; Logarit	hmic	: mean te	mperat	ure difference		

(LMTD)	method; Effectiveness-NTU method; Compact heat exchangers.				
Condensation and Boiling: Introduction to condensation phenomena; types of condensation, Heat transfer relations for					
laminar film condensation on vertical surfaces and on outside & inside of a horizontal tube; Dropwise condensation;					
Heat pipe	es: Boiling modes, pool boiling.	,			
Introdu	ction to Mass Transfer.				
Introduct	ion: Fick's law of diffusion: Steady state equimolar counter diffusion: Steady state diffusion t	hough a			
ataonant	and film diffusion in Homodialusia	nougn a			
stagnant					
Course					
Course		17.1			
COI	Identify different modes of heat transfer and apply the governing law to calculate rate of heat	KI			
	transfer.				
CO 2	Solve the problems of Heat conduction and convection related to plane wall, composite cylinders,	K5			
	spheres, Extended surfaces, and their application in different industry.				
CO 3	Model problem for convective heat transfer coefficient, Analyze boiling and condensation related	K5			
	problems and their application to industry.				
CO 4	Analysis of radiation heat transfer problems and understanding its effect on global warming and	K4			
	gas emission.				
CO 5	Solve the problems of heat exchangers and analyze different design criteria of heat exchangers.	K4			
Text	books:				
1.	Heat and Mass Transfer by Cengel, McGraw-Hill				
2.	A Textbook on Heat Transfer, by Sukhatme, University Press.				
3.	Heat and Mass Transfer by Rudramoorthy and Mayilsamy, Pearson Education				
4. D C	Heat and Mass Transfer by K K Rajput, S Chand Publication.				
Refe	rence Books				
1.	Fundamentals of Heat and Mass Transfer, by Incroperra & DeWitt, John Wiley and Sons				
2.	Heat Transfer by J.P. Holman, McGraw-Hill				
Link: N	PTEL/ YouTube/ Faculty Video Link:				
Unit 1	Shorturl at/innRP				
	Shorturl.at/eogW0				
	ShorturLat/nptGM				
	Shorturl.at/EKTZ1				
	shorturl.at/elT12				
Unit 2	Shorturl.at/bGLU5				
	Shorturl.at/hEM29				
	Shorturl.at/abgjU				
	shorturl.at/ilrtV				
Unit 3	Shorturl.at/dnoqT				
	Shorturl.at/rSWZ9				
	Shorturl.at/cfQW2				
	https://www.youtube.com/watch?v=eUMLUu52bF8&list=PL5F4F46C1983C6785&index=21				
	https://www.youtube.com/watch?v=BilVxT0lW7U&list=PL5F4F46C1983C6785&index=22				
Unit 4	https://www.youtube.com/watch?v=CDncSyDvpdQ&list=PL5F4F46C1983C6785&index=10				
	https://www.youtube.com/watch?v=CDncSyDvpdQ&list=PL5F4F46C1983C6785&index=10				
	https://www.youtube.com/watch?v=fnEu5g8V-5s&list=PL5F4F46C1983C6785&index=12				
	nttps://www.youtube.com/watch?v=atQ-SWZFWF4&list=PL5F4F46C1983C6785&index=13				
	nttps://www.youtube.com/watch?v=ipoMia2UvKE&list=PL5F4F46C1983C6785&index=14				
Unit 5	https://www.youtube.com/watch?v=jc_hL_tSFzo&list=PL5F4F46C1983C6785&index=25				
	nttps://www.youtube.com/watch?v=Kj0ebo-vVAg&list=PL5F4F46C1983C6785&index=26	-			
	nttps://www.youtube.com/watcn?v=GrUDKH1eNBw&list=PL5F4F46U1983U6/85&index=2	/			
	https://www.youtube.com/watcn:v=y5IVIA_gawtvQ&iist=PL5F4F46C1985C6/85&index=28				
	https://www.youtube.com/watch://watch:///watch://watch:///watch:///watch://watch:///watch:///watch:///watch:///watch:///watch:///watch:////watch:///watch:////////////////////////////////////				
	nups.//www.youtube.com/watchv=wk35v2rWD11@list=rL5r4r40C1965C0/85@llidex=30				

	Mechanical Engineering Third Year						
Course Code	AME0502	L	Т	Р	Credit		
<b>Course Title</b>	rse Title THEORY OF MACHINES 3 1 0						
Course objectiv	ve:						
1	Study, analyze, identify and interpret various mechanisms and design linkage or mechanism with their inversions for industria that meets desired specifications and requirements.	mac al eq	hines t uipme	o nt	<b>K</b> <sub>1</sub> , <b>K</b> <sub>2</sub>		
2	Demonstrate and perform mechanism analysis by using both g analytically to find the position, velocity, acceleration and forc mechanisms used in modern machinery.	raph es o	ically a f multi	ind -bar	K <sub>3</sub> , K <sub>4</sub>		
3	Study and design basic cam, gear and gear train mechanism for	r des	sired m	otion	K <sub>2</sub> , K <sub>3</sub>		
	for power transmission.						
4	Study, identify and analyze the static and dynamic forces on th linkage mechanism such as engine and also analyze a machine with flywheel.	e sy or e	stems o ngine f	of itted	K <sub>3</sub> , K <sub>4</sub>		
5	Study and identify the causes of an unbalance system due to ro reciprocating masses used in various machinery and also study governor.	tatir the	ng and role of		K4		
6	Study and demonstrate the gyroscopic effect and its effect on t aero-plane and ship.	he st	ability	of	<b>K</b> <sub>3</sub>		
Pre-requisites	:						
Basic knowledg	e of Engineering Mechanics						
Basic knowledg	e of Engineering Mathematics						
Basic knowledg	e of Engineering Graphics						
	Course Contents / Sullabus						

	Course Contents / Synabus	
UNIT-I	Mechanisms, Velocity and Acceleration	10 hours

#### Mechanism:

Introduction, mechanisms and machines, kinematics and kinetics, kinematic link and its types, kinematic pairs and their classification, kinematic chain, constraint motion, degrees of freedom of planar mechanism, Grobler's equation, inversion of four bar chain, single slider crank chain and double slider crank chain.

## **Velocity Analysis:**

Introduction, velocity of point in mechanism, relative velocity and instantaneous centre method, Kennedy's theorem, velocities in four bar and slider crank mechanism.

## Acceleration Analysis:

Introduction, acceleration of a point on a link, Coriolis's component of acceleration, acceleration in four bar and slider crank mechanism, crank and slotted lever mechanism.

UNIT-II	Cam, Follower and Gears	8 hours
	•	

## **Cam and Follower:**

Introduction, classification of cams and followers, terminology of cam, cam profiles for knife edge, roller and flat faced followers for uniform velocity, simple harmonic motion, uniform acceleration and retardation.

## Gears and Gear Trains:

Introduction, classification of gears, terminology of gear, law of gearing, tooth forms and their comparisons, systems of gear teeth, length of path of contact and arc of contact, contact ratio, minimum number of teeth on gear and pinion to avoid interference, simple, compound, reverted and epicyclic gear trains.

UNIT-	II Force Analysis and Flywheel	8	hours			
Force A	nalysis:					
Static force analysis of mechanisms, D'Alembert's principle, dynamic force analysis of planar mechanisms, engine						
force ana	ysis, piston effort, crank effort and turning moment on crankshaft.					
Flywhee	l:					
Flywheel	s and its function, turning moment diagrams for single cylinder double acting steam	engine, four s	troke IC			
engine an	d multi-cylinder engines, fluctuation of energy and speed, energy stored by flywheel	l.				
UNIT-	V Balancing and Governors	8	hours			
Balanci	ıg:					
Introduct	on, static balancing and dynamic balancing, balancing of rotating masses in same pl	ane and differ	ent			
plane, gra	phical and analytical methods, balancing of reciprocating masses.					
1 0						
Govern	pr:					
Introduct	on, governor and its function, types of governors, centrifugal governors and inertia	governors, dea	d weight			
and sprin	g controlled centrifugal governors, sensitivity and stability of governor, isochronous	governor, hur	nting of			
centrifug	I governors, effort and power of governor.	<i>c</i>	0			
	V Gyroscope	8	hours			
Currages		0	liours			
Gyrosco	pe: is seen to Compare is stabilized in a fata fata fata income a tangent a tability of thilling at this is a stability of	£ £				
Gyroscop	ic couples, Gyroscopic stabilization of shaft bearing, aero plane and ships, stability c	of four wheel a	and two-			
wheel ve	licies moving on curved paths.					
Dermone						
Dyname	meters:		.1 1			
Dynamor	ieters, types of dynamometers, prony brake and rope brake dynamometer, belt transi	mission, epicy	clic and			
torsion dy	namometer.					
Course	outcome: After completion of this course students will be able to					
CO 1	Design linkage or mechanism with their inversions for industrial equipment that me	eets desired	$\mathbf{K}_1, \mathbf{K}_2$			
	specifications and requirements and Perform mechanism analysis to find the position	on,	-, -			
	velocity, acceleration, and dynamics of multi-bar mechanisms.					
CO 2	Calculate the amount of power transmission through the gear drive and calculate th	eir driving	K3, K4			
00-	efficiencies.	0				
CO 3	Understand balancing of reciprocating and rotary masses through solving engineeri	ing	K <sub>2</sub> , K <sub>3</sub>			
	problems.	0				
<b>CO 4</b>	Analyze static and dynamic force analysis of various mechanism and design of flyw	wheel.	K <sub>3</sub> , K <sub>4</sub>			
CO 5	Understand the gyroscopic forces and couple and its effect on the stability of aero-	plane and	K <sub>3</sub>			
000	ship.	1	5			
Text b	ooks					
1 Th	eory of Machines - S.S. Rattan, McGraw Hill					
2. TI	eory of Machines - R. K. Bansal, Laxmi Publications					
3. Th	eory of Machines - Khurmi & Gupta, S. Chand Publication					
4. M	echanics of Machines - V. Ramamurti, Alpha Science					
5. Ki	nematics of Machines - Dr. Sadhu Singh, S.K. Kataria & Sons					
6. Th	eory of Machines and Mechanisms - Rao & Dukkipati, bohem press.					
7. Th	eory of Machines - V. P. Singh, Dhanpat Rai Publishing Co. Pvt. Ltd.					
Kefere	ice Books					
1. Th	eory of Mechanisms and Machines: Amitabha Ghosh and Ashok Kumar Mallik, Third Editi	ion Affiliated E	ast-West			
2 TL	88.	and University	Pross			
2. 10 3 Th	cory of Machines and Miconanisms. Joseph Edward Singley and John Joseph Oleker, Jr. OXIC 2019 of Machines - Thomas Beyan, CBS Publishers	Ju Oniversity I	1088			
J. III						
Unit 1	https://www.youtube.com/watch?v=MJeRFzs4oRU&list=PLBEA57F7E7560C	8E8				

	https://www.youtube.com/watch?v=dT-0HzgmudU https://www.youtube.com/watch?v=-PRgEFcPStA
Unit 2	https://www.youtube.com/watch?v=oQrcPiQuCHI https://www.youtube.com/watch?v=BjkxYZ93Fbs
Unit 3	https://www.youtube.com/watch?v=fEdz91oWrts https://www.youtube.com/watch?v=oZhR1HPdvR4
Unit 4	https://www.youtube.com/watch?v=CI9xMNvTLFI https://www.youtube.com/watch?v=OlZXxPVpmBs
Unit 5	https://www.youtube.com/watch?v=FydJu1A1oeM https://www.youtube.com/watch?v=ty3O5CNaMy8

			Mechanical Engineering Third Year				
Co	urse C	ode	AME0503	L	Т	Р	Credit
Co	urse Ti	tle	Applied Industrial IoT (AIIoT)	3	0	0	3
Co	urse ot	iectiv	e:				
ſ	1	To fa	miliarize students with the concept of IIoT			K <sub>2</sub>	, K <sub>3</sub>
F	2	To m	ake students understand how to apply the concepts of IIoT			K <sub>2</sub> , 1	K <sub>3</sub> K <sub>4</sub>
	3	Stud	ents will be able to understand the applications of IIoT			K_2	, K <sub>3.</sub>
Pro	e-requi	sites: gramm	Students should have basic knowledge of sensors, electronic doing	evices	, contr	ol syste	ems and basic
	01 0	<i>,</i>	Course Contents / Syllabus				
Uľ	IT-I	Int	roduction to Industrial IoT and Its Architecture			10	hours
Int Cor Ind Ind Inf Der Rev	roduct ncept of ustry <b>dustria</b> l ormation mo of p view of	ion to Intern IoT A and ( ractical Compo	Industrial IoT et of Things – Drivers, Benefits and Challenges of IOT – Catego Architecture Departional Technology – Layers of IIoT Architecture – Function use cases – Components of IIoT Architecture – Introduction to nents in various layers of IoT	ories o ons of On-p	of IoT IIoT A	– Exam Architec servers	ples of IoT in cture Layers – s and Cloud –
Uľ	NIT-II	1	Data Acquisition				8 hours
The Me Sys	ermal Se easureme stems	nsors - nts — 1	- Pressure, Shear and Photo Sensor – Electrical, Magnetic and Me Direct Measurement, Indirect Measurement, Derived Measurement	rchanton t = N	cal Ser Ieasur	nsors – I ement fi	ntroduction to rom Industrial
Uľ	NIT-II		Edge Computing, The Gateway and IoT Connectivity Pr	otoco	IS		10 hours
Ed Edg Cho IoT IoT Pro Pro	ge Compoice of Compoice of Connector Connector Connector Connector Connector Connector Constant Consta	ectivity Optic Optic	<b>g and The Gateway</b> – Gateway Overview – Types and Features of Gateway – Selec y – Configuring the Gateway – lot Video Analytics and Quality C <b>y Protocols</b> Overview – Wireless Long Range (WAN) Protocols – Practical e al Networks – Transmission Protocols in IoT – Wired LAN ar Solutions	ting a ontrol xampl nd Fib	Gatev l at the es – L per Op	vay – Io Edge AN Pro tic Prot	oT Gateway – tocols – Serial ocols – Serial
Uľ	NIT-IN	7	Platform Architecture				8 hours
Pla Typ Die Sto Typ	<b>atform</b> pes of S esel Gen rage Di pes of A	Archi erver A erators mensio nalytic	tecture Architecture – Data Architecture – Data Ingestion and Stream F 5 – Big Data Architecture and Stream Processing – Storage D ning – Database – Monitor and Control Schedule, Cost and R 5 – Algorithms and Machine Learning – Visualization	Process evices esourc	sing – s – Sto ses – A	Smart 1 prage T Analytic	Monitoring of echnologies – s Overview –
Uľ	NIT-V	IIo	T Security				6 hours
IIo IIo' Sec	T Secu T Securi curity – 7	<b>rity</b> ty Con Гhreat	cerns – IIoT Device Security – IIoT Connection Security – IIoT A Modeling – Industrial Example: IoT Connected Workplace Solution	pplica on	ation P	latform	and Cloud
Co	urse ou	itcom		- 41			· · · · · · · · · · · · · · · · · · ·
C	<b>1 U</b>	Link	o 1 with Industry 4.0, real world situations, daily life and recogniz	e the a	archite	cture of	$K_2, K_3$

	IIoT					
CO 2	Identify the right components needed for data acquisition and recognize how to utilize them.	K <sub>2</sub> , K <sub>3,</sub> K <sub>4</sub>				
CO 3	<b>) 3</b> Define the functionalities required in edge computing and the gateway and also understand the concept of connectivity protocols.					
CO 4	$\begin{array}{c c} \textbf{4} & \text{Explain and classify the platform architecture focused on server and data architecture, also} & K_2, K_3 \\ \text{analyze data for business decisions.} & K_4 \end{array}$					
CO 5	Foresee possible security threats in IIoT and identify solutions to overcome them.	$K_2, K_3$				
Text book	KS :					
1. Olivier willey	Hersent, DavidBoswarthick, Omar Elloumi"The Internet of Things key applications and p	protocol				
2. Jeeva Jo	ose, Internet of Things, Khanna Publishing House					
3. Michae	l Miller "The Internet of Things" by Pearson 4. Raj Kamal "INTERNET OF THINGS", M	IcGraw-				
Hill, 1ST	Edition, 2016					
5. Arshdee	epBahga, Vijay Madisetti" Internet of Things( A hands on approach)" 1ST edition, VPI					
publication	ns, 2014					
6. Adrian	McEwen, Hakin Cassimally "Designing the Internet of Things" Wiley India					
Link: NP	TEL/ YouTube/ Faculty Video Link:					
Unit 1	https://www.youtube.com/watch?v=LlhmzVL5bm8					
	https://www.youtube.com/watch?v=bhDA7x3MAMQ					
Unit 2	https://www.youtube.com/watch?v=bkq8Te4FnbI&ab_channel=EyeonTech					
	https://www.youtube.com/watch?v=TPowbUhf0_Q&ab_channel=Ekeeda https://youtu.be/ZKSxOB8jtmY					
Unit 3	https://www.youtube.com/watch?v=bkq8Te4FnbI&ab_channel=EyeonTech https://www.youtube.com/watch?v=7eNU4rvdTC0&ab_channel=MAKERDEMY					
Unit 4	shorturl.at/aejs3					
Unit 5	https://www.youtube.com/watch?v=KeaeuUcw02Q					

Mechanical Engineering Third Year							
Course Code	AME0511	L	Т	Р	Credit		
Course Title	Internal Combustion Engine	3	0	0	3		
<b>Course objective:</b> This course is designed to make the students familiar with the classification of air standard cycles and efficiencies, thermodynamic analysis, classification of engines, understand the concept Petrol and Diesel engines, Combustion chamber, Engine cooling lubrication, Testing and performance, fuels for SI and CI engine, Crankcase ventilation, modern technologies in I C Engines.							
Pre-requisites:	basic laws of thermodynamics, Thermodynamic cycles.						
I	Course Contents / Syllabus						
Unit-I				1(	Hours		
Construction and Ignition (CI) Engin Air Standard Cyo Working. Compari Firing Order, theor	<b>Operation:</b> Engine Classification, Constructional Details of Spates. es. <b>cles-</b> Otto, Diesel and Dual. Working Principle of Two Stroke SI a son of SI and CI Engines, Four Stroke and Two Stroke Engines –Scar etical and actual valve timing diagrams for engines.	ark Ign and CI venging	ition ( Engin g Proce	(SI) and les – Co ess, Sca	d Compression onstruction and venging Pump,		
Engine Cycles: the	coretical Otto, diesel and dual cycles, Fuel-air Cycles and Actual cycl	e, nume	erical	problem	IS.		
Unit-II				09	Hours		
Construction of en and exhaust valves	<b>ngine parts:</b> Cylinder, cylinder head, piston, piston pin, connecting ro flywheel, valve operating mechanisms.	od, cran	ık shat	ft, inlet			
Combustion of Stoichiometry of H Adiabatic Flame T Front. Fuel Spray C	<b>Fuel:</b> Chemical Composition and Molecular Structure of Iydrocarbon Fuels – Chemical Energy and Heat of Reaction Calcul emperature Calculation. Theory of SI and CI Engine Combustion – Characteristics – Droplet Size, Depth of Penetration and Atomization.	Hydro ations - Flame	carboı – Che Veloc	n Fuels mical E eity and	6. Combustion quilibrium and Area of Flame		
Unit-III				09	Hours		
Combustion in IC Engine: Introduction to Combustion in SI and CI Engines and Stages of Combustion – Ignition Systems. Dependence of Ignition Timing on Load and Speed. Knock in SI and CI Engines.         Combustion Chambers: SI and CI Engines combustion chamber, Direct and Indirect Injection Combustion Chambers for CI Engines. Importance of Swirl– Squish and Turbulence-Measurements. Factors Controlling Combustion Chamber Design– Introduction to Heat Release Measurements.         Unit-IV         10 Hours         Cooling System: Necessity, variation of gas temperature, Areas of heat flow, heat transfer, piston and cylinder temperature, Heat rejected to coolant, quantity of water required, air cooling, water cooling, thermodynamics of forced circulation, thermostats, pressurized water cooling, regenerative cooling, comparison of air and water cooling, radiators – types, cooling fan – power requirement, antifreeze solution, types of coolant.         Lubrication System: Lubricants, lubricating systems, Lubrication of piston rings, bearings, oil consumption, additives							
Unit-V				1(	Hours		
<ul> <li>Engine Testing: Dynamometers, Indicated thermal, brake thermal and volumetric efficiencies. Measurement of friction, Cylinder pressure measurement. Heat Balance, Engine performance maps, Engine testing standards.</li> <li>Modern Technologies in I C Engines</li> <li>Stratified-charged Engine, Mixed-cycle engines, HCCI Engines, CRDi injection system, GDI Technology, E-Turbocharger, Variable compression ratio engines, variable valve timing technology, Fuel cell, Hybrid Electric Technology, Hydrogen and Fuel Cell Technology.</li> <li>New developments in combustion engines. Hybrid powertrain concepts and designs (series, parallel), downsizing, electric powertrain efficiency and control concepts.</li> </ul>							
Course outcome	2:						

CO 1	To understand need, constructional details and working of various auxiliary system used for	K1, K2				
	internal combustion engine, scavenging systems for two stroke engines.					
CO 2	To understand available energy sources for internal combustion engine& Determine correct	K2,K3				
	A/F ratio for a given fuel.					
CO 3	To Illustrate the stages of combustion and its influence by different combustion	on <b>K2,K3</b>				
	chamber parameters					
CO 4	To choose cooling and lubrication system for internal combustion engine <b>K2,I</b>					
CO 5	CO 5To explain, classify and analyze various types of modern technologies in IC EnginesK2,K4					
Text bool	KS :					
1. Fundam	entals of Internal Combustion Engine by Gill, Smith,Ziurs, Oxford & IBH Publishing CO.					
2. Fundam	entals of Internal Combustion Engines by H.N. Gupta, Prentice Hall of India					
3. A Cours	e in International Combustion Engines, by Mathur& Sharma, DhanpatRai& Sons.					
4. I.C Engi	ne Analysis & Practice by E.F Obert.					
5. I.C Engi	ne, by Ganeshan, Tata McGraw Hill Publishers					
D. C						
Reference	e Books:					
1. I.C Engine, by R. Yadav, Central Publishing House, Allahabad .						
2. Re	cciprocating and Rotary Compressors, by Chlumsky, SNTI Publications, Czechoslovakia.					
$\int 3. \Pi$	urbines, Compressors and Fans, by S.M. Yanya, Tata McGraw Hill Pub.					
4. Ef	TEL / YouTube/ Faculty Video Link:					
	TEL/ Tourube/ Faculty video Link.					
Unit 1	https://extrudesign.com/category/mechanical-engineering/internal-combustion-engines/					
	.https://www.mechanicalbooster.com/2017/12/valve-timing-diagram-two-stroke-and-four-stroke-eng	ine.html				
II. 4 0	https://www.youtuba.com/watab?ralaad=0.8x/=DM0A1kOuVI4					
Unit 2	https://www.youtube.com/watch?v=aaopC0Dftbo					
Unit 3	https://www.youtube.com/watch?v=UKs4t8yCRyA					
	.https://www.youtube.com/watch?v=YTruI3IVpUI					
Unit 4	Unit 4 https://www.youtube.com/watch?v=saJgOYoevP0					
	https://www.youtube.com/watch?v=8KLNPC19uLY					
Unit 5	https://www.youtube.com/watch?v=tzJd8aHj-vg					
	https://www.youtube.com/watch?v=ZQUO0Jrz8zs					

Mechanical Engineering Third Year							
Course Code	AME0513	L	Т	Р	Credit		
Course Title	Power Plant Engineering	3	0	0	3		
<b>Course objective:</b> To help engineering students understand the concepts and practical aspects of the Design, Construction, Operation, and Energy Conversion of different power plans.							
Pre-requisites:	The knowledge of the following subjects is essential to understand	l Pow	er Plan	t Engin	eering:		
• Thermal E	ngineering						
Heat Trans	fer.						
• Fluid Meel	nanics & Hydraulic Machines						
	Course Contents / Syllabus				<u> </u>		
UNIT-I Int	roduction, energy scenario and basic concepts	1 4	<u>,                                     </u>	4 4	8 Hrs		
Scenario and povel         efficiency vs numperformance mease         Coal Based Powel         parameters, Plant         Factors, Environ         plant tour.         Steam Generator         Subcritical Steam         Desulphurization         reduction technique         UNIT-II         Steam turbine aux         Purification System         Material Handling         Technologies and aspects in the fu         systems, Ash utili         Power Plant Wate         Raw water intake         analysis	Scenario and power generation technologies, Statutory and regulatory aspects, and fire protection system, cycleefficiency vs number heaters, understanding of plant performance, Brayton cycle or Joule cycle, Power plantperformance measurement.Coal Based Power Plant: Introduction, Subcritical and Supercritical power plants, Basic Design and Performanceparameters, Plant Layout: Turbine, Generator, and Building layout, Site selection: Natural Resources, EconomicFactors, Environmental factor, etc. Plant Layout of Thermal Power plant, Coal Based Thermal power plant virtualplant tour.Steam Generator and its auxiliaries: Steam generator, Fluidized Bed Combustion Boiler, Circulation system inSubcritical Steam generator, Efficiency of the Steam generator, Air & Draft system, Coal Milling System, Flue GasDesulphurization (FGD): Overview and types of FGD systems, Selection Catalytic reduction (SCR-SNCR): NOx,reduction technique, Overview of Electrostatic Precipitator and bag filter, Principle of operation of ESP.UNIT-IIPower Plant Steam Turbine and auxiliary systems:Steam turbine auxiliary systems, ST Auxiliary Systems: Electrohydraulic oil system, Gland Steam systems, Lube OilPurification System, Condensate system and its major equipmentMaterial Handling SystemTechnologies and material handling system, Fuel handling systems: Type of fuel oil and typical characteristics, Safetyaspects in the fuel oil system, Coal handling plant system design, Ash Handling system: Type of ash handlingsystems, Ash utilization, Overview of Limestone, and gypsum handling system.Power Plant Water, Compressed Air System, and Fire system						
analysis, Chemica	al dosing and filtration, Demineralization plant (DM) plant: ION	Exc	hange,	Conder	nsate Polishing		
unit, Steam, and v	vater analysis system (SWAS)						
UNIT-III	Gas Based nower plant				6 Hrs		
Introduction and a	dvantages of a Gas based power plant. Heat Recovery Steam Gen	erato	r Maio	r oas ti	urbine auxiliary		
systems: Intake f	ilter. Lube and Jacking Oil System. Natural Gas System. Heat	Reco	verv st	eam ge	nerator system		
(HRSG): Function	n of HRSG in combined cycle power plant, Overview of Gas base	ed pla	nt layo	out, Lay	out of an open		
cycle and combine	e cycle power plant	1	5	, ,	1		
Nuclear Power P	lant						
Introduction to N	uclear power plant, Power Reactor, Safety of Nuclear Power R	eacto	r-Safet	y meas	sures, Fuel and		
water system, Wa	ste disposal and Site selection, Thermodynamic cycle of a nuclear	powe	er plant	•			
UNIT-IV	Renewable Energy (RE) Sources				10 Hrs		
Importance, Role,	and Potential of renewable sources of energy, Sustainable Types	of R	E sour	ces, Lir	nitations of RE		
sources,							
Wind energy		• .•					
Sources and poter	itials, horizontal and vertical axis windmills, performance characte	ristic	s,				

#### Solar energy

Solar energy an option, Environmental impact of solar power, physics of the sun, the solar constant, instruments for measuring solar radiation.

Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation, and thermal analysis.

Solar Energy Storage and Applications: Different methods, Sensible, latent heat, and stratified storage, solar ponds. Solar Applications solar heating/cooling technique, solar distillation, and drying, photovoltaic energy conversion

#### **Biomass energy**

Principles of Bioconversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine.

Other energy sources: Tidal Energy, Wave Energy, Ocean Thermal Energy Conversion (OTEC), Hydrogen Production and Storage, Fuel cell,

UNIT-V	Basics of Power Plant Piping, Physical layout, and development	10 Hrs
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Introduction to power plant piping and piping components, Basics of power station valve, Comparison of features of generic types of valves, Multidisciplinary activities, *Introduction to Industrial drawing:* Piping and instrumentation diagram, pipe stress analysis, Pipe supports,

#### **Overview of Electrical Generator and its Auxiliary Systems**

Basics of Generator and Types of Generators, Generator testing, Excitation, and synchronization,  $H_2$  and  $CO_2$  Gas system, Stator coil cooling water system

#### Overview of Electrical system for power plant

Electrical system-Introduction and plant Auxiliary distribution system, Main, Auxiliary, and Evacuation power system, Electrical power system studies, Electrical Power Evacuation System, Cable, Raceway, Earthing, and Lightning

#### **Power Plant Measuring Instruments**

Instruments: Introduction and selection criterion, Supervisory instruments and analyzers used in Power plant, Control valve construction and CV sizing, Control valve actuator types, Cavitation, and flashing

#### **Power Plant Control System**

Overview, Automated Control system, Control system configuration, Wireless Communication, Foundation Fieldbus and Profibus in power plant.

#### **Course outcome:**

CO 1	To understand the need, importance, and energy scenario in coal-based power plants.	K1, K2				
CO 2	To understand the role of steam turbine power plant auxiliary systems and material handling	K2, K3				
	and water balance diagram.					
CO 3	To ascertain fundamental design parameters (including thermodynamic cycles) of gas-based	K2, K4				
	power plants and nuclear power plants.					
CO 4	To understand the need and process of extracting electrical energy from renewable energy	K3, K4				
	sources.					
CO 5	To understand, identify and design the power plant piping and components, an overview of	K4, K5				
	electrical systems for power plant and power plan measuring and controlling systems.					
Text l	books :					
1.	Power Plant Engineering 4th Edition, By P K Nag,					
2.	A Course in Power Plant Engineering: / Arora and S. Domkundwar.					
3.	Power Plant Engineering – P.C. Sharma / S.K. Kataria Publication.					
Refer	ence Books:					
1.	Fundamentals and Applications of Renewable Energy by Mehmet Kanoglu, Yunus A. Cengel					
2.	2. Power Plant Engineering, F.T. Morse, Affiliated East-West Press Pvt. Ltd, New Delhi/Madras					
3.	Power Plant Technology El-Vakil, McGraw Hill					
Link:	NPTEL/ YouTube/ Faculty Video Link:					

Unit 1	https://www.youtube.com/watch?v=O8zMD1eCbq0 https://www.youtube.com/watch?v=BXbRJ0OB9A0
Unit 2	https://www.youtube.com/watch?v=Jb-ZDmjxdwM https://www.youtube.com/watch?v=8uwrMLrqQlU
Unit 3	https://nptel.ac.in/courses/103103206
Unit 4	https://www.youtube.com/watch?v=UW4HYJ36q0Y https://www.youtube.com/watch?v=sh4ZjiVlRC4 https://nptel.ac.in/courses/103103206
Unit 5	https://www.youtube.com/watch?v=9njuNoLIADY https://www.youtube.com/watch?v=YYKOS1F-iGo

Mechanical Engineering Third Year					
Cou	irse Co	de AME0512	L ′	Г Р	Credit
Coi	irse Tit	e Mechatronics Systems	3	) 0	3
Cou	irse obj	ective			
	1	Understand key elements of Mechatronics system and its integration	in manu	facturing	system.
	2	Impart the knowledge of different sensors and transducers used in m	anufactu	ring syste	m.
	3	Impart the knowledge of various actuation systems and controllers u	sed in m	anufacturi	ng system.
	4	Familiarize concepts of microprocessors, microcontrollers, and PLC	· ·		
	5	Apply interdisciplinary knowledge of mechanical and electronic con	nponents	in manuf	acturing
	3	system.			
:					
Pre	-requisi	tes: Students know about basics of electronics.			
		Course Contents / Syllabus			
UN	IT-I	Introduction to Mechatronics System			8 hours
Inti	oductio	n:			
Intro	oduction	to Mechatronics: Function of Mechatronic System, Scope & Applic	cation of	Mechatro	onics, Advantages
and	disadvaı	tages of Mechatronics, role of mechatronics in manufacturing. Pro	duction	line autor	nation, Benefit of
Mec	hatronic	s in Manufacturing. Representation of Mechatronic System in bloc	k Diagra	m and Co	oncept of transfer
func	tion for	each element of Mechatronic system. Basic concept of Robotics, Au	totronics	Bionics,	and Avionics and
their	applicat	ions			
UN	IT-II	Signal Transmission Sensors and transducers			10 hours
Sig	nal trar	smission: types of signals:- hydraulic signal, pneumatic signal, o	electroni	es signal.	ADC (Analog to
Digi	tal Conv	rertor, DAC (Digital to Analog Convertor) R-2R circuit and DAC n	resolution	n. Signal 1	Filters: Low pass,
Hig	n Pass an	d Band Pass with circuit diagrams for simple cases			
Sen	sors an	d transducers: Sensors & Transducer with classification, Deve	lopment	in Transo	lucer technology,
Crit	eria for s	election of sensors based on requirements, Principle of measurement,	, Sensing	method, ]	Performance chart
etc.	(Displac	ement, temperature, acceleration, force/pressure) based on Static an	d Dynan	iic charac	teristics. Principle
of v	orking a	and application of Inductive Proximity, Capacitive Proximity, Photo	pelectric,	Ultrasoni	c, Magnetic, Hall
EIIC		A strategy and A stratign contains			0 1
UN	11-111	Actuators and Actuation system			8 nours
Act	uators:	Types of Actuators, Selection of Actuators based on principle of op	eration,	erforman	ce characteristics,
		ading conditions, Safety etc., Principle and Selection of Mechano-ele	ctrical ac	tuators, N	licro actuators.
Sale	noida on	d Salanaid Operated Direction Control Valvas, Dringina of working	of DC or	d 2 Dhogo	Induction Motor
Stor	nor mot	a solehold Operated Direction Control valves, Finiciple of working	of DC al	iu 5 Fliase	mauchon wotor,
	$\mathbf{T}$	Instand Serve Motors with their ments and dements.			10 hours
	ll-lV Inculia	Actuation System: Different tenus of endous much on flore	D:	1	
пу	iraunc	Actuation System: Different types of valves such as now,		the size Control	valve, Hydraulic
pum	ips, Actu	ators and Auxiliary elements in Hydraulics, their applications and		their Gr	aphical Symbols,
Synthesis and design of circuits (up to 2 cylinders), Hydraulic system design, Electro-Hydraulics.					
Pneumatic Actuation System: Production and Distribution of Compressed air, Components of Pneumatic					
System, Different types of Valves, Graphical symbols, Graphical representation and design of Pneumatic system,					
Elec	tro- Pne				10.1
UN	11-V	Control System & Programming Lechniques			IU hours
	urol Sys	iem: introduction to Control Systems, Elements of control system, Ba	asic of op	en and clo	osed loop control
with example.					
Automatic Control and Real Time Control Systems: types of controllers PID controller adaptive control D DI DD					
and	PID con	rol systems	aoner, at	aptive col	1.1.01, 1 , 1 1, 1 D
unu		201 5J500115			

**Programming Techniques:** Ladder Logic programming for different types of logic gates, Ladder diagram – Concept of Contacts and Coil, Latching/ Holding Circuit, Memory Bits, Timers, and Counter

#### **Course outcome:**

CO1	O1 Identify mechatronic system and have knowledge about the sensors and transducers used in manufacturing system.					
CO2 Identify different actuation systems and design basic system for manufacturing system.						
CO3	CO3Design and apply hydraulic, pneumatic and electrical system in manufacturing.K3,K4					
CO4	CO4Identify different types of controllers and ability to choose one according to the need.K2					
CO5	O5 Design a mechatronic system for manufacturing. K4					
Text books :						
1	Mechatronics System Design , Shetty and Kolk, Cengage Learning, India Edition					
2	Introduction to Mechatronics and Measurement Systems, Alciatore and Hist and Tata McGraw-Hill					
3	Mechatronics - Electronic Control Systems in Mechanical Engineering, Bolton Pearson education					

## **Reference Books:**

Mechatronics: A Multidisciplinary Approach, William Bolton, Pearson Education

A Textbook of Mechatronics, R.K.Rajput, S. Chand & Company Private Limited

Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, William Bolton, Prentice Hall

## Link: NPTEL/ YouTube/ Faculty Video Link:

Unit 1	https://www.youtube.com/watch?v=4lilX8cHDHI.
Unit 2	https://www.youtube.com/watch?v=1uPTyjxZzyo.
Unit 3	https://www.youtube.com/watch?v=YBpfLWTE6ak.
Unit 4	https://www.youtube.com/watch?v=akZjDHD6JC4
Unit 5	https://www.youtube.com/watch?v=6Ro3lnNYU2w

Mechanical Engineering Third Year						
Course CodeAME0514LTPCredit						
Course TitleComputer Aided Engineering3003						
Course objective:						
Understand the importance, benefits, applications and essential elements of K <sub>1</sub> , K <sub>2</sub> , K <sub>3</sub>						
CAD such as graphics input, display and output devices.						
2 Impart the fundamentals approach for generating line, circle by algorithm and understand the mathematics behind 2D & 3D geometric transformations. $K_2, K_3$						
Develop the mathematical representation of parametric form of analytic planar						
3 curves and synthetic space to create and manipulate the design using various $K_2, K_3$						
Types of curves						
4 impart the fundamentals of CAD tools to create and manipulate the design conceptualization, geometric modelling using surfaces and solids. $K_2, K_3, K_4$						
5 Understand the fundamental concepts of Finite Element method and different K <sub>2</sub> , K <sub>3</sub>						
approaches used to solve realistic problems in Mechanical Engineering						
Pre-requisites: Students should have basic knowledge of computer, Engineering Drawing, and manufacturing process.						
Course Contents / Syllabus						
UNIT-I Introduction: 8 Hours						
Computer in Engineering Design, Classical vs Computer Aided Design, Elements of CAD, Essential requirements						
CAD, CAD Tools, Concepts of integrated CAD/CAM, Necessity & Benefits, Engineering Applications.						
Computer Graphics Hardware:						
Graphics systems, Graphics Input devices - Cursor control devices, Digitizers, Image scanner, Keyboard terminal						
Speech oriented devices, Graphics display devices – Cathode Ray Tube, Random & Raster scan display, Direct Vie						
Storage Tubes, Color CRT monitors, Solid state monitors – emissive displays and non-emissive displays, Graphi						
output devices – Hard copy printers and plotters.						
UNIT-II Computer Graphics Software: 12 Hours						
Graphics Software, Software Configuration, Graphics Functions, Graphics standards, viewing transformations -						
Output primitives:						
Line generation algorithms – DDA and Bresenham's line drawing algorithm. Circle generating algorithm – Mid-poi						
and Bresenham's algorithm						
Geometric Transformations:						
2D Geometric transformations – Translation, Scaling, Shearing, Rotation & Reflection matrix representation						
Rotation and scaling about arbitrary point, Reflection through arbitrary line, Composite transformation, 3						
transformations, Multiple transformation.						
UNIT-III Planar Curves: 8 Hours						
Curves representation, Properties of curve design, Interpolation vs Approximation, Parametric representation of						
analytic curves, Parametric continuity conditions,						
Space Curves:						
Parametric representation of synthetic curves – Spline curves and specifications, Hermite curves – Blending function						
formulation and its properties, Bezier curves – Blending function formulation and its properties, B-spline curves –						
Biending function formulation and its properties.						
UNIT-IV 3D Graphics: 6 Hours						
Introduction, Wireframe modelling, Surface modelling, Polygon surfaces - Polygon meshes, Polygon equations,						
Quadric and Super quadric surfaces, Blobby objects, Solid modelling - Solid entities, Boolean set operations, Sweep						
representation – Translational, Rotational and Hybrid sweeps, Boundary representation – Topology, Geometry,						
Boundary models, Constructive solid geometry – Unbounded and Bounded primitives.						
Coloring in computer graphics RGB CMV VIO HSV and HIS color models						
UNIT-V Finite Element Modelling: 8 Hours						

Introduction, Principles of Finite elements modelling, General procedure for finite element analysis, Local and global coordinates, node and elements, Mesh Generation and its requirements Stiffness matrix/displacement matrix, Formulation of global stiffness matrix, Weighted Residual methods, Variation Rayleigh Ritz method, Principle of minimum potential energy. Problem on spring system, bar & beam elements.

Commercially available FEM packages, Desirable features of FEM packages, An overview of FEM software's like ANSYS, ABAQUS, NISA etc.

## Course outcome:

CO1	Understand the knowledge of basic structure of CAD, Memory types, input/output devices, display devices and its working principles	$K_1, K_2, K_2$	
	display devices and its working principles.	13	
	Develop about the knowledge of graphics software, graphics standards, configuration, and		
CO2	functions; skill of writing algorithm for generating 2D graphic elements; and apply the	K <sub>2</sub> , K <sub>3</sub>	
	mathematics behind 2D & 3D individual and combined geometric transformations.		
	The ability of mathematical representation of parametric form of analytic planar curves and		
CO3	synthetic space curves such as Hermite, Bezier and B-spline curves and knowledge of their	K <sub>2</sub> , K <sub>3</sub>	
	properties.	2, 5	
	The ability the knowledge of polygonal, quadric and super quadric surfaces, blobby objects.		
CO4	color models and different solid modelling techniques and the skill of developing 3D	$K_2, K_{3,}$	
001	geometric models in CAD software	K <sub>4</sub>	
C05	Apply the fundamental concepts and approaches to solve a realistic engineering problem and	K <sub>2</sub> K <sub>2</sub>	
	analyze the design using Finite Element Methods.	<b>1x</b> <sub>2</sub> , <b>1x</b> <sub>3</sub>	
T 41			

#### **Text books :**

1.	Computer Graphics-Hearn & Baker (Prentice Hall of India)
2.	CAD/CAM Theory and Practice- Ibrahim Zeid & R Sivasubramaniam (McGraw Hill)
3.	CAD/CAM-HP Groover & EW Zimmers, Jr (Prentice Hall India)

## **Reference Books:**

	1. Cor	nputer Aided Er	gineering Design-	Anupam Saxena &	& B. Sahay (Anama	ava Publishers)
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- 2. Mathematical Elements for Computer Graphics- DF Rogers & JA Adams (McGraw Hill)
- 3. Computer Aided Design-S.K. Srivastava (IK International Publications)
- 4. Computer Aided Design-R.K. Srivastava (Umesh Publications)
- 5. The Finite Element Method in Engineering by S. S. Rao, (Pergamon Press, Oxford)
- 6. An Introduction to Finite Element Method by J.N. Reddy published (Mc Graw Hill)
- Link: NPTEL/ YouTube/ Faculty Video Link:

Unit 1	https://youtu.be/EgKc9L7cbKc
	https://youtu.be/1y2Vec5XdXg
	https://youtu.be/HJLuKbU11jY
	https://youtu.be/BgGADYtIhgk
	https://youtu.be/082HkPVEz 8
	https://youtu.be/6XTLrz9Wd9E
	https://youtu.be/195BztHFk5g
Unit 2	https://youtu.be/MViI7GPG9xo
	https://youtu.be/qrWASTbyyBQ
	https://youtu.be/iWxS2zpaRjk
	https://youtu.be/I8o4kK9QRL4
	https://youtu.be/yZIyWA08sJ4
	https://youtu.be/QIa-V7XuJEM
Unit 3	https://youtu.be/0NbD-c0Ctdk
	https://youtu.be/uKXbkJR6gek

	https://youtu.be/sxvcjmbolXw https://youtu.be/mEAmuKxYPLQ https://youtu.be/FTg1DUr7bhY https://youtu.be/2-V4oHj0xpY https://youtu.be/7yc4Pf14FIw https://youtu.be/1foc4sbmQb8
Unit 4	https://youtu.be/TEAtmCYYKZA https://youtu.be/Sp0OogV-Eh0 https://youtu.be/FshEXrd28qw https://youtu.be/TYqzwU8pW7s https://youtu.be/HaVAANeXb0A
Unit 5	https://youtu.be/GHjopp47vvQ https://youtu.be/hVleTL6CeKw https://youtu.be/boSLQYhDXoE https://youtu.be/GVBv2Yz4n2c https://youtu.be/IH1vgdJw1DQ.

Mechanical Engineering Third Year									
Course C	Course CodeAME0551LTPCredit								
Course Title Heat and Mass Transfer lab			0	2	1				
Course o	bjective: Students will be perform the experiments based	on condu	ction	convect	tion and heat				
exchanger									
-									
Pre-requisites: Student know the concept of conduction convection and heat exchangers									
<u>i i c i cqu</u>	Course Contents / Syllabus	and near	exenu	11501 51					
Suggest	ed list of Experiment								
Perform Te	n experiment from the list of Experiment								
Sr No	Name of Experiment								
1	Conduction – Experiment on Composite plane wall								
2	Conduction - Experiment on critical insulation thickness								
3	Conduction – Experiment on Thermal Contact Resistance								
4	Convection - Pool Boiling experiment								
5	5 Convection - Experiment on heat transfer from tube- (natural convection).								
6	6 Convection - Heat Pipe experiment.								
7	Convection - Heat transfer through fin- (natural convection).								
8	Convection - Heat transfer through tube/fin- (forced convection).								
9 Convection - Determination of thermal conductivity of fluid									
10	10   Experiment on Stefan's Law, on radiation determination of emissivity, etc.								
11	Experiment on solar collector, etc.								
12	Heat exchanger - Parallel / Counter flow experiment								
13	Making of Thermocouple								
14	Calibration of thermocouple.								
Course of	itcome:								
CO 1	Formulate heat conduction problems to determine the conductivity	v of compos	site m	aterial	К3				
<u> </u>	Analyze the heat transfer through extended surface calculate the t	emperature	distri	bution					
	effectiveness for pin fin.		41541	- 401011,	K.3				
CO 3	O 3   Analyze the phenomena of boiling and condensation.   K3				К3				
<b>CO4</b> Modelling of Heat exchanger problem to Calculate fluid temperature heat exchange and			K3						
effectiveness during parallel and counter flow heat exchanger.				K.3					
CO 5Calculate the Stefan Boltzmann's Constant and measure emissivity of different surfaces.K3				K3					
Link: NP	TEL/ YouTube/ Faculty Video Link:								
1.	http://htv-au.vlabs.ac.in/								
2	http://vlabs.iitb.ac.in/vlab/chemical/List%20of%20experiments.html?domair	=Chemical%	20Engi	neering					

Mechanical Engineering Third Year						
Course C	Course Code AME0552			Т	Р	Credit
Course Ti	itle	THEORY OF MACHINES	0	0	2	1
Student w	ill per	form the experiments based on mechanism, governor, gear tr	ain ar	ıd vibr	ation.	
Pre-requi	sites:	Studnets know the theory of mechanism , governor and	vibra	tions		
		Course Contents / Syllabus				
Sr. No.	Na	nme of Experiment				
1	Stud	y of simple linkage models/mechanisms				
2	Stud	y of inversions of four bar linkage				
3	Stud	y of inversions of single/double slider crank mechanisms				
4	Expo	eriment on critical speed of shaft				
5	Exp	eriment on cam and follower motion				
6	Exp	eriment on gyroscope				
7	Exp	eriment on static/dynamic balancing				
8	Exp	eriment on watt governor				
9	Exp	eriment on porter governor				
10	10 Experiment on proell governor					
11	11   Experiment on hartnell governor					
12	Experiment on gear trains					
13	Exp	eriment on longitudinal vibration				
14 Experiment on transverse vibration						
Lab Co	Lab Course Outcome:					
CO 1 Student will be able to understand the relative motion between the element of a mechanisms and their						
	inversion for the specified type of motion in a machine.					
CO 2	O 2Student will be able to understand the fundamental principles of balancing to balance the masses		masses			
statically & dynamically of a rotating mass system and observe the effect of unbalance in a		a rotating				
	mass system.					
CO 3	CO 3 Student will be able to demonstrate the torque analysis and measure epicyclic gear ratio on any kind of		on any kind of			
	on er	ngine or machine shaft.				
CO 4	Stude	ent will be able to understand the working principle of a governor	and a	ble to i	dentif	y different
	types	of governors in actual practice for maintain the constant speed o	of engi	ne.		
CO 5	0 5 Student will be able to understand the fundamental principles of gyroscope and observe the gyroscopic					
	effect of a rotating disc.					
CO 6	CO 6 Student will be able to observe the effect of longitudinal, transverse and torsional vibration and determine			and determine		
	the frequency and time period of oscillation.					
Link:						
Unit 1		https://www.youtube.com/watch?v=MJeRFzs4oRU&list=P	LBEA	57F71	E7560	<u>C8E8</u>
Unit 2		https://www.youtube.com/watch?v=55tKVBVQDUY				
Unit 3		https://www.youtube.com/playlist?list=PL46AAEDA6ABA	FCA	<u>78</u>		
Unit 4		https://www.youtube.com/watch?v=OlZXxPVpmBs				
Unit 5		https://www.youtube.com/watch?v=ZldkigrDplc				

Mechanical Engineering Third Year							
Course Code	AME0553	L	Т	Р	Credit		
Course Title	Applied Industrial IOT lab	0	0	2	1		
Course objective: S	tudent will perform the study on sensor	and ir	strum	entation,	actuator systems		
and perform the expe	eriment on IOT based systems.						
Pre-requisites: Stud	lents know about the sensors and actuation	on sys	tem a	nd IOT b	ased systems.		
	Course Contents / Syllabus						
S. No.	LIST OF EXPERIMENTS (Total Eight to be performed)						
1	Study of Sensing and Actuating	system	ns used	l in Indust	rial IOT.		
	Study of Healthcare based sensors such	as:- E	CG – ]	Electrocar	diogram ACC –		
2	Accelerometer, TEMP – Temperature, 1	RESP	– Resp	piration, H	eartbeat sensor.		
3	Study of Agriculture based sensors such	as:- 1	emper	ature, Hu	midity, Pressure		
5	Study of Healthy Environment based set	nsors s	such as	:- PIR Mo	otion sensor. Air		
	quality sensor, Fire sensor, Accelerometer	er, Gyr	oscop	e sensor, (	Gas sensors, Light		
4	sense	ors.	-				
5	Introduction to IoT, Arduino platform and perform necessary software installation.						
	To interface motor using relay with Arduino and write a program to turn motor						
6	ON/OFF.						
7	To interface sensors to Arduino and display the sensor data.						
Q	To interface sensor with Arduino and write a program to turn ON/OFF Solenoid						
0	• Valve when sensor data is detected.						
9	9 Actuator when sensor data is detected.						
	To interface Arduino to a Bluetooth Module and send sensor data to a smart phone						
10 using Bluetooth.							
11	11         Develop an IoT based Smart water flow system.						
12 Develop an IoT based smart lock system for Motor cycle/Car/Household door							
<b>Course outcomes:</b> After completion of this course students will be able to							
CO 1	CO 1         Become familiar with the concept of Sensor systems						
CO 2	Understand and implement fundamentals of IOT						
CO 3	Practically implement the concepts IOT programming						
CO 4	Learn and implement the concepts Industri	ial IOT	Γ				
	Link: NPTEL/ YouTube/ Faculty	Video	Link				
Link 1	Difference between Sensor and Actuator -	Geek	sfor Ge	eks			
Link 2	Temperature Sensors: Types, How It Work	s, & A	pplicat	tions (enc	ardio.com)		
Link 3	https://www.fierceelectronics.com/senso	rs/wha	at-acce	eleromete	<u>r</u>		

B. TECH. THIRD YEAR							
Course Code	ANC0501	L	Т	Р	Credits		
Course Title	rse Title CONSTITUTION OF INDIA, LAW AND				2		
	ENGINEERING						
Course objecti	ve:To acquaint the students with legacies of constitutional develop	men	t in Ir	ndia a	nd help them		
to understand the	most diversified legal document of India and philosophy behind it.						
Pre-requisites:	Computer Organization and Architecture						
	<b>Course Contents / Syllabus</b>						
UNIT-I	INTRODUCTION AND BASIC INFORMATION ABO CONSTITUTION	UT	IND	IAN	8 Hours		
Meaning of the	constitution law and constitutionalism, Historical Background of	the	Cons	tituer	nt Assembly,		
Government of In	idia Act of 1935 and Indian Independence Act of 1947, Enforcement	nt of	the C	onstit	ution, Indian		
Constitution and i	ts Salient Features, The Preamble of the Constitution, Fundamental	Righ	ts, Fu	ndam	ental Duties,		
Directive Principl	es of State Policy, Parliamentary System, Federal System, Centre-	State	Rela	tions,	Amendment		
of the Constitution	onal Powers and Procedure, The historical perspectives of the co	onstit	ution	al am	endments in		
India, Emergency	y Provisions: National Emergency, President Rule, Financial H	Emerg	gency	, and	l Local Self		
Government – Co	nstitutional Scheme in India.						
UNIT-II	UNION EXECUTIVE AND STATE EXECUTIVE				8 Hours		
Powers of Indian	Parliament Functions of Rajya Sabha, Functions of Lok Sabha, I	Powe	rs and	1 Fun	ctions of the		
President, Compa	rison of powers of Indian President with the United States, Pow	vers a	and F	uncti	ons of Vice-		
President, Powers	s and Functions of the Prime Minister, Judiciary – The Independ	ence	of th	e Sup	oreme Court,		
Appointment of J	udges, Judicial Review, Public Interest Litigation, Judicial Activisi	n, Lo	okPal	Lok	Ayukta, The		
Lokpal and Lok	ayuktas Act 2013, State Executives – Powers and Functions of Chief Minister Experience of State Le	the	Gove	ernor, Euroat	Powers and		
Court and Subord	inete Courts	gisia	ure,	runci	ions of righ		
	INTRODUCTION AND BASIC INFORMATION ABO	UT	IFC	TAT	0 II auna		
	SYSTEM	U I	LEC	AL	o nours		
The Legal System: Sources of Law and the Court Structure: Enacted law -Acts of Parliament are of primary							
legislation, Common Law or Case law, Principles taken from decisions of judges constitute binding legal rules.							
The Court System in India and Foreign Courtiers (District Court, District Consumer Forum, Tribunals, High							
Courts, Supreme Court). Arbitration: As an alternative to resolving disputes in the normal courts, parties who are							
in dispute can agree that this will instead be referred to arbitration. Contract law, Tort, Law at workplace.							
UNIT-IV	INTELLECTUAL PROPERTY LAWS AND REGULATION	ТО			8 Hours		
Intellectual Property Laws: Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from							
Patents, Infringement of Patents, Copyright and its Ownership. Infringement of Copyright, Civil Remedies for							
Infringement, Regulation to Information, Introduction, Right to Information Act. 2005. Information Technology							
Act, 2000, Electronic Governance, Secure Electronic Records and Digital Signatures. Digital Signature							
Certificates, Cyber Regulations Appellate Tribunal, Offences, Limitations of the Information Technology Act.							
UNIT-V	BUSINESS ORGANIZATIONS AND E-GOVERNANCE				8 Hours		
Sole Traders, Pa	artnerships: Companies: The Company's Act: Introduction, F	orma	tion	of a	Company,		

Memorandum of Association, Articles of Association, Prospectus, Shares, Directors, General Meetings and Proceedings, Auditor, Winding up. E-Governance and role of engineers in E-Governance, Need for reformed engineering serving at the Union and State level, Role of I.T. professionals in Judiciary, Problem of Alienation and Secessionism in few states creating hurdles in Industrial development.

**COURSE OUTCOMES:** After completion of this course students will be able to

CO 1	Identify and explore the basic features and modalities about Indian constitution.	K1
CO 2	Differentiate and relate the functioning of Indian parliamentary system at the center and state level.	K2
GO 3		
CO 3	Differentiate different aspects of Indian Legal System and its related bodies.	K4
CO 4	Discover and apply different laws and regulations related to engineering	K4
	practices.	
CO 5	Correlate role of engineers with different organizations and governance models	K4
Text Books:	· · · · · · · · · · · · · · · · · · ·	

1. M Laxmikanth: Indian Polity for civil services and other State Examination,6th Edition, Mc Graw Hill

2. Brij Kishore Sharma: Introduction to the Indian Constitution, 8th Edition, PHI Learning Pvt. Ltd.

3. Granville Austin: The Indian Constitution: Cornerstone of a Nation (Classic Reissue), Oxford University Press.

## **Reference Books:**

1. Madhav Khosla: The Indian Constitution, Oxford University Press.

2. PM Bakshi: The Constitution of India, Latest Edition, Universal Law Publishing.

3. V.K. Ahuja: Law Relating to Intellectual Property Rights (2007)

	<b>B. TECH. THIRD YEAR</b>		
<b>Course Code</b>	ANC0502	L T P	Credits
<b>Course Title</b>	ESSENCE OF INDIAN TRADITIONAL	2 0 0	2
	KNOWLEDGE		
Course objecti	ve: This course aims to provide basic knowledge about different t	theories of soci	ety, state and
polity in India, In	dian literature, culture, Indian religion, philosophy, science, manag	gement, cultura	heritage and
different arts in In	dia.s		
Pre-requisites:	Computer Organization and Architecture		
	Course Contents / Syllabus		
UNIT-I	SOCIETY STATE AND POLITY IN INDIA		8 Hours
State in Ancient	India: Evolutionary Theory, Force Theory, Mystical Theory Cont	ract Theory, St	ages of State
Formation in And	cient India, Kingship, Council of Ministers Administration Polit	ical Ideals in A	Ancient India
Conditions' of th	e Welfare of Societies, The Seven Limbs of the State, Society in	n Ancient India	a, Purusārtha,
Varnāshrama Sys	tem, Āshrama or the Stages of Life, Marriage, Understanding Gene	der as a social	category, The
representation of	Women in Historical traditions, Challenges faced by Women.		
UNIT-II	INDIAN LITERATURE, CULTURE, TRADITION, AND PR	ACTICES	8 Hours
Evolution of scrip	ot and languages in India: Harappan Script and Brahmi Script. The	e Vedas, the Up	panishads, the
Ramayana and th	ne Mahabharata, Puranas, Buddhist And Jain Literature in Pali	Prakrit And S	anskrit, Sikh
Literature, Kautily	ya's Arthashastra, Famous Sanskrit Authors, Telugu Literature, Ka	innada Literatu	re,Malayalam
Literature ,Sangar	na Literature Northern Indian Languages & Literature, Persian And	Urdu ,Hındı Lı	terature
UNIT-III	INDIAN RELIGION, PHILOSOPHY, AND PRACTICES		8 Hours
Pre-Vedic and V	edic Religion, Buddhism, Jainism, Six System Indian Philosoph	y, Shankaracha	arya, Various
Philosophical Do	ctrines, Other Heterodox Sects, Bhakti Movement, Sufi movem	nent, Socio reli	gious reform
movement of 19th	century, Modern religious practices.		
	SCIENCE MANACEMENT AND INDIAN KNOWLEDCE S	WOTEM	0 11
UNIT-IV	SCIENCE, MANAGEMENT AND INDIAN KNOW LEDGE S	Y SI ENI	8 Hours
Astronomy in Ind	ja Chemistry in India Mathematics in India Physics in India Ag	riculture in Ind	ia Medicine
in India Metallur	ay in India Geography Biology Harappan Technologies Water M	anagement in I	ndia Textile
Technology in I	ndia Writing Technology in India Pyrotechnics in India Trade	e in Ancient I	ndia/India's
Dominance up to	Pre-colonial Times.		
UNIT-V	CULTURAL HERITAGE AND PERFORMING ARTS		8 Hours
Indian Architect	Engineering and Architecture in Ancient India Sculptures Pottery	Painting India	Handicraft
UNESCO'S List	of World Heritage sites in India. Seals, coins, Puppetry, Dance, Mu	sic. Theatre. dr	ama. Martial
Arts Traditions.	Fairs and Festivals. UNESCO'S List of Intangible Cultural He	eritage. Calend	ers. Current
developments in A	Arts and Cultural. Indian's Cultural Contribution to the World. India	n Cinema.	
COURSE OUTC	<b>OMES:</b> After completion of this course students will be able to		
CO 1	Understand the basics of past Indian politics and state polity.		K2
CO 2	Understand the Vedas, Upanishads, languages & literature of India	an society.	K2
CO 3	Know the different religions and religious movements in India.		K4

	CO 4	Identify and explore the basic knowledge about the ancient history of Indian	K4
		agriculture, science & technology, and ayurveda.	l
	CO 5	Identify Indian dances, fairs & festivals, and cinema.	K1
Te	ext Books:		
1.	Sivaramakris	hna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhava	an, Mumbai,
	5th Edition, 2	2014.	
2.	S. Baliyan, Ir	ndian Art and Culture, Oxford University Press, India	
3.	Nitin Singha	nia, Indian Art and Culture: for civil services and other competitive Exam	inations,3rd
	Edition,Mc G	raw Hill	
R	eference B	ooks:	
1.	Romila Thapa	r, Readings In Early Indian History Oxford University Press, India	
2.	Basham, A.L.	The Wonder that was India (34th impression), New Delhi, Rupa & co.	

		<b>BTECH THIRD YEAR</b>			
<b>Course Cod</b>	e	AME0601	L-T-	P	Credit
<b>Course Title</b>	e	<b>Design of Machine Elements</b>	3-1-	0	4
Course obje	ectiv	e:			
1.	T	o develop an Efficient, Economic and Ecofriendly	product for	the	K1,K2
	w	elfare of society based on market demand.			
2.	T	o develop sustainable approach in problem solving	for the soci	ety.	K2,K3
3.	T	o develop an art of design & analysis the complex	problem rela	ated to	K3,K4,K5
	m	achine elements.			
Pre-requisit	es:				
•		General laws of science, force analysis.			
•		Basic knowledge of material science & man	ufacturing.		
•		Fundamental of engineering mechanics & St	rength of M	aterial.	
		<u>Course Contents / Syllabus</u>			
UNIT-I	INT	<b>RODUCTION &amp; DESIGN FOR STATION</b>	C LOAD		8 hours

## Introduction

Definition, Design requirements of machine elements, Design procedure, Standards in design, Indian Standards designation of carbon & alloy steels Selection of preferred sizes, Selection of materials for static and fatigue loads.

## Design for Static Load

Stresses due to bending and torsion, Theory of failure, Cause of failure in shafts, Materials for shaft, Design of shafts subjected to twisting moment, bending moment and combined twisting & bending moments, ASME design, Shafts subjected to fatigue loads, Design for rigidity.

UNIT-II	DESIGN	FOR	FLUCTUATING	LOAD	&	10 hours
	MECHAN	ICAL S	PRING			

## Design for Fluctuating Loads

Cyclic stresses, Fatigue and endurance limit, Stress concentration factor and its measures for various machine parts, Notch sensitivity, Design for finite and infinite life, Soderberg, Goodman & Gerber criteria.

## Mechanical Springs

Types, Material for helical springs, End connections for compression and tension helical springs, Stresses and deflection of helical springs of circular wire, Design of helical springs subjected to static and fatigue loading.

UNIT-III	SPUR GEAR & HELICAL GEAR	12 hours
Sour Gears		

# Tooth forms, System of gear teeth, contact ratio, Standard proportions of gear systems, Interference in involute gears, Backlash, Selection of gear materials, Gear manufacturing methods, Beam strength of gear tooth, Dynamic tooth load, Wear strength of gear tooth, Failure of gear tooth.

## Helical Gears

Terminology, Proportions for helical gears, Forces components on a tooth of helical gear, Virtual number of teeth, Beam strength & wear strength of helical gears, Dynamic load on helical gears, Design of helical gears.

UNIT-IV	<b>BEVEL GEAR &amp; WORM GEAR</b>	12 hours
Bevel gears		

Terminology of bevel gears, Force analysis, Virtual number of teeth, Beam strength and wear strength of bevel gears, Effective load of gear tooth, Design of a bevel gear system.

## Worm Gears

Types of worms, Terminology, Gear tooth proportions, Efficiency of worm gears, Heat dissipation in worm gearing, Strength and wear tooth load for worm gears, Design of worm gearing system.

UNIT-V	<b>SLIDING &amp; ROLLING CONTACT BEARING</b>	10 hours
Cliding Cont	act Pearing	

## Sliding Contact Bearing

Types, Properties and materials, Hydrodynamic lubrication, Heat generation, Design of journal bearing, Thrust bearing-pivot and collar bearing

## **Rolling Contact Bearing**

Types, Advantages and disadvantages, Designation of bearing, Bearing life, Selection of roller bearings, Dynamic equivalent load for roller contact bearing under constant and variable loading, Reliability of Bearing, Design of roller bearing.

Course outco	Ome: After completion of this course students will be able to		
<b>CO1</b>	Analyse stress in different components, theories of failure and	K1, K2	
	material science to analyse, design and/or select commonly		
	used machine components.		
CO2	Analyse fluctuating stress in different components using	K1, K2, K3	
	different criterion.		
CO3	Design Spur and helical gear for different application.	K1, K2, K3, K4, K5	
CO4	Design Bevel and Worm gear for different application.	K1, K2, K3,	
CO5	Select the suitable bearing for given operating conditions.	K1, K2, K3,K4	
Text books			
1.	Text Book of Machine Design, R. S. Khurmi, Eurasia Pu	ublishing House.	
2.	A Text Book of Machine Design, Dr. Rajendra Karwa, I	Laxmi Publications.	
3.	Design of Machine Elements, V. B. Bhandari, Tata McGr	aw Hill Co.	
4.	Machine Design: An Integrated Approach, Robert L. Nor	rton, Pearson Education	
5.	Design of Machine Elements: Volume II, T. Krishna Rao,	I K International	
	Publishing House Pvt. Ltd		
6.	Mechanical Engineering Design, Joseph Shigley, McGrav	w-Hill Education	
Link: NPTEL/	YouTube/ Faculty Video Link:		
Unit 1 https://y	outu.be/ofmbhbVCUqI		
https://y	outu.be/m911tVXyFp8		
Unit 2 https://y	outu.be/2xLHFiBOA4M		
https://y	outu.be/QfhIea6KzZA		
Unit 3 https://y	voutu.be/46quOD7V-cQ		
https://y	voutu.be/i9xbJTIGJIE		
Unit 4 <u>https://y</u>	voutu.be/0jNX9bnWkho		
https://y	youtu.be/kBLWugfEjrs		
Unit 5 https://y	outu.be/NZOKgk001 E		
https://y	voutu.be/ZCvOjnRi9TM		
https://y	youtu.be/rB3qIBSEI4A		

	Bachelor of Technology Third Yea	ar			
<b>Course Code</b>	AME0602	L	Т	P	CREDITS
<b>Course Title</b>	INDUSTRIAL ENGINEERING	3	0	0	3
Course obje	ctive: To make the students able			1	
1	To understand the Concept of Industrial engineering.				K <sub>2</sub>
2	Understand the forecasting and scheduling techniques.				K <sub>3</sub> , K <sub>4</sub>
3	To understand the concept of inventory control and queuin	g the	ory		K <sub>3</sub> , K <sub>4</sub>
4	To apply the concept of work system design				K <sub>3</sub> , k <sub>4</sub>
5	Ability to solve the problem of LPP, Transportation.				K <sub>3</sub> , K <sub>4</sub>
Pre-requisit	es: Basic knowledge of production system				I
	Course Contents / Syllabus				
UNIT-I	Overview of Industrial Engineering				9 hours
Overview of In	dustrial Engineering: Types of production systems, conc	ept o	of pr	oduct	ivity, productivity
measurement in	manufacturing and service organizations, operations strategi	es, lia	abilit	y and	process design.
Facility location	n and layout: Factors affecting facility location; principle	of p	lant	layou	it design, types of
plant layout; c	omputer aided layout design techniques; assembly line	bal	ancir	ıg; n	naterials handling
principles, types	s of material handling systems, methods of process plant	ning,	step	s in	process selection,
production equip	oment and tooling selection, group technology, and flexible n	nanu	factu	ring.	
UNIT-II	Production Planning and Control			-	9 hours
Production Plan	nning and control: Forecasting techniques – causal and time	e seri	es m	odels	, moving
average, expone	ntial smoothing, trend and seasonality; aggregate production	plan	ning;	mast	ter
production schee	duling; materials requirement planning (MRP) and MRP-II; r	outir	ng, sc	hedu	ling and
priority dispatch	ing, concept of JIT manufacturing system				-
Project Manage	ement: Project network analysis, CPM, PERT and Project cr	ashin	g.		
UNIT-III	Engineering Economy and Inventory Co	ntro	l		10 hours
Engineering eco	onomy and Inventory control: Methods of depreciation; br	eak e	even	analy	sis, techniques for
evaluation of c	apital investments, financial statements, time cost tradeo	ff, r	esour	ce le	eveling; Inventory
functions, costs	, classifications, deterministic inventory models, perpetual	and	peri	odic	inventory control
systems, ABC an	nalysis, and VED analysis.				
Queuing Theor	y: Basis of Queuing theory, elements of queuing theory	, Op	erati	ng cl	haracteristics of a
queuing system,	Classification of Queuing models.				
UNIT-IV	Work System Design				9 hours
Work System I	Design: Taylor's scientific management, Gilbreth's contribu	tions	; woi	·k stu	dy: method study,
micro motion stu	ady, principles of motion economy; work measurement -tim	e stu	dy, w	ork s	sampling, standard
data, Predeterm	ined motion time system (PMTS); ergonomics; job eva	luati	on,	merit	rating, incentive
schemes, and wa	ge administration.				
Product Design	and Development: Principles of product design, tolerance of	lesig	n; qu	ality	and cost
Considerations;	product life cycle; standardization, simplification, diversity	ficat	ion,	value	e engineering and
analysis, and con	ncurrent engineering.				
UNIT-V	Operational Analysis				9 hours
<b>Operational</b> A	nalysis: Formulation of LPP, Graphical solution of LPI	P, Si	mple	x M	ethod, Sensitivity
Analysis, degen	eracy, and unbound solutions. Transportation and assignm	ent 1	node	ls; O	ptimality test: the
steppingstone m	ethod and MODI method, simulation.				
<u>.</u>					

Course of	<b>Outcome:</b> After completion of this course students will be able to	
CO 1	Understand the concept of production system, productivity, facility and process planning in various industries	K2
CO 2	Apply the various forecasting and project management techniques	K3
CO 3	Apply the concept of breakeven analysis, inventory control and resource utilization using queuing theory	K3
CO 4	Apply principles of work study and ergonomics for design of work systems	K3
CO 5	Formulate mathematical models for optimal solution of industrial problems using linear programming approach	K4
Text boo	oks:	
1. Ind	ustrial Engineering and Production Management by Martand T Telsang S. Chand Pu	ıblishing
2. Ind	ustrial Engineering and Production Management by M. MahajanDhanpatRai& Co. (	P) Limited
Referen	ce Books:	
1. Ind	ustrial Engineering and Management by Ravi Shankar, Galgotia Publications Pvt Lt	d
2. Pro	duction and Operations Management by Adam, B.E. & Ebert, R.J., PHI	
3. Pro	duct Design and Manufacturing by Chitale A.V. and Gupta R.C., PHI	
4. Op	erations Research Theory & Applications by J K Sharma, Macmillan India Ltd,	
5. Pro	duction Systems Analysis and Control by J.L.Riggs, John Wiley & Sons	
6. Au	tomation, Production Systems & Computer Integrated Manufacturing by Groover, M	1.P. PHI
7. Op 8. Op	erations Research by P. K. Gunta and D. S. Hira, S. Chand & Co.	ucation
Link: NP	TEL/ YouTube/ Faculty Video Link:	
Unit 1	https://archive.nptel.ac.in/courses/112/107/112107143/	
Unit 2	https://nptel.ac.in/courses/112107143	
Unit 3	https://www.youtube.com/watch?v=ZpUD9kkPTiI	
	https://www.youtube.com/watch?v=xGkpXk-AnWU	
Unit 4	https://nptel.ac.in/courses/112107142	
	https://onlinecourses.nptel.ac.in/noc21_me83/preview_	
Unit 5	https://nptel.ac.in/courses/111102012	

Course Code         AME0603         L-T-I           Course title         REFRIGERATION AND AIR CONDITIONING         3-0-0           Course objective:         I         To Learn the fundamental principles and different methods of refrigeration and its application in different aircraft refrigeration systems.         K <sub>1</sub> , K	<b>Credit</b>
Course title         REFRIGERATION AND AIR CONDITIONING         3-0-0           Course objective:         1         To Learn the fundamental principles and different methods of refrigeration and its application in different aircraft refrigeration systems.         K <sub>1</sub> , K	
Course objective:         1       To Learn the fundamental principles and different methods of refrigeration and its application in different aircraft refrigeration systems.	3
$\begin{array}{ c c c c c }\hline 1 & & To \ Learn \ the \ fundamental \ principles \ and \ different \ methods \ of \ refrigeration \ and \ its \ application \ in \ different \ aircraft \ refrigeration \ systems. \end{array}  \begin{array}{ c c c c c c c c c c c c c c c c c c c$	
refrigeration and its application in different aircraft refrigeration systems.	2
systems.	
2 To study of different refrigerants with respect to properties, and K <sub>3</sub> , K	4
familiarize the simple and compound vapour compression	
refrigeration systems.	
3 To understand the vapour absorption refrigeration systems and K <sub>2</sub> , K	
some recent refrigeration systems and its operating principles.	
4 To Learn principles of psychrometric processes and load K <sub>3</sub> , K	ł
calculations criteria for comfort and different air conditioning	
systems.	
5 To study about different refrigeration Equipments and its K <sub>2</sub> , K	3
application in industry.	
Pre-requisites: Thermodynamics, Basic Fluid Mechanics, Heat and Mass Transfer	
Course Contents / Syllabus	
UNIT-I         Basics of refrigeration and air refrigeration systems         8	hours
Introduction: Brief history and need of refrigeration and air conditioning, methods	of natural
refrigeration, unit of refrigeration, coefficient of performance, types and application of refriger	ation.
Air refrigeration: Reversed Carnot cycle and its limitation, Bell-Coleman cycle, aircraft reworking and analysis of Simple; Bootstrap; Reduced ambient and Regenerative air refrigeration	frigeration,
comparison of different aircraft refrigeration systems with Mach number.	on systems,
comparison of different aircraft refrigeration systems with Mach number.UNIT-IIRefrigerants and Vapour compression refrigeration.	on systems, 12 hours
comparison of different aircraft refrigeration systems with Mach number.         UNIT-II       Refrigerants and Vapour compression refrigeration.         Refrigerants: Classification, nomenclature, desirable properties, secondary refrigerants, future	on systems, <u>12 hours</u> e industrial
comparison of different aircraft refrigeration systems with Mach number.         UNIT-II       Refrigerants and Vapour compression refrigeration.         Refrigerants:       Classification, nomenclature, desirable properties, secondary refrigerants, future refrigerants, recent trends in refrigerants and its environmental impact.	on systems, 12 hours e industrial
comparison of different aircraft refrigeration systems with Mach number.         UNIT-II       Refrigerants and Vapour compression refrigeration.         Refrigerants: Classification, nomenclature, desirable properties, secondary refrigerants, future refrigerants, recent trends in refrigerants and its environmental impact.	on systems, <u>12 hours</u> e industrial
comparison of different aircraft refrigeration systems with Mach number.         UNIT-II       Refrigerants and Vapour compression refrigeration.         Refrigerants: Classification, nomenclature, desirable properties, secondary refrigerants, future refrigerants, recent trends in refrigerants and its environmental impact.         Vapour Compression system: Simple system on P-h and T-s diagrams, analysis of the simple	n systems, 12 hours e industrial nple cycle,
comparison of different aircraft refrigeration systems with Mach number.         UNIT-II       Refrigerants and Vapour compression refrigeration.         Refrigerants: Classification, nomenclature, desirable properties, secondary refrigerants, future refrigerants, recent trends in refrigerants and its environmental impact.         Vapour Compression system: Simple system on P-h and T-s diagrams, analysis of the si factors affecting the performance of the cycle, actual cycle. Compound Compression System:	n systems, 12 hours re industrial nple cycle, Compound
comparison of different aircraft refrigeration systems with Mach number.UNIT-IIRefrigerants and Vapour compression refrigeration.Refrigerants:Classification, nomenclature, desirable properties, secondary refrigerants, future refrigerants, recent trends in refrigerants and its environmental impact.Vapour Compression system:Simple system on P-h and T-s diagrams, analysis of the si factors affecting the performance of the cycle, actual cycle. Compound Compression System: compression with intercooler, flash gas removal and flash intercooler, Multistage vapour compression	n systems, 12 hours re industrial nple cycle, Compound ompression
comparison of different aircraft refrigeration systems with Mach number.UNIT-IIRefrigerants and Vapour compression refrigeration.Refrigerants:Classification, nomenclature, desirable properties, secondary refrigerants, future refrigerants, recent trends in refrigerants and its environmental impact.Vapour Compression system:Simple system on P-h and T-s diagrams, analysis of the si factors affecting the performance of the cycle, actual cycle.Compound Compression System:Simple system on P-h and flash intercooler, Multistage vapour compression with intercooler, flash gas removal and flash intercooler, Multistage vapour compression system:	nple cycle, Compound ompression
comparison of different aircraft refrigeration systems with Mach number.         UNIT-II       Refrigerants and Vapour compression refrigeration.         Refrigerants: Classification, nomenclature, desirable properties, secondary refrigerants, future refrigerants, recent trends in refrigerants and its environmental impact.         Vapour Compression system: Simple system on P-h and T-s diagrams, analysis of the si factors affecting the performance of the cycle, actual cycle. Compound Compression System: compression with intercooler, flash gas removal and flash intercooler, Multistage vapour compression system requirement, Different configuration of multistage system, cascade refrigeration system         UNIT. III       Absorption and other performance	nple cycle, Compound ompression
comparison of different aircraft refrigeration systems with Mach number.UNIT-IIRefrigerants and Vapour compression refrigeration.Refrigerants:Classification, nomenclature, desirable properties, secondary refrigerants, future refrigerants, recent trends in refrigerants and its environmental impact.Vapour Compression system:Simple system on P-h and T-s diagrams, analysis of the si factors affecting the performance of the cycle, actual cycle.Compound Compression System:Simple system on P-h and T-s diagrams, analysis of the si factors affecting the performance of the cycle, actual cycle.Compound Compression System:Simple system on P-h and flash intercooler, Multistage vapour compression with intercooler, flash gas removal and flash intercooler, Multistage vapour compression systemUNIT-IIIAbsorption and other refrigeration systemsUNIT-IIIAbsorption and other refrigeration systems	12 hours         re industrial         mple cycle,         Compound         ompression         10 hours
comparison of different aircraft refrigeration systems with Mach number.UNIT-IIRefrigerants and Vapour compression refrigeration.Refrigerants:Classification, nomenclature, desirable properties, secondary refrigerants, future refrigerants, recent trends in refrigerants and its environmental impact.Vapour Compression system:Simple system on P-h and T-s diagrams, analysis of the si factors affecting the performance of the cycle, actual cycle. Compound Compression System: compression with intercooler, flash gas removal and flash intercooler, Multistage vapour cosystem requirement, Different configuration of multistage system, cascade refrigeration systemUNIT-IIIAbsorption and other refrigeration systemsAbsorption Refrigeration System:Working Principal of vapour absorption refrigeration time.	12 hours         12 hours         re industrial         mple cycle,         Compound         ompression         1.         10 hours         on system,         LO system
comparison of different aircraft refrigeration systems with Mach number.UNIT-IIRefrigerants and Vapour compression refrigeration.Refrigerants:Classification, nomenclature, desirable properties, secondary refrigerants, futu refrigerants, recent trends in refrigerants and its environmental impact.Vapour Compression system:Simple system on P-h and T-s diagrams, analysis of the si factors affecting the performance of the cycle, actual cycle.Compound Compression System: compression system: flash gas removal and flash intercooler, Multistage vapour c system requirement, Different configuration of multistage system, cascade refrigeration systemUNIT-IIIAbsorption and other refrigeration systemsAbsorption Refrigeration System:Working Principal of vapour absorption refrigerat comparison between absorption & compression systems. practical NH3- H2O cycle, LiBr – I and its working.	$\frac{12 \text{ hours}}{12 \text{ hours}}$ The industrial mple cycle, Compound ompression 1. $\frac{10 \text{ hours}}{12 \text{ on system}}$
comparison of different aircraft refrigeration systems with Mach number.         UNIT-II       Refrigerants and Vapour compression refrigeration.         Refrigerants: Classification, nomenclature, desirable properties, secondary refrigerants, futurefrigerants, recent trends in refrigerants and its environmental impact.         Vapour Compression system: Simple system on P-h and T-s diagrams, analysis of the sifactors affecting the performance of the cycle, actual cycle. Compound Compression System: compression with intercooler, flash gas removal and flash intercooler, Multistage vapour cosystem requirement, Different configuration of multistage system, cascade refrigeration system         UNIT-III       Absorption and other refrigeration systems         Absorption Refrigeration System:       Working Principal of vapour absorption refrigeration system.         Other refrigeration system:       Thermo electric rafrigeration system.	12 hours         12 hours         re industrial         mple cycle,         Compound         ompression         10 hours         on system,         120 system
comparison of different aircraft refrigeration systems with Mach number.UNIT-IIRefrigerants and Vapour compression refrigeration.Refrigerants: Classification, nomenclature, desirable properties, secondary refrigerants, futurefrigerants, recent trends in refrigerants and its environmental impact.Vapour Compression system: Simple system on P-h and T-s diagrams, analysis of the sifectors affecting the performance of the cycle, actual cycle. Compound Compression System: compression with intercooler, flash gas removal and flash intercooler, Multistage vapour cosystem requirement, Different configuration of multistage system, cascade refrigeration systemUNIT-IIIAbsorption and other refrigeration systemsAbsorption Refrigeration System:Working Principal of vapour absorption refrigeration comparison between absorption & compression system.Other refrigeration systems:Thermo-electric refrigeration system, Steam jet refrigeration system	on systems, 12 hours re industrial mple cycle, Compound ompression n. 10 hours on system, $I_2O$ system on system,
comparison of different aircraft refrigeration systems with Mach number.         UNIT-II       Refrigerants and Vapour compression refrigeration.         Refrigerants: Classification, nomenclature, desirable properties, secondary refrigerants, futurefrigerants, recent trends in refrigerants and its environmental impact.         Vapour Compression system: Simple system on P-h and T-s diagrams, analysis of the si factors affecting the performance of the cycle, actual cycle. Compound Compression System: compression with intercooler, flash gas removal and flash intercooler, Multistage vapour cystem requirement, Different configuration of multistage system, cascade refrigeration system         UNIT-III       Absorption and other refrigeration systems         Absorption Refrigeration System:       Working Principal of vapour absorption refrigeration system.         Other refrigeration systems: Thermo-electric refrigeration system, Steam jet refrigeration system.         UNIT IV       Air conditioning	$\frac{12 \text{ hours}}{12 \text{ hours}}$ The industrial mple cycle, Compound ompression 1. $\frac{10 \text{ hours}}{12 \text{ on system}}$ on system, 12 hours
comparison of different aircraft refrigeration systems with Mach number.         UNIT-II       Refrigerants and Vapour compression refrigeration.         Refrigerants: Classification, nomenclature, desirable properties, secondary refrigerants, futur refrigerants, recent trends in refrigerants and its environmental impact.         Vapour Compression system: Simple system on P-h and T-s diagrams, analysis of the si factors affecting the performance of the cycle, actual cycle. Compound Compression System: compression with intercooler, flash gas removal and flash intercooler, Multistage vapour c system requirement, Different configuration of multistage system, cascade refrigeration system         UNIT-III       Absorption and other refrigeration systems         Absorption Refrigeration System:       Working Principal of vapour absorption refrigeration compression system.         Other refrigeration systems:       Thermo-electric refrigeration system, Steam jet refrigeration system.         UNIT-IV       Air conditioning	12 hours         12 hours         re industrial         mple cycle,         Compound         ompression         10 hours         on system,         12O system         on system,         12 hours         Different
comparison of different aircraft refrigeration systems with Mach number.         UNIT-II       Refrigerants and Vapour compression refrigeration.         Refrigerants: Classification, nomenclature, desirable properties, secondary refrigerants, futu refrigerants, recent trends in refrigerants and its environmental impact.         Vapour Compression system: Simple system on P-h and T-s diagrams, analysis of the si factors affecting the performance of the cycle, actual cycle. Compound Compression System: compression with intercooler, flash gas removal and flash intercooler, Multistage vapour c system requirement, Different configuration of multistage system, cascade refrigeration system         UNIT-III       Absorption and other refrigeration systems         Absorption Refrigeration System:       Working Principal of vapour absorption refrigeration system.         Other refrigeration systems: Thermo-electric refrigeration system.       UNIT-IV         Vair conditioning       Psychrometry: Psychrometric properties and their definitions, Psychrometric chart	$\frac{12 \text{ hours}}{12 \text{ hours}}$ $\frac{12 \text{ hours}}{12 \text{ hours}}$ $\frac{10 \text{ hours}}{10 \text{ hours}}$ $\frac{10 \text{ hours}}{12 \text{ system}}$ $\frac{12 \text{ hours}}{12 \text{ hours}}$
comparison of different aircraft refrigeration systems with Mach number.         UNIT-II       Refrigerants and Vapour compression refrigeration.         Refrigerants: Classification, nomenclature, desirable properties, secondary refrigerants, futu refrigerants, recent trends in refrigerants and its environmental impact.         Vapour Compression system: Simple system on P-h and T-s diagrams, analysis of the si factors affecting the performance of the cycle, actual cycle. Compound Compression System: compression with intercooler, flash gas removal and flash intercooler, Multistage vapour c system requirement, Different configuration of multistage system, cascade refrigeration system         UNIT-III       Absorption and other refrigeration systems         Absorption Refrigeration System:       Working Principal of vapour absorption refrigerat Comparison between absorption & compression systems.         UNIT-IV       Air conditioning         Psychrometry:       Psychrometry: Psychrometric properties and their definitions, Psychrometric chart         Psychrometry:       Psychrometric processes, Thermal analysis of human body, Effective temperature and con Concling and heating load calculations.	$\frac{12 \text{ hours}}{12 \text{ hours}}$ The industrial mple cycle, Compound ompression n. $\frac{10 \text{ hours}}{12 \text{ hours}}$ on system, 120 system on system, 12 hours Different nfort chart, pat transfer

factor, Grand Sen	sible heat factor (GSHF), Apparatus dew point (ADP).			
Air conditioning	systems and components: Summer and winter air conditioning system	em, Air ventilation		
system, Air Washers, Cooling towers.				
UNIT-V	Refrigeration Equipments and applications	8 hours		
Refrigeration S	ystem Equipment: Compressors, Condensers, Expansion Devices	and Evaporators,		
Elementary know	ledge of transmission and distribution of air through ducts and fans.			
Application: Foo	od preservation, Transport refrigeration, Cold storage, Refrigerates F	Freezers, Ice plant,		
Water coolers, Co	omfort and Industrial air conditioning.			
Course outcome	After completion of this course students will be able to			
CO 1	Illustrate the basic concepts of refrigeration and air conditioning	$K_1, K_2$		
	systems and air refrigeration cycles			
CO 2	Analyze the simple vapour compression refrigeration systems,	K <sub>3</sub> , K <sub>4</sub>		
	multi stage vapour compression refrigeration systems and the			
	properties, applications and environmental issues of different			
	refrigerants used in refrigeration and air conditioning,			
CO 3	Familiarize about the various equipments employed in	K <sub>2</sub> , K <sub>3</sub>		
	refrigeration and air conditioning systems and grasp construction			
	and working of vapour absorption system.			
CO 4	Calculate the heating and cooling load requirements of a room and	K <sub>3</sub> , K <sub>4</sub>		
	design it for human and industrial comfort.			
CO 5	Apply scientific and engineering principles to analyze and design	$K_2, K_3$		
	of ducting and ventilation systems that relate to refrigeration and			
	air conditioning.			
Text books				
1. Refrigeration a	nd Air Conditioning by C P Arora, McGraw-Hill India Publishing Ltd			
2. Refrigeration a	nd Air-conditioning by Ramesh Arora, Prentice Hall of India			
		• •		
3. Refrigeration a	nd Air Conditioning by Manohar Prasad, New Age International Publ	Isher		
4. Principles of R	etrigeration by Roy. J Dossat, Pearson Education	T - 1		
5. Refrigeration a	nd Air Conditioning by Jordon and Prister, Prentice Hall of India Pvt.	Ltd.		
Reference Books				
1. Refrigeration a	nd Air Conditioning by R.S. Khurmi&J.K.Gupta, S.Chand Publication	1		
Link: NPTEL/ Y	ouTube/ Faculty Video Link:			
Unit 1 https://you	itu.be/4mWsRUr0A7A			
Unit 2 https://you	tu.be/XO2PBDMEHfs			
Unit 3 https://you	tu.be/4w3Obp8ILpA			
Unit 4 https://yor	utu.be/0BOVDcMxlyY			
Unit 5 https://you	tu.be/ExNJoT_2XeI			

BTECH THIRD YEAR				
Course code AME0611 L-T-P Credit				Credit
Course title	Hybrid Vehicle Propulsion	3-	·0-0	3
<b>Course objec</b>	tive:			
1.	Understand the basics of the hybrid electric vehicles a	nd it's type	s.	K2
2.	Understand the types of drive trains used in hybrid vehicles		K2	
3.	Understand the propulsion units used in Hybrid Vehic	les and the	ir efficiency.	K2
4.	Understand the requirements and devices of energy st	orage used	in hybrid	K2
	vehicles.	C	2	
5.	Understand the concept of downsizing of IC engineering vehicles.	nes in cas	e of hybrid	K2
6.	Understand the principles of energy management and	l issues rel	ated to these	K2
Dro roquisitos:	strategies.			
Tre-requisites.				
Interest in hybrid V	ehicles			
	Course Contents / Sullahus			
	<u>Course Contents / Syllabus</u>		0.1	
UNIT-I	Introduction to Hybrid Electric Vehicles		8 hou	rs
Introduction :	History of hybrid and electric vehicles, social and env	vironmenta	l importance of	of hybrid
and electric vehi	cles, impact of modern drive-trains on energy supplies.			
Conventional V	ehicles:			
Basics of vehicl	e performance, vehicle power source characterization,	, transmissi	on characteris	stics, and
mathematical models to describe vehicle performance.				
UNIT-II	Hybrid & Electric Drive-trains		10 hou	irs
Hybrid Electri	c Drive-trains: Basic concept of hybrid traction,	introducti	on to variou	s hybrid
drive-train topol	ogies, power flow control in hybrid drive-train topologi	ies, fuel eff	iciency analys	sis.
Electric Drive-t	rains:			~
Basic concept c	f electric traction, introduction to various electric di	rive-train to	opologies, pov	wer flow
control in electri	c drive-train topologies, fuel efficiency analysis.		10.1	
UNIT-III Electric Propulsion unit 12 hours			irs	
Electric Propu	sion unit: Introduction to electric components used	in hybrid	and electric	vehicles,
Configuration a	nd control of DC Motor drives, Configuration and co	ontrol of Ir	iduction Moto	or drives,
configuration ar	d control of Permanent Magnet Motor drives, Cont	figuration	and control o	f Switch
Reluctance Motor drives, drive system efficiency				
UNIT-IV Energy Storage 12 hour			12 hours	
Energy Storage	: Introduction to Energy Storage Requirements in Hyb	orid and Ele	ectric Vehicles	s, Battery
based energy sto	brage and its analysis, Fuel Cell based energy storage	and its ana	alysis, Super (	Capacitor
based energy sto	brage and its analysis, Flywheel based energy storage	and its ana	lysis, Hybridi	zation of
different energy	storage devices.			
Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE),				
Sizing the prop	ulsion motor, sizing the power electronics, selecting	g the energ	gy storage tec	hnology,
Communications	s, supporting subsystems			
UNIT-V	Energy Management Strategies			10 hours

Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

## Text books

- 1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press , 2003.
- 2. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004

## **Reference Books**

- 1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley , 2003.
- 2. Chris Mi, M. Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, John Wiley & Sons Ltd., 2011
- Link: NPTEL/ YouTube/ Faculty Video Link:
- Unit 1 https://nptel.ac.in/courses/108103009

Unit 2 <u>https://youtu.be/WfiTscWVfWI</u>

Unit 3 https://www.youtube.com/playlist?list=PLyqSpQzTE6M9spod-UH7Q69wQ3uRm5thr

Unit 4 https://nptel.ac.in/courses/108106170

Unit 5 https://onlinecourses.nptel.ac.in/noc20\_ee99

	BTECH THIRD YEAR		
<b>Course code</b>	Course code AME0613 L-T-P Credit		
<b>Course title</b>	Vehicle Body Engineering	3-0-0	3
Course obied	tives:		
This course provi chassis and body body engineering	des a fundamental understanding (A) To present a problem engineering (B) To address the underlying concepts and m	n in depth Knowledge o lethods behind automob	of automobile bile chassis and
Pre-requisite	s:		
Interest in electri	e Vehicles		
	Course Contents / Syllabus		
UNIT-I C	lassification of Coachwork		9 hours
Styling forms,	coach and bus body style, layout of cars, buses an	d coach with differe	nt seating and
loading capacit construction, ar posts, seat rail, structure, wheel	y, types of commercial vehicles, vans and pickups, agle of approach, Angle of departure, ground clearan waist rail, cant rail, Roof stick, Roof longitude, Rub ra arch, post diagonals, gussets.	etc. Terms used in ice, Cross bearers, flo ail, skirt rail, truss par	body building por longitudes, nel, wheel arch
UNIT-II V	ehicle Body Materials		8 hours
glass reinforced plastics, semi ri corrosion, and t	l plastics and high strength composites, thermoplast gid PUR foams and sandwich panel construction. Pa heir prevention.	ics, ABS and styrene aints adhesives and the	e, load bearing neir properties,
UNIT-III A	erodynamics and Load Distribution		8 hours
Aerodynamics and moments, technology, flo vehicles.	ion:	rces and moments, ef m drag, Principle o els, aerodynamic stu	f wind tunnel dy for heavy
Type of body st	ructures, Vehicle body stress analysis, vehicle weight	distribution, Calcula	tion of loading
bending and tor	g, symmetrical, longitudinal loads, side loads, stress a	analysis of bus body s	structure under
	ntariar Franamics and Vahiela Stability		8 hours
Interior Free	amine Introduction Secting dimensions Interior	r erachomics erach	omics system
design, seat co instruments, elo goods vehicle la winding and sea	omfort, suspension seats, split frame seating, ba ectronic displays, commercial vehicle cabin ergono ayout. Visibility, regulations, drivers' visibility, metho at adjustment mechanisms.	ods of improving visil	s, dash board ackage layout, pility, Window
Vehicle Stabili	v:		
Introduction, Lo	ongitudinal, lateral stability, vehicle on a curvilinear	path, critical speed for	or toppling and
wheels. mass di	stribution and engine location on stability.	meny and submizati	
	Noise and Vibrations		9 hours
Noise and Vil Body structura	<b>pration:</b> Noise characteristics, Sources of noise, no l vibrations, chassis bearing vibration, designing	oise level measureme against fatigue, met	ent techniques, hods of noise

suppression.

## Impact protection:

Basics, physics of impact between deformable bodies, design for crash worthiness, occupant and cargo restraint, passive restraint systems, side impact analysis, bumper system, energy absorbent foams, laws of mechanisms applied to safety.

Cours	e outcome: After completion of this course students will be able to		
CO1	Understand the classification of the vehicles on the basis of body.	K2	
CO2	Understand the importance of material selection in designing automotive bodies.	K2	
CO3	Understand the concepts of aerodynamics used in designing automobiles.	K2	
CO4	Understand the importance of interior and exterior ergonomics while designing the vehicle.	K2	
CO5	Identify various sources of noise and methods of noise separation and various safety aspects in a given vehicle.	K2	
Text b	ooks		
7.	Powloski J., "Vehicle Body Engineering", Business books limited, London, 1969.		
8.	Vehicle body engineering Giles J Pawlowsky Business books limited 1989		
9.	Vehicle body layout and analysis John Fenton Mechanical Engg. Publication ltd, Londo	on. 1990	
Refere	nce Books		
1.	1. Bosch, "Automotive Handbook", 8th Edition, SAE publication, 2011.		
2.	Ronald K. Jurgen, "Automotive Electronics Handbook", Second Edition, McGraw-Hill	Inc.,	
	1999.		
3.	Vehicle Safety 2002 Cornwell press Town bridge, UK ISBN 1356 – 1448		
4.	Aerodynamics of Road Vehicles W.H. Hucho Butter worth's 1987 4th Edition		
Link: N	PTEL/ YouTube/ Faculty Video Link:		
Unit 1	ttps://youtu.be/924_ZQMQh10		
Unit 2	nttps://youtu.be/qxNTQozl5fE		
Unit 3	ttps://youtu.be/qxNTQozl5fE		
Unit 4	ttps://youtu.be/qQkszLYPjm4		
Unit 5	ttps://youtu.be/qHvlqbjJ3uM		

	<b>Bachelor of Technology Third Year</b>		
Course code	AME0612	L-T-P	Credits
Course title	RAPID PROTOTYPING & MANUFACTURING (ADDITIVE3-0-0MANUFACTURING)3-0-0		
Course objectiv	/e:	1	
1	Understand the Fundamentals of various Rapid Prototyping Technologies for Application to various Industrial needs	K1,K2	
2	Able to convert part file into STL format & Generating STL file from various Sources and Further Process	K3, K4	
3	Able to understand the method of Manufacturing of Liquid Based, Powder Based and Solid Based RP Techniques	K3	
4	Understand the Manufacturing procedure of a Prototype using FDM, SLA Techniques	K3	
5	Understand the broad aspects of Rapid Prototyping and Interconnected & Interdisciplinary Applications & Techniques	K4, K5	
Pre-requisites:			
Basic knowledg	ge of material science engineering i.e. polymers and composites and the	r proper	ties.
UNIT I	Course Contents / Syllabus	6 6 6 0 0 0	
Prototyping Fu	ndamentals Historical Development Advantages of RP Commonly	Used Te	s arms 3D
Modeling 3D	Scanning Data Conversion and Transmission Checking Repairir	o seu ite	Prenaring
(Slicing) Pre I	Processing Building Post Processing RP Data Formats Classification	on of RE	Process
with Different	Aspects Applications & Limitations	JII OI KI	1100035
	Liquid Based DB Systems		10 hours
Storeg Lithog	Liquid Dascu KF Systems		<u>Dringinlo</u>
Photopolymers	Photo Polymerization Light Sources Industrial Applications	A dyonto	merpic,
Disadvantages	case studies Practical Demonstration Solid Cround Curing (SC		dels and
Disadvantages,	Process Working Principle Industrial Applications Advantages or	d Dicad	ucis anu
Debulat. Mode	In and Specifications, Process, Working, Dringing, Industrial Applications, Advantages at	tiona Ad	vantages.
and Disadvanta	as and assa studies	lions, Au	vantages
			10
UNIT-III Lowinsted Ob	Solid Based KP Systems	I antrin a I	<u>IU nours</u>
Laminated Of	bject Manufacturing (LOM): Models and Specifications, Process, w	orking I	rinciple,
Industrial App	lications, Advantages and Disadvantages, Case Studies. Ultrasoni		indation:
Models and S	pecifications, Process, Working Principle, Industrial Applications,	Advanta	ages and
Disadvantages,	Case Studies. Fused Deposition Modeling (FDM): Models an	a Speci	fications,
Process, Work	ing Principle, Industrial Applications, Advantages and Disadvantage	es, Case	Studies,
Practical Demo	Instration. Solid Based RP Systems, Materials and Parameters.		10.1
	Powder Based RP Systems	• • 1	10 hours
Selective Laser	Sintering (SLS): Models and Specifications, Process, Working Process, Work	rinciple,	Industrial
Applications, Ac	avantages and Disadvantages, Case Studies. Binder Jetting: Models	and Spe	cification,
Process, workin	g Principle, Industrial Applications, Advantages and Disadvantage	s, Case	Studies.
Inkjet Fusion:	Models and Specification, Process Working Principle, Industrial Appli	cations, A	Advantages
UNIT V	A dyanaomont in DB Tachnology		0 hours
UNII-V Composito 21	Auvancement in KF recimology	la Ann	o nours
Adventogen	J Frinting: Would and Specifications, Process, Working Princip	ne, App	incations,
Auvantages an	u Disauvantages, Case Studies, Materials, Practical Demonstration.	interais(	nonda :
<b>RP:</b> DFRP, D	esign Applications & Advancement in Manufacturing, Tooling & H	Productio	n. Batch
Production and	Associated Technologies: Vacuum Casting, Thermo Forming etc.		

Course Outco	ome: After completion of this course students will be able to	
CO1	Understand the fundamentals of Rapid Prototyping	K1, K2
	Technologies for Engineering Applications	,
CO2	Understand the methodology to Manufacture the Products using SLA,	K3, K4
	SGC, PolyJet and CLIP Technologies and study their Applications ,	
	Advantages and Case Studies & Materials	
CO3	Understand the methodology to Manufacture the Products using LOM,	K3
	Ultrasonic Consolidation and FDM Technologies and study their	
<u> </u>	applications, advantages and case studies & Materials	
C04	Understand the methodology to Manufacture the Products using SLS,	K3
	Applications Advantages and Case Studies & Materials	
C05	Understand the Advancements Scopes Design Aspects & Associated	VA V5
	Applications & Techniques	K4, K3
Text Books:		
1. Sanjay	Kumar, "Additive Manufacturing Processes", Springer 2020.	
2. Ian Gibso	on, Davin Rosen, Brent Stucker "Rapid Prototyping Technologies, Springer, 2nd Ed, 20	14
Reference Bo	oks:	
1. Chua C.K.,	Leong K.F. and LIM C.S Rapid prototyping: Principles an Application	s, World Scientific
publications, 3rd	IEd., 2010	
2. D.T. Pham an	d S.S. Dimov, "Rapid Manufacturing", Springer, 2001	
3. Terry Wohlers	s, "Wholers Report 2000", Wohlers Associates, 2000	
4. Paul F. Jacobs	s, "Rapid Prototyping and Manufacturing"-, ASME Press, 1996	
Link: NPTEL	// YouTube/ Faculty Video Link:	
Unit 1 https://v	www.youtube.com/watch?v=NkC8TNts4B4	
Unit 2 https://v	www.youtube.com/watch?v=5FC6onIkVH8	
Unit 3 <u>https://v</u>	www.youtube.com/watch?v=ICjQ0UzE2Ao	
Unit 4 <u>https://v</u>	www.youtube.com/watch?v=oTIKEIaBWO8	
Unit 5 https://v	www.youtube.com/watch?v=MutAvQVhK5g	

B TECH THIRD YEAR					
Cours	Course CodeAME0614L T PCredits				
Cours	se Title	PRODUCT LIFECYCLE MANAGEMENT	3-0-0 3		
Course	e Objec	tives:			
1	To integrate systematic approaches of innovative product lifecycle management using design thinking with an awareness of business1considerations needed to produce products.K1, K2, K3			K <sub>1</sub> , K <sub>2</sub> , K <sub>3</sub>	
2	To deve process To dev	elop ability to employ state-of-the-art technology in produce development and be PLM proficient. elop skills to support product realization, including proto	otype,	K <sub>2</sub> , K <sub>3</sub>	
3	testing,	validation and marketing.		K <sub>2</sub> , K <sub>3</sub>	
4	To intro	oduce the latest trends and technology in digital manufactu	ring.	$K_2, K_3, K_4$	
5	To fam	iliarize with the concepts of PLM strategy and application	ı.	K <sub>2</sub> , K <sub>3</sub>	
Pre-requis	ites:		I		
Students sh	ould hav	e basic knowledge product design & development and man	nufacturing	g.	
		<b>Course Contents / Syllabus</b>			
UNIT	-I ]	Introduction to Product Life Cycle Management (PLM	()	8 Hours	
of PLM, E Developme .Collabora Engineering	environm ent, Valid <b>tive Pr</b> g, Chang	ent Driving PLM, PLM Elements, Drivers of PLM, C ation, Production, Support of PLM oduct Development: Engineering Vaulting, Produc e Management	conceptuali	zation, Design, Smart Parts,	
UNIT-II Collaborative Product Development& Digital 8 Hours Manufacturing – PLM			8 Hours		
Prototype Development, Design for Environment, Virtual Testing and Validation, Marketing Collateral. Digital Manufacturing, Benefits of Digital Manufacturing, Manufacturing the First-One, Ramp Up, Virtual Learning Curve, Manufacturing the Rest, Production Planning.					
UNIT-III	]	Developing a PLM Strategy and Conducting a Assessment	PLM	8 Hours	
Strategy, In Objectives,	Strategy, Impact of strategy, implementing a PLM strategy, PLM Initiatives to Support Corporate Objectives, Infrastructure Assessment, Assessment of Current Systems and Applications.				
<b>Basic Concepts and Introduction</b> – Procurement, Supply Chain Management, Project Procurement and Subcontract Management, Vendor Management, Inventory Management.					
UNIT-IVProject Cost Management8 Hours					
Essentials of and Contro	of Cost N l, Essenti	Ianagement, Cost Estimation, Cost Budget and Variance A als of Project Cash Flows.	Analysis, C	Cost Monitoring	
Quality & System, 7 ( and Environ	<b>EHS M</b> Quality T nment,	anagement: Defining Quality, Construction Project Qualools, Control Chart & Cost of Quality. Introduction to Oc	lity, Quali ccupationa	ty Management l Health, Safety	
UNIT-V		Project Risk Management, Project Monitorin Control.	ng &	8 Hours	

**Risk Introduction:** Risk Introduction, Risk Analysis, Risk Response Strategy and Implementation, Introduction to Project Monitoring and Controlling, Analysis Techniques, Visualization Techniques, Elements of Control, Monitor and Control Schedule, Cost and Resources, MS Project:

Course outo	ome: After completion of this course students will be able to	
C01	Understand the concept of Product Life Cycle Management.\ & Work flow	$K_1, K_2, K_3$
CO2	Know on the product realization, including prototype, testing, validation and marketing.	K <sub>2</sub> , K <sub>3</sub>
CO3	Identify and prioritize risks and Implement risk response	K <sub>2</sub> , K <sub>3</sub>
CO4	Understand the cost of quality, importance of managing environment, health, and safety in projects	K <sub>2</sub> , K <sub>3</sub>
CO5	Describe the project monitoring process and Explain the supply chain strategies	K <sub>2</sub> , K <sub>3</sub>
SELF-STU	DY	
Students sha product life	ll be assigned with topics related to the latest technological developments cycle management	s in field of
TEXT BOO	KS:	
1. Product I ISBN:978-0	ifecycle Management: Grieves, Michael, McGraw-Hill Publications, Edi 071452304.	tion 2013,
2. Product L 3319174396	ifecycle Management Volume I : Stark, John, Springer, 3rd Edition, 2016	5, ISBN: 978-
3. Product L 3319244341	ifecycle Management Volume II : Stark, John, Springer, 3rd Edition, 201	6, ISBN: 978-
REFERENC	E BOOKS:	
1. Fabio G and Francis	uidice, Guido La Rosa, Product Design for the environment -A lifecycle a 2013, ISBN:978-1420001044	pproach, Taylor
2. Robert J 2013 ISBN:	Thomas, "NDP: "Managing and forecasting for strategic processes", Wi 078-0471572268	ley Publications,
3. Stark, Joh	n, "Product Life cycle Management: Paradigm for 21st Century Product	
4. Realizatio	n", Springer-Verlag, 2015. ISBN:978-3-319-17440-2	
5. PDM : Pro	oduct Data Management : Burden, Rodger, Resource Pub,2013.ISBN:978-0970	035226
6. PDM : Pro	oduct Data Management : Burden, Rodger, Resource Pub,2013.ISBN:978-0970	035226
SUGGESTED S	OFTWARE PACKAGES: Windchill & associated PTC packages (PLM)	
Link: NPTEL/	/ouTube/ Faculty Video Link:	
Unit 1 https:/	/youtu.be/HN9GtL21rb4	
Unit 2 https:/	/archive.nptel.ac.in/courses/110/104/110104084/	
Unit 3 https:	//archive.nptel.ac.in/courses/110/104/110104084/	
Unit 4 https:	//archive.nptel.ac.in/courses/110/104/110104084/	
Unit 5 https:/	/youtu.be/dcup4kRxSEs	

Course	Code	AME0651	LTP	Credit
Course Title		Machine Design Lab	0-0-2	1
	Suggested list of Experiment			
Sr. No.	Sr. No. Name of Experiment			
1.	Review of drawing & editing command in PTC Creo / AutoCAD.			
2.	Draw 2	D model of 4 bar mechanism.		
3.	Draw 3	D model of single slider crank mechanism.		
4.	Design	& Analysis of shaft subjected to bending.		
5.	Design	& Analysis of shaft subjected to twisting.		
6.	Design & Analysis of shaft subjected to combined loading.			
7.	Design & Analysis of stress concentration in one of the machine elements.			
8.	8. Design & Analysis of closed coil helical spring.			
9.	9. Design & Analysis of gear.			
10.	10. Design & Analysis of bearing.			
Lab Co	urse Ou	utcome: After completion of this course stude	ents will be ab	le to
CO	1	Draw the design problem into design software i	n the form of 2	2D or 3D model.
CO	2	Apply the governing equations and formulate the	e boundary co	nditions.
CO	3	Evaluate the various aspects related to the	design of ma	achine elements viz.
		technical, economic, social & environmental via	ability.	
CO	4	Design the machine elements ensuring its qualit	y & functional	lity satisfactorily.

Course CodeAME0654LTPCredit			Credit	
Course Tit	le	AI & ML lab	0-0-2	1
	Suggested list of Experiment -(At least 8 experiments of the following)			following)
Course Ob	Course Objective: This course will enable students to			
1. Make use of Data sets in implementing the machine learning algorithms			S	
2. Imp	2. Implement the machine learning concepts and algorithms in any suitable language of choice.			le language of choice.
Sr. No.	Name	of Experiment		
1	Write a	a program to perform various types of regre	ssion (Linear &	Logistic)
2	For a g	given set of training data examples stored in	a .CSV file, im	plement and
	demon	strate the Candidate-Elimination algorithm	to output a desc	cription of the set of all
	hypoth	hypotheses consistent with the training examples.		
3	Write a	a program to demonstrate the working of the	e decision tree	based ID3 algorithm.
	Use an	appropriate data set for building the decision	on tree and appl	ly this knowledge to
	classify	y a new sample	1	1
4	Write a	a program to implement the naïve Bayesian	classifier for a	sample training data set
-	stored	as a .CSV file. Compute the accuracy, preci	sion and recall	for test data set.
5	Write a	a program to construct a Bayesian network of	considering me	dical data. Use this
	model	to demonstrate the diagnosis of heart patien	ts using standa	rd Heart Disease Data
	Set. Yo	bu can use Java/Python ML library classes/	$\frac{\text{API.}}{(m,n) \in CSV \text{ file}}$	Lize the same data set
0	Apply for alw	Elvi algorithm to cluster a set of data stored	the regults of the	Use the same data set
	for clus	stering using k-Means algorithm. Compare	l Iouo/Duthon N	AL library alagaad/A DI
	in the program			
7	In the p	In the program Write a program to implement k-Nearest Neighbor algorithm to classify the tris data set		
/	Print both correct and wrong predictions Java/Python MI library classes can be used for			
	this pro	ohi concet and wrong predictions. Java/1 yt	non with norary	
8	Implen	nent the non-parametric Locally Weighted I	Regression algo	rithm in order to fit
0	data po	pints Select appropriate data set for your ex-	periment and di	raw graphs.
9	Build a	an Artificial Neural Network by implementi	ng the Backpro	pagation algorithm and
	test the same using appropriate data sets.			
10	Write a	a program to implement an AI chatbot		
11	Write a	a program to perform the TIK TAK TOE pr	ogram	
12	Write a	a program to perform Breadth first search		
13	Write a	a program to perform Water Jug Problem		
14	Write a	a Program to perform simple Calculator		
Lab Course	e Outco	me: After completion of this course student	s will be able to	)
CO1	Unders	stand the implementation procedures for the	ML algorithm.	
CO2	Identif	y and apply machine learning algorithms to	solve real worl	d problems.
CO3	Apply	searching problems using various algorithm	ıs. Explain func	ctionality of Chat-bot.
CO4	Identify problems that are amenable to solution by AI methods, and which AI methods			
	may be suited to solving a given problem.			
Reference	Books			
1.	Christo	opher Bishop, Pattern Recognition and Mac	hine Learning,	Springer, 2007
2.	Hal Da	aume III, A Course in Machine Learning, 20	)15	
3.	Trevor	Hastie, Robert Tibshirani, Jerome Friedma	n, The Element	ts of Statistical
	Learni	ng, Springer, 2009		
4.	John H	Iopcroft, Ravindran Kannan, Foundations of	f Data Science,	2014

Course Code		AME0652	L-T-P	Credit
Course Title		<b>REFRIGERATION AND AIR CONDITIONING</b>	0-0-2	1
	LAB			
Sugges	Suggested list of Experiment -(At least 8 experiments of the following)		ng)	
Sr. No.	Nar	ne of Experiment		
1	Expo	Experiment on refrigeration test rig and calculation of various performance		
-	para	meters.		
2	To s	tudy different types of expansion devices used in refrigera	tion systen	n.
3	To s	tudy different types of evaporators used in refrigeration sy	vstems.	
4	To s	tudy basic components of air-conditioning system.		-
5	Expo	eriment on air-conditioning test rig & calculation of v	arious per	formance
6	para Eve	meters.	2	
0	Expe	v of window air conditioner	е	
/	Too	tudy different types of compressors used in refrigeration	and air oar	ditioning
8	svste	and an element types of compressors used in remgeration		lattioning
9	Visi	t of a central air conditioning plant and its detailed study.		
10	Visi	t of cold-storage and its detailed study.		
11	Exp	eriment on Desert coolers.		
10	Tos	tudy different types of condensers used in refrigeration	and air cor	ditioning
12	12 systems.			
Lab Cours	e Ou	tcome:		
CO 1	Demonstrate practical understanding of Simple vapour compression refrigeration			
	syste	em.		
CO 2	Dem	emonstrate working understanding of types of evaporators, condensers,		
	com	ompressors and expansion devices used in refrigeration system.		
CO 3	Ana	Analyze and calculate the performance of refrigeration test rig.		
<b>CO 4</b>	Calc	ulate coefficient of performance of air-conditioning test ri	g.	
CO 5	Dem	ionstrate the complete working of window air conditioner.		
Link:				
Unit 1		shorturl.at/xyT36		
		Shorturl.at/bexyz		
		Shorturl.at/stvP0		
		Shorturi.at/akrtP		
II:4 2		shorturi.at/vL v23		
		Shorturi.at/dfKWQ		
		Shorturl at/fACEX		
		Shorturl at/opyKS		
		shorturl at/sHR19		
Unit 3 shorturl at/ilCR5				
		Shorturl.at/adew9		
		Shorturl.at/chmM6		
		Shorturl.at/ikpuS		
		shorturl.at/gwFIX		
Unit 4		shorturl.at/dmwUX		

	Shorturl.at/ajmS7 Shorturl.at/auLY4
	Shorturl.at/btD37
	shorturl.at/nqP08
Unit 5	shorturl.at/HUWZ4
	Shorturl.at/IKS29
	Shorturl.at/giuAM

Course Code ANC0601 L T P					
	Credits				
Course TitleCONSTITUTION OF INDIA, LAW AND2 0 0	2				
ENGINEERING					
<b>Course objective:</b> To acquaint the students with legacies of constitutional development in India and	d help them				
to understand the most diversified legal document of India and philosophy behind it.	1				
Pre-requisites: Computer Organization and Architecture					
Course Contents / Syllabus					
UNIT-I INTRODUCTION AND BASIC INFORMATION ABOUT INDIAN	8 Hours				
CONSTITUTION	0 Hours				
Meaning of the constitution law and constitutionalism, Historical Background of the Constituent	Assembly,				
Government of India Act of 1935 and Indian Independence Act of 1947, Enforcement of the Constitu	tion, Indian				
Constitution and its Salient Features, The Preamble of the Constitution, Fundamental Rights, Fundame	ntal Duties,				
Directive Principles of State Policy, Parliamentary System, Federal System, Centre-State Relations, A	Amendment				
of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendment	nts in India,				
Emergency Provisions: National Emergency, President Rule, Financial Emergency, and Local Self Go	vernment –				
Constitutional Scheme in India.					
UNIT-II UNION EXECUTIVE AND STATE EXECUTIVE	8 Hours				
Powers of Indian Parliament Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Funct	tions of the				
President, Comparison of powers of Indian President with the United States, Powers and Function	ns of Vice-				
President, Powers and Functions of the Prime Minister, Judiciary - The Independence of the Supr	eme Court,				
Appointment of Judges, Judicial Review, Public Interest Litigation, Judicial Activism, LokPal, Lok A	yukta, The				
Lokpal and Lok ayuktas Act 2013, State Executives - Powers and Functions of the Governor, I	Powers and				
Functions of the Chief Minister, Functions of State Cabinet, Functions of State Legislature, Function	ons of High				
Court and Subordinate Courts.					
UNIT-III INTRODUCTION AND BASIC INFORMATION ABOUT LEGAL	8 Hours				
The Legal System: Sources of Law and the Court Structure: Enacted law -Acts of Parliament are	of primary				
legislation. Common Law or Case law. Principles taken from decisions of judges constitute binding l	legal rules				
The Court System in India and Foreign Courtiers (District Court, District Consumer Forum, Tribu	nals. High				
Courts. Supreme Court). Arbitration: As an alternative to resolving disputes in the normal courts, parti	es who are				
in dispute can agree that this will instead be referred to arbitration. Contract law, Tort, Law at workplac	e.				
UNIT IN INTELLECTUAL DOODEDTY LAWS AND DECULATION TO	0 11				
UNIT-IV INTELLECTUAL PROPERTY LAWS AND REGULATION TO INFORMATION	8 Hours				
	. 1				
Intellectual Property Laws: Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from					
Patents, Intringement of Patents, Copyright and its Ownership, Intringement of Copyright, Civil Remedies for					
Act 2000 Electronic Governance Secure Electronic Records and Digital Signatures Digital Signatures					
Act, 2000, Electronic Governance, Secure Electronic Records and Digital Signatures, Digital Contifications Cyber Depulations Appellate Teibunal Offeneous Limitations of the Information Technology	Signature				
Continuates, Cyber Regulations Appendie Tribunal, Ottences, Limitations of the information Technolog	zy Act.				
UNIT V BUSINESS ORGANIZATIONS AND E-COVERNANCE	8 House				
	·· · · · · · · · · · · · · · · · · · ·				

Sole Traders, Partnerships: Companies: The Company's Act: Introduction, Formation of a Company, Memorandum of Association, Articles of Association, Prospectus, Shares, Directors, General Meetings and Proceedings, Auditor, Winding up. E-Governance and role of engineers in E-Governance, Need for reformed engineering serving at the Union and State level, Role of I.T. professionals in Judiciary, Problem of Alienation and Secessionism in few states creating hurdles in Industrial development.

COURSE OUTCOMES: After completion of this course students will be able to

CO 1	Identify and explore the basic features and modalities about Indian constitution.	K1
CO 2	Differentiate and relate the functioning of Indian parliamentary system at the	K2
	center and state level.	
CO 3	Differentiate different aspects of Indian Legal System and its related bodies.	K4
CO 4	Discover and apply different laws and regulations related to engineering practices.	K4
CO 5	Correlate role of engineers with different organizations and governance models	K4

## **Text Books:**

4. M Laxmikanth: Indian Polity for civil services and other State Examination,6th Edition, Mc Graw Hill

5. Brij Kishore Sharma: Introduction to the Indian Constitution, 8th Edition, PHI Learning Pvt. Ltd.

6. Granville Austin: The Indian Constitution: Cornerstone of a Nation (Classic Reissue), Oxford University Press.

## **Reference Books:**

1. Madhav Khosla: The Indian Constitution, Oxford University Press.
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2. PM Bakshi: The Constitution of India, Latest Edition, Universal Law Publishing.

3. V.K. Ahuja: Law Relating to Intellectual Property Rights (2007)

B. TECH. THIRD YEAR					
Course Code	ANC0602	L	Τ	Р	Credits
<b>Course Title</b>	ESSENCE OF INDIAN TRADITIONAL	2	0	0	2
	KNOWLEDGE				
Course object	ive: This course aims to provide basic knowledge about different th	eories	s of	societ	y, state and
polity in India, In	ndian literature, culture, Indian religion, philosophy, science, manage	ment,	cul	tural h	neritage and
different arts in I	ndia				
Pre-requisites	Computer Organization and Architecture				
	<b>Course Contents / Syllabus</b>				
UNIT-I S	OCIETY STATE AND POLITY IN INDIA				8 Hours
State in Ancient	India: Evolutionary Theory, Force Theory, Mystical Theory Contra	ict Th	leory	v, Stag	ges of State
Formation in An	cient India, Kingship, Council of Ministers Administration Politic	al Id	eals	in Ar	ncient India
Conditions' of th	he Welfare of Societies, The Seven Limbs of the State, Society in	Ancie	ent I	ndia,	Purusārtha,
Varnāshrama Sys	stem, Ashrama or the Stages of Life, Marriage, Understanding Gende	er as a	a soc	al ca	tegory, The
TINIT I	NDIANLITEDATUDE CULTURE TRADITION AND PRAC	FICE	c		0 II anna
	A 11 C C C C C C C C C C C C C C C C C C		<b></b>	TI	<b>ð Hours</b>
Remayana and t	pi and languages in India: Harappan Scripi and Branmi Scripi. The	vedas Irakrit	s, the	d Sar	nisnads, the
Literature, Kautil	va's Arthashastra, Famous Sanskrit Authors, Telugu Literature, Kan	nada	Lite	ature.	Malavalam
Literature ,Sanga	ma Literature Northern Indian Languages & Literature, Persian And	Urdu	,Hin	di Lit	erature
UNIT-III I	NDIAN RELIGION, PHILOSOPHY, AND PRACTICES				8 Hours
Pre-Vedic and V	vedic Religion, Buddhism, Jainism, Six System Indian Philosophy	, Sha	nkar	achar	ya, Various
Philosophical Do	octrines, Other Heterodox Sects, Bhakti Movement, Sufi moveme	nt, So	ocio	religi	ous reform
movement of 19th	h century, Modern religious practices.				
	CIENCE MANACEMENT AND INDIAN KNOWLEDCE SVS	TEM			<b>0 H</b> ound
	CIENCE, MANAGEMENT AND INDIAN KNOW LEDGE 515				o nours
Astronomy in Inc	dia, Chemistry in India, Mathematics in India, Physics in India, Agri	cultur	e in	India	, Medicine
in India, Metallurgy in India, Geography, Biology, Harappan Technologies, Water Management in India,					
Textile Technology in India ,Writing Technology in India Pyrotechnics in India Trade in Ancient India/,India's					
Dominance up to Pre-colonial Times.					
UNIT-V C	CULTURAL HERITAGE AND PERFORMING ARTS				8 Hours
Indian Architect, Engineering and Architecture in Ancient India, Sculptures, Pottery, Painting, Indian					
Handicraft, UNESCO'S List of World Heritage sites in India, Seals, coins, Puppetry, Dance, Music, Theatre,					
drama, Martial Arts Traditions, Fairs and Festivals, UNESCO'S List of Intangible Cultural Heritage, Calenders,					
Current developm	COURSE OUTCOMES: After completion of this course students will be able to				
COURSE OUTCOMES. And completion of this course students will be able to					

CO 1	Understand the basics of past Indian politics and state polity.	K2			
CO 2	Understand the Vedas, Upanishads, languages & literature of Indian society.	К2			
CO 3	Know the different religions and religious movements in India.	K4			
CO 4	Identify and explore the basic knowledge about the ancient history of Indian agriculture, science & technology, and ayurveda.	K4			
CO 5	Identify Indian dances, fairs & festivals, and cinema.	K1			
Text Books:					
3. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014.					
4. S. Baliyan, Indian Art and Culture, Oxford University Press, India					
5. Nitin Singhania, Indian Art and Culture: for civil services and other competitive Examinations, 3rd					
Edition,Mc Graw Hill					
Reference Books:					
1. Romila Thapar, Readings In Early Indian History Oxford University Press, India					
2. Basham, A.L., The Wonder that was India (34th impression), New Delhi, Rupa & co.					