## CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (Autonomous)

## DEPARTMENT OF MECHANICAL ENGINEERING

Scheme of Instruction and Syllabi of

M.E. (Mechanical)

**Specialization:** 

# THERMAL ENGINEERING

**Full time** 



Chaitanya Bharathi Institute of Technology (Autonomous) Chaitnaya Bharathi P.O., Gandipet, Hyd-500 075. Telangana Ph: 040-24193276, 24193280, Fax: 040-24193278

## 2016-2017-CBCS

## CHAITANYA BHARATHI INSTIUTE OF TECHNOLOGY

## (AUTONOMOUS)-CBCS

Gandipet, Hyderabad – 500 075

#### INSTITUTE

#### Vision

To be a centre of excellence in technical education and research

### Mission

To address the emerging needs through quality technical education and advanced research

## DEPARTMENT

#### Vision

To be a Pace Setter in the field of mechanical Engineering by providing conducive environment for understanding and applying its principles to cater the needs of Society

### Mission

To impart quality & innovative technical education to the students of mechanical engineering for their professional achievements in consultancy, R&D and to become successful entrepreneur enabling them to serve the society in general and the industry in particular

# CHAITANYA BHARATHI INSTIUTE OF TECHNOLOGY (AUTONOMOUS)

Gandipet, Hyderabad – 500 075

## MECHANICAL ENGINEERING

## **Programme: M.E (Thermal Engineering)**

## **Programme Educational Objectives:**

- 1. To provide the students with a solid understanding of thermal engineering fundamentals and applications required to solve real life problems.
- 2. To motivate the students to excel in research and to practice the technologies in field of thermal engineering in a broad way.
- 3. To train the student with scientific and engineering knowledge so as to comprehend analyze the design products and systems pertaining to broad among thermal engineering
- 4. To indicate an altitude to face typical thermal engineering problems with confidence through multi-disciplinary team approach.
- 5. To provide student with an academic environment that is aware of professional excellence and leadership through interaction with practicing engineering and professional bodies.

#### With effect from the academic year 2016- 2017

#### Scheme of Instruction & Examination M.E. (THERMAL ENGINEERING) – 4 Semesters (Full Time)

			S	emester - I				
		No. of Hr	's. per	Duration		Marks for		
SI.		week	-	(Hrs)	Internal		Total	
No	Subject	Lecture	T/P/S		Assessment	End Exa	m Marks	Credits
1.	Core	3	1	4	30	70	100	4
2.	Core	3	1	4	30	70	100	4
3.	Core	3	1	4	30	70	100	4
4.	Elective-1	3		3	30	70	100	3
5.	Elective-2	3		3	30	70	100	3
6.	Elective-3	3		3	30	70	100	3
7.	Laboratory - I		3	3	50		50	2
8.	Seminar - I		3	3	50	7	50	2
9.	Soft Skills							
	Total	18	09		340	360	700	25
	1		S	emester - II				
		No. of Hr	's. per		Mark	s for		
SI. No	Subject	week		Duration (Hrs)	Internal Assessment	End Exam	Total Marks	Credits
		Lecture	T/P/S					
1.	Core-4	3	1		30	70	100	4
2.	Core-5	3	1		30	70	100	4
3.	Core-6	3	1		30	70	100	4
4.	Elective-4	3			30	70	100	3
5.	Elective-5	3			30	70	100	3
6.	Elective-6	3			30	70	100	3
7.	Laboratory - II		3		50		50	2
8.	Seminar - II		3		50		50	2
9.	Mini Project		2		50		50	1
	Total	18	11		390	360	750	26
			Se	emester - III				
SI.	Subje	ct			Marks for			Credits
No				Internal As	sessment E	nd Exam	Total Marks	
1	Project Seminar* (i) Problem formulation ar synopsis within 8 weeks f commencement of 3 <sup>rd</sup> Ser (50 Marks) (ii) Preliminary work on Pr implementation. (50 Marks)	nd submissio rom the mester. roject	on of	10	0		100	6
	Total			10	0		100	6
	011		Se	emester - IV				
				Marks for				
SI.				Internal				Credits
No	Subjec	ct		Assessment	End Exam	Total	Marks	
1	Project Work			100	100	20	00	12

Note : Six core subjects, Six elective subjects, Two Laboratory Courses and Two Seminars, Mini Project and Soft Skills should normally be completed by the end of semester II.

\* Project seminar presentation on the topic of Dissertation only, 50 marks awarded by the project guide and

50 marks by the internal committee

Credit requirements for the award of degree, lower limit and upper limit of credits for registration by a student in a semester Credit Requirement for the award of M.E/M. Tech. Degree is 69

### With effect from the academic year 2016-2017

## Scheme of Instruction & Examination of Post Graduate course in

## Mechanical Engineering with specialization in Thermal Engineering

## **Course duration: 4 Semesters (Full Time)**

SI.	Syllabus	Subject	Sche	me of	Schen	ne of Ex	amination	Credits
NO	Ref. NO.		Hour	ICTION S DOT	Duration	Max	Marks	
			we	ek	Duration	Max		
			L	T/P	in	End	Internal	
					Hours	Exam	Assessment	
		CORE SUBJECTS						
1.	16MEC 105	Finite Element Techniques	3	1	4	70	30	4
2.	16MEC 201	Fluid Flow and Gas Dynamics	3	1	4	70	30	4
3.	16MEC 202	Advanced Thermodynamics	3	1	4	70	30	4
4.	16MEC 203	Advanced Heat & Mass Transfer	3	1	4	70	30	4
5.	16MEC 204	Advanced I.C. engines	3	1	4	70	30	4
6	16MEC 205	Computational Fluid Dynamics	3	1	4	70	30	4
		ELECTIVES						
1.	16MEE105	Optimization Techniques	3		3	70	30	3
2.	16MEE107	Engineering Research Methodology	3		3	70	30	3
3.	16MEE201	Computer Aided Graphics and Design	3		3	70	30	3
4.	16MEE 202		3		3	70	30	3
5.	16MEE203	Fluid Power Systems	3		3	70	30	3
6. 7	16MEE 204	Design of Thermal Systems	3		3	70	30	3
1.	16MEE 205	Design of Gas Turbines	3		3	70	30	3
8.	16MEE 206	Advanced Energy Systems	3		3	70	30	3
9.	16MEE 207	Fuels and Combustion	3		3	70	30	3
10.	16MEE 208	Power Plant Control and Instrumentation	3		3	70	30	3
11.	16MEE 209	Design of Pumps and Compressors	3		3	70	30	3
12.	16MEE 210	Numerical Methods	3		3	70	30	3
	16MEE 211	Environmental Engineering and Pollution						
13.		Control	3		3	70	30	3
14.	16MEE 212	Refrigeration Machinery & Components	3		3	70	30	3
15.	16MEE 213	Energy Management	3		3	70	30	3
16.	16MEE 214	Convective Heat Transfer	3		3	70	30	3
17.	16MEE 215	Thermal & Nuclear Power Plants	3		3	70	30	3
		DEPARTMENTAL REQUIREMENTS						
1.	16MEC 206	Thermal Systems Laboratory (Lab – I)		3			50	2
2.	16MEC 207	CFD Laboratory (Lab –II)		3			50	2
3.	16MEC 208	Seminar – I		3			50	2
4.	16MEC 209	Seminar – II		3			50	2
5	16MEC 210	Mini Project		2			50	1
6.	16MEC 211	Project Seminar		6			100	6
7.	16MEC 212	Project work		6		100	100	12

CBIT	Autonomous Regulation		Semester-	1			AY - 200	6-17	
Department	Mechanical Engineering	Program	me Code &	Nam	ne	M.E. Th	ermal Eng	ineering	g
Course Code	Course Name	Hours/ V	Veek	(	Credit	Maximu	m Marks		
16MEC 105	FINITE ELEMENT	L	Т Р		С	Е	I	Тс	otal
	TECHNIQUES	3	1 0		4	70	30	1	00
Objective (s)	1. Identify mathematical mo	del for sol	ution of com	nmon	n engine	ering prob	olems		
,	<ol><li>Enable the students to fo</li></ol>	rmulate th	e design pro	obler	ms into F	FEA			
	3. Enable the students to pe	erform eng	gineering sin	nulat	tions usi	ng Finite I	Element A	nalysis	
	software								
	Studente ere oble te								
Outcome (S)	1 implement finite element	formulatio	one to avial	and	auadrati	- alamant	e and col	vo prob	lome
	with hand calculations n	umerically			quadrati	element	.5 anu 301	ve pion	101113
	2. formulate numerically the	e truss, be	am and frar	ne el	lements	and solve	e for defle	ction, st	rains
	and stresses							·	
	3. formulate numerically the	e plane an	d axisymme	etric t	triangula	r element	ts and qua	drilater	al
	elements then solve for o	deflections	s, strains and	d stre	esses in	structura	l mechani	cs probl	ems
	4. apply FE formulations to	heat trans	ster of 1D ar	nd 2L	D eleme	nts and so	olve for ter	mperatu	ire and
	5 apply EE formulations to	and plates	analysis of	1 D o	nd 2D o	lomonte c	and colvo		0
	values and eigen vectors	s in hars a	nd beams	ID a				or eiger	1
	6. apply FE formulations to	3D solids	s, plates and	l for i	non line	ar probler	ns		
1. FIELD PROB	LMES AND MODELING		.,				Tota	Hrs	10
Introduction to F	inite Element Method of solving	field prob	lems. Stres	s and	d Equilib	rium. Bou	indary cor	nditions.	
Strain-Displacer	nent relations. Stress-strain rela	ations.					-		
One Dimension	al Problem: Finite element mo	deling. Lo	cal, natural	and	global o	coordinate	es and sh	ape fur	nctions.
Potential Energ	y approach: Assembly of Glo	obal stiffn	ess matrix	and	load v	ector. Fir	nite elem	ent equ	ations,
treatment of bou	indary conditions. Quadratic sha	ape functio	ons						1
2. ANALYSIS O	F TRUSSES AND FRAMES				<u> </u>		Tota	Hrs	10
Analysis of plan	e truss with number of unknown	is not exce	eding two a	it ead	ch node.	i i			
Analysis of Bear	ms: Element stiffness matrix for	two node	d, two degre	es of	t freedor	m per noc	le for bear	n eleme	ent.
Analysis of fram	es with two translations and a re	otational d	egree of fre	edon	n at eac	n node	Tatal	Ure	40
5. TWO DIVIEN	modeling of two dimensional	stross and	alveie proble	ma	with cor	etant etra	in triangles		opt of
boundary cond	litions Two dimensional four no	ded isona	rametric ele	ment	ts treatm	nent of bo	undary co	nditions	
dimensional f	our noded isoparametric eler	nents an	d numerica	al int	tegration	n. Finite	element	modeli	ng of
Axisymmentric	solids subjected of axisymmetr	ic loading	with triangu	lar el	lements				0
Convergence r	equirements and geometric isot	ropy							
4. HEAT TRAN	SFER PROBLEMS AND DYNA	MIC ANA	LYSIS				Tota	Hrs	10
Steady state he	at transfer analysis: One dimen	sional and	alysis of a fi	n and	d two di	mensiona	I, conduct	ion ana	lysis of
thin plate,									
Time dependent	tield problems: Application to	one dimer	isional heat	flow Iuc n	in a rod.	for a stan	nod hor o		~
Evaluation of Ei	is: Formulation of linite element	modeling	or Eigen va	lue p baft	subjecte	or a step	ped bar al on using F	inite	n <b>.</b>
Element Analysi	S.	11019313 01	a uniform s	man	Subjecte		on using i	nne	
5. THREE DIME	NSIONAL PROBLEMS IN SRE	ESS ANAL	YSIS				Tota	Hrs	10
Finite element for	ormulation of three dimensional	problems	in stress an	alvsi	s.			_	_
Bending of elast	ic plates: Thin and Thick plate f	ormulatior	ns, Introduct	ion to	o non-lir	ear probl	ems and I	-inite El	ement
analysis softwar	e's					•			
				Tota	al hours t	o be taug	lht		
Text book (s)									
1. Tirupath	i R Chandrupatla and Ashok.D.	Belegund	lu, Introduct	ion o	of Finite	Element i	n Enginee	ring. Pr	entice
Hall of I	ndia, 2004			_			~ (		
2. Rao S.S	5., I ne Finite Element Methods i	n Enginee	ring, 2 <sup>m</sup> Edi		rgamon	Press, 20	U1.		
3. David.v.	Hullon, Fundamentals of Finit	e Elemeni	Analysis,	lala	MCGraw	/ HIII,2003	)		
1 Robert (	Cook "Concepts and applicatio	ns of finite	a element ar	alve	sis" ∕۱≏	lohn Wile	v and son	s 2000	
	IN An Introduction to Finite F	ement Mc	thode Mc 0	iaiyə Traw	Hill Con	nnanv 10	y and 5011 184	3,2009	
3 K I Rat	he Finite element procedures	2 <sup>nd</sup> Edn Pi	entice Hall	of Inc	dia 2007	inpuny, 10			
4. Logan	D. L. (2011). First course in finite	e element	method (5t	h Ed	.). Maso	n. OH <sup>.</sup> Se	outhWeste	ern. Cer	ndade
Learning	g.				,	.,		, 501	33-
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CBIT	Autonomous Regulation		Sem	ester-1			AY - 2006	5-17
Department	Mechanical Engineering	Progra	amme C	ode & Na	ame	M.E. Th	ermal Eng	ineering
Course Code	Course Name	Hours	/Week		Credit	Maximu	m Marks	
16MEC 201	FLUID FLOWS & GAS	L	Т	Р	С	E	I	Total
	DYNAMICS	3	1	0	4	70	30	100
Objective (s)	Student will							
, , ,	1. understand different ty	/pes of	fluid flov	vs and va	rious func	tions rela	ted to fluic	ls
	2. learn important equati	ons rela	ated to fl	uids				
	<ol><li>understand the conce</li></ol>	pt of bo	undary l	ayer				
	<ol><li>learn the concept of st</li></ol>	teady flo	ow energ	gy equation	on			
	<ol><li>understand the isentro</li></ol>	pic beh	navior of	gas in no	ozzles			
	6. learn about shocks of	fluids						
Outcome (s)	Student will be able to							
Outcome (3)	1 understand the conce	ot of str	eam and	d velocitv	potential	function		
	2. apply of the knowledg	e of eau	Jations f	or analys	is in CFD	ranouom		
	3. calculate thickness of	bounda	arv lave	and she	ar stress			
	4. apply SFEE for variou	s types	of turbo	machines	S			
	5. design nozzles and di	ffusers						
	6. estimate various para	meters	in fluids	subjected	d to shock	S		
1. FLUID FLOW	/S						Total	Hrs 9
Fluid flow: Cla	ssification of fluids. Lagrang	ian and	d Eulari	ian Meth	nods of S	study of f	luid flow.	Velocity and
acceleration ve	ectors. Circulation and Vorti	city. St	ream li	nes. Str	eam tub	e. Path I	ines. Stre	eak lines and
Time lines. Str	eam function and Potential fu	unction						
2. LAW OF FLU	IID FLOWS						Total	Hrs 9
Basic laws o	f fluid flow – Continuity.	Euler's	s and	Bernoul	lli's equa	ations. I	ncompres	ssible and
Compressible	flows. Potential and viscous	flows. I	Navier -	<ul> <li>Stoke's</li> </ul>	s equation	n and ap	plications	;
3. CONCEPT O	F BOUNDARY LAYER						Total	Hrs 9
Flow over an ae	erofoil – Lift and Drag coefficier	nts. Bou	indary la	ayer theo	ry – Iamir	ar and tu	rbulent bo	undary layers.
Hydrodynamic a	and thermal boundary layer equa	ations. I	Flow sep	paration in	n boundar	y layers		
4. FUNDAMEN	TALS OF GAS DYNAMICS						Total	Hrs 9
Gas dynamics	: Energy equation for flow	and no	on flow	process	ses. App	lication of	of Steady	flow energy
equation for to	urbines, turbo-compressors,	nozzle	es and	diffusers	s. Adiaba	atic ener	gy equat	ion. Acoustic
velocity, Mach	Number. Stagnation proper	ties. R	elations	ships be	tween st	atic and	stagnatic	on properties.
Various regime	es of flow – Steady flow ellips	se						
5. PRINCIPLES	OF GAS DYNAMICS APPLIC	ABLE T	O SHO	CKS			Total	Hrs 9
Isentropic flow	v through variable area pa	issage	s. Desi	gn of s	supersoni	ic and s	subsonic	nozzles and
diffusers. Supe	er sonic flows. Expansion ar	nd Sho	ck wav	es. Norn	nal and (	Oblique \$	Shock wa	ves. Prandtl-
Meyer and Rai	nkine-Hugoniot Relations. Si	mple p	roblems	s on norr	mal and c	blique s	hock wav	es.
				То	tal hours	to be taug	ght	
Text book (s)	<u> </u>						-	
1. C P Kot	handaraman, R Rudramoorthy,	Basic F	luid Me	chanics, I	New Age	Intl. Publis	shers, 201	4
2. S.M. Ya	hya, Fundamentals of Compres	sible flo	ow, Wile	y Eastern	1 Ltd,2014			
3. S. Radh	akrishnan, "Fundamentals of C	ompres	sible flo	w," IMH,	,2014			
References:								
1. Shapiro	, Compressible fluid flow. Ronol	d Press	s, New Y	′ork, 1956	6			
2. Liepme	n & Rosko, Elements of Gas Dy	/namics	, Wiley,	New Yor	k, 1956.			
3. Zoeb Hu	<u>issain, Gas Dynamics Though É</u>	Problem						

CBIT	Autonomous Regulation		Sem	ester-1			AY - 200	6-17	
Department	Mechanical Engineering	Progra	amme C	ode & Na	ame	M.E. Th	ermal Eng	gineering	l
Course Code	Course Name	Hours	/Week		Credit	Maximu	m Marks		
16MEC 202	ADVANCED	L	Т	Р	С	E	I	Total	
	THERMODYNAMICS	3	1	0	4	70	30	10	00
Objective (s)	<ol> <li>To review the basic laws on thermodynamic principles</li> <li>To understand the behavion</li> <li>To create awareness of the the understand thermodyna</li> <li>To understand thermodyna</li> <li>To understand the basic period</li> <li>To understand the basic period</li> </ol>	f therm in engir or of Re e impor amic ap principle ethods o	odynam neering a al Gases tance of plication s power of direct	ics and cl applicatio s vis-à-vi combust is in psyc cycles a energy co	reate awa ns. is ideal ga tion reacti thrometry nd its rela onversion	areness of as. ons in rea , refrigera ation with o	the impor I time app tion. combustic	rtance of plications on proces	sses.
Outcome (s)	<ul> <li>A student will be able to</li> <li>apply various laws of them</li> <li>apply the knowledge of the</li> <li>understand the phenomen</li> <li>select and design air cor comfort conditions</li> <li>understand the application</li> <li>understand various non-conditions</li> </ul>	modyna ermody ion of c nditionir n of pow	mics to namics fo ombustiong or ps ver cycle onal ene	suit the e for the be on in IC e ychrome s to engli rgy conve	ngineerin havior of engines tric proce neering p ersion me	g applicat real gases ess depen ractice. thods like	ions. s. ding on a	applicatic etc.	on and
1 LAWS OF T	HERMODYNAMICS						Tota	l Hrs	9
Review of The	rmo dynamic Laws and Corollar	ies – T	ransien	Flow Ar	nalveis –	Second la	aw of the	modvna	mics –
Entropy - Avail	ability and unavailability – Irrever	sibility	- Therm	o dynam	ic Potenti	als – Max	well Relat	tions – S	pecific
2. PSYCHRON	IETRY AND AIR CONDITIONING	G PRO	CESS			onning out	Tota	l Hrs	9
P.V.T. surface compressibility Throttling – Jou of properties – Towers – Real	<ul> <li>Equations of state – Real Gas</li> <li>Factor – Energy properties of Reule – Thompson coefficient Non-r</li> <li>Pychrometric Mixture properties</li> <li>Gas Mixture</li> </ul>	Behavio eal Gas eactive and ps	our – Va es – Vaj Mixture ychrome	nder Waa oour pres of perfec tric chart	al's equat sure – Cl t Gases - – Air con	ion - Gene ausius – ( - Governii ditioning p	eralised Clapeyron ng Laws – processes	Equation Evaluat – Coolir	n – ion ng
3. COMBUSTI	ON REACTIONS						Tota	l Hrs	9
Combustion - Tables – Ene Equilibrium. ( Reactions. Th	- Combustion Reactions – Entha rgy of formation – Heat of React Chemical Equilibrium of Ideal ( e van Hoff's Equation. The chem	alpy of tion – A Gases tical pot	Formation Nabatic f – Effect Cential ar	on – Entr lame Ter ts of No nd phase	ropy of F mperature n-reacting Equilibriu	ormation e General g Gases im – The g	<ul> <li>Referer</li> <li>product -</li> <li>Equilibriu</li> <li>Gibbs pha</li> </ul>	nce Leve - Enthalp m in Mu ise Rule	els for bies – ultiple
4. POWER CY				O and 1		0.1.1			9
Power cycles, Refrigeration c Onsagar Reci Production – T	Review Binary vapour cycle, co- cycles. Thermo Dynamics off in procity Relation – Applicability hermo dynamic phenomena – Th	generat reversi of th termo e	ion and ble proc e phen lectric ci	Combine cesses – omenolog rcuits	ed cycles Introduc gical Rel	– Second tion – ph ations– H	law analy nenomeno leat Flux	ysis of cy logical 1 and E	/cles – aws – intropy
5. DIRECT EN	ERGY CONVERSION						Tota	l Hrs	9
Introduction – F	-uel Cells - Thermo electric energ	gy – Th	ermo-ior	nic power	generatio	on -Therm	odynamic	c devices	5
Magneto Hydro	odynamic Generations – Photo vo	oltaic ce	ells.						
				10	tal nours	to be taug	Int		
Text book (s)		· · · ·		0000					
1. Nag, P 2. Holma 4. Obert I 5. Younu 6. Arian E	.ĸ., "Basic and Applied Thermod n, J.P., "Thermo Dynamics", Mc Edward. F. & Young Rober L, "El s.A.cengel & Michael A. Boles " T Bejan " <u>Advanced Engineering Th</u>	ynamic Graw H ements Thermo <u>ermody</u>	s″, I MH, lill, 2008 of Theri dynamic <u>namics</u> '	2008 modynam s an eng ' 3 <sup>rd</sup> Editi	nics" McG ineering a on Wiley	raw Hills approach s Publicatio	sixth editic ns,2006	on,TMH	

CBIT	Autonomous Regulation		Sem	ester-1			AY - 200	6-17	
Department	Mechanical Engineering	Progra	amme C	ode & Na	ame	M.E. The	ermal Eng	gineerin	g
Course Code	Course Name	Hours	/Week		Credit	Maximur	m Marks		
16MEC 203	ADVANCED HEAT &	L	Т	Р	С	E	I	Total	
	MASS TRANSFER	3	1	0	4	70	30	1	00
Objective (s)	Student will								
	1. understand the basic princ	iples of	fins and	lunstead	ly state he	eat transfe	r applied	to indus	tries.
	2. learn various equations ar	d their	applicati	on in eng	lineering h	neat transf	fer		
	3. Understand boundary laye	r conce	pt and the	ieir applio	cations				
	5 understand the importance	of radi	iation he	applicatic	er er				
	6. learn about mass transfer	and its	applicati	ons in pr	ocess ind	ustries			
				-					
Outcome (s)	Student will be able to								
	1. apply the equations pert	aining t	o unstea	ady state	heat trai	nster and	knowledg	ge in ex	tended
	2 evaluate mass momentur	n and a	norav oc	u ations v	with annro	vimata an	nd evact n	nothode	
	3 apply heat transfer know	/ledae	in calcu	lation of	boundar	v laver	thickness	and	various
	dimensionless numbers	neuge			boundar	j lajoi		ana	laneae
	4. evaluate heat transfer coe	fficients	under p	hase cha	ange pher	nomena			
	5. apply the knowledge of ra	diation	heat tra	nsfer in v	various fie	elds like s	olar engir	neering,	design
	of reactors etc,								
	6. apply the knowledge of ma	ass tran	sfer in p	rocess in	dustries				
1. BRIEF INTR	ODUCTION TO DIFFERENT MO	DDES C	DF HEAT	TRANS	FER		Tota	Hrs	9
Brief Introducti	on to different modes of neat 1	ranster	; Condu	ction: Ge	eneral nei	at conduc	tion equa	tion-inii Tropoio	hal and
conduction. Lu	mod system analysis- Heisler	charte-	semi inf	inite soli		b anu zi shane fac	tors in co	nductic	n - 2D
transient heat of	conduction – product solutions	onarto				Shape lao		maaone	20
2. FINITE DIFF	ERENCE METHODS FOR CON	DUCTI	ON				Tota	l Hrs	9
Finite Difference	e methods for Conduction: 1D &	2D stea	ady state	and sim	ple transi	ent heat c	onduction	proble	ns
<ul> <li>implicit and e</li> </ul>	xplicit methods. Forced Convect	ion: Equ	uations o	of Fluid F	low – Con	cepts of C	Continuity,		
momentum equ	uations – Derivation of Energy ec	uation	- Method	ls to dete	ermine he	at transfer	coefficier	nt:	
Analytical Metr	lods - Dimensional Analysis and	concep	t of exac	t solutior	i. Approxi	mate Metr	nod – Inte	gral	
3. EXTERNAL	FLOWS						Tota	Hrs	9
External flows	: Flow over a flat plate: Integral r	nethod	for lamir	nar heat t	ransfer co	efficient fo	or differer	nt veloci	ty and
temperature p	profiles. Application of empirical	relation	s to vari	iation ge	ometrics f	or Lamina	ar and Tu	irbulent	flows.
Internal flows	: Fully developed flow: Integral	analys	is for la	minar he	eat transfe	er coeffici	ent – Ty	pes of	flow –
Constant Wa	I Temperature and Constant F	leat Flu	ix Boun	danı Ca	nditione -	Hydrodyr	namic &	thermal	
				uary Cor		, ,		unonnui	entry
Free convection	/ F= 1						Total		entry
	on: Approximate analysis on lar	inar fre			t transfer		Tota	I Hrs	entry 9
Different geo	on: Approximate analysis on lam metries – combined free and	inar fre	e conve d conve	ctive hea	t transfer	– Boussin condensa	Total nesque Ap ation: Boi	<b>I Hrs</b> pproxim ilina cu	entry 9 ation - rye -
Different geo Correlations-	on: Approximate analysis on lam metries – combined free and Nusselt's theory of film conder	inar fre I forceonsation	e conve d conve on a ve	ctive hea ctionBoil	t transfer ing and ate – Ass	– Boussin condensa sumptions	Total nesque Ap ation: Boi & correl	I Hrs proxim iling cu ations (	entry 9 ation - rve – of film
Different geo Correlations- condensation	on: Approximate analysis on lam metries – combined free and Nusselt's theory of film conder for different geometrics	inar fre forceonsation	e conve d conve on a ve	ctive hea ctionBoil ertical pla	t transfer ing and ate – Ass	– Boussin condensa sumptions	Total nesque Ap ation: Boi & correl	I Hrs proxim iling cu ations o	entry 9 ation - rve - of film
Different geo Correlations- condensation 5. MASS TRA	on: Approximate analysis on lam metries – combined free and Nusselt's theory of film conder for different geometrics NSFER	inar fre I forceonsation	e conveo d conve on a ve	ctive hea ctionBoil ertical pla	t transfer ing and ate – Ass	– Boussin condensa sumptions	Total nesque Ap ation: Boi & correl	I Hrs pproxim iling cu ations o I Hrs	entry 9 ation - rve – of film 9
Different geo Correlations- condensation 5. MASS TRA Radiation Heat	on: Approximate analysis on lam metries – combined free and Nusselt's theory of film conder for different geometrics <b>NSFER</b> Transfer: Radiant heat exchang	inar fre I forceonsation e in gre	e conve d conve on a ve	ctive hea ctionBoil ertical pla	t transfer ing and ate – Ass	– Boussin condensa sumptions	Total nesque Ap ation: Boi & correl Total	I Hrs pproxim iling cu ations o I Hrs g and	entry 9 ation - rve - of film 9
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ODIT	Autonomous Regulation	Semester-1 AY - 2006-17							
Department	Mechanical Engineering	Progra	amme C	ode & Na	ame	M.E. Th	ermal Eng	gineering	g
Course Code	Course Name	Hours	/Week		Credit	Maximu	m Marks		
16MEC 204		L	Т	Р	С	E	I	Total	
	ADVANCED I.C. ENGINES	3	1	0	4	70	30	1	00
Objective (s)	1. importance of combustion ph	enome	na in I.C	. Engines	S				
	2. phenomena of the engine pe	rformar	nce and	decrease	the pollu	tants kno	cking in Sl	and CI	
	engines	tral of	difforont	ovhouot	omioniona	from IC	nainaa		
	4 use of alternate fuel technolo	av to in	norove	exhaust	emissions		engines.		
	5 suggested modifications in L	C enai	ne to sui	t bio-fuel	s				
	6. basic concepts of recent tren	ids with	change	of engine	e configur	ation			
Outcome (s)	1. Describe the phenomena o	f comb	ustion ar	nd knock	in SI engi	nes	$\nabla$		
	2. Understand the normal and	l abnorr	mal com	bustion ir	n CI engin	es			
	3. Explain the sources and for	mation	of vario	us polluta	ints from	IC engine	s .		
	4. Understand how the undes	irable e	xhaust e	missions	from IC	engines a	re controll	ed	
	5. Demonstrate an understand	ding of	technolo	gical, en	vironment	al and so	cial impac	ts of	
	6 Explain modern concents li	ko Loor	a hura is	tratificatio		and CD			
1 SPARK IGN		KE LEAI	r burn, s	lialincalit			Tota	Hrs	9
Spark ignition	engine mixture requirements –	Fuel -	Iniectio	n system	s – Mono	point Mi	ultipoint in	iection	Direct
injection – St	ages of combustion – Normal a	nd abn	ormal co	ombustion	n – Facto	rs affectir	na knock -	– Comb	ustion
chambers	3						5		
2. COMPRESS	SION IGNITION ENGINES						Tota	l Hrs	9
2. COMPRESS Stages of co	SION IGNITION ENGINES mbustion in C.I. Engine – Direct	and in	direct in	ection sy	/stems –	Combust	Tota	<b>I Hrs</b> bers – N	9 Iormal
2. COMPRESS Stages of co and Abnorma	<b>SION IGNITION ENGINES</b> mbustion in C.I. Engine – Direct al Combustion – Knock in C.I Er	and in ngines-	direct in Basic Co	jection sy oncepts a	/stems – and Study	Combust / of Fuel	<b>Tota</b> ion chamb Spray – I	<b>I Hrs</b> bers – N ntroduct	9 Iormal tion to
2. COMPRESS Stages of co and Abnorma Turbo chargir	SION IGNITION ENGINES mbustion in C.I. Engine – Direct al Combustion – Knock in C.I Er ng	and in ngines-	direct in Basic Co	jection sy oncepts a	vstems – and Study	Combust / of Fuel	<b>Tota</b> on chamb Spray – I	<mark>I Hrs</mark> bers – N ntroduct	<b>9</b> Iormal tion to
2. COMPRESS Stages of co and Abnorma Turbo chargir	SION IGNITION ENGINES mbustion in C.I. Engine – Direct al Combustion – Knock in C.I Er ng	and in ngines-	direct in Basic Co	iection sy oncepts a	vstems – and Study	Combusti / of Fuel	Tota fon chamb Spray – I	I Hrs pers – N ntroduct	9 Iormal tion to
2. COMPRESS Stages of co and Abnorma Turbo chargir 3. POLLUTAN	SION IGNITION ENGINES mbustion in C.I. Engine – Direct al Combustion – Knock in C.I Er ng T FORMATION AND CONTROL Sources – Formation of carbon	and in ngines-	direct in Basic Co	ection sy oncepts a	vstems – and Study	Combusti y of Fuel	Tota on chamb Spray – I Tota	I Hrs pers – N ntroduct I Hrs Smok	9 lormal tion to 9
2. COMPRESS Stages of co and Abnorma Turbo chargir 3. POLLUTAN Pollutant – S Particulate m	SION IGNITION ENGINES mbustion in C.I. Engine – Direct al Combustion – Knock in C.I Er ng T FORMATION AND CONTROL Sources – Formation of carbon atter – Methods of controlling Er	and in ngines- monov mission	direct in Basic Co kide, Un s – Cata	burnt hyd	/stems – and Study drocarbor verters a	Combust of Fuel n, Aldehy	Tota fon chamb Spray – I <b>Tota</b> des, NOx late Trap	I Hrs pers – N ntroduct I Hrs , Smok	9 lormal tion to 9 e and ods of
2. COMPRESS Stages of co and Abnorma Turbo chargir 3. POLLUTAN Pollutant – S Particulate m measurement	SION IGNITION ENGINES mbustion in C.I. Engine – Direct al Combustion – Knock in C.I Er ng T FORMATION AND CONTROL Sources – Formation of carbon atter – Methods of controlling Er ts and Introduction to emission no	and in ngines- monox mission orms	direct in Basic Co kide, Un s – Cata	burnt hydralytic con	/stems – and Study drocarbor verters a	Combusti y of Fuel n, Aldehy nd Particu	Tota fon chamb Spray – I <b>Tota</b> des, NOx ilate Traps	I Hrs bers – N ntroduct I Hrs , Smok s- Metho	9 lormal tion to 9 e and ods of
<ul> <li>2. COMPRESS</li> <li>Stages of col and Abnorma Turbo chargin</li> <li>3. POLLUTAN</li> <li>Pollutant – S Particulate m measurement</li> <li>4. ALTERNAT</li> </ul>	SION IGNITION ENGINES mbustion in C.I. Engine – Direct al Combustion – Knock in C.I Er ng T FORMATION AND CONTROL Sources – Formation of carbon atter – Methods of controlling Er ts and Introduction to emission no IVE FUELS	and in ngines- monox mission orms	direct in Basic Co kide, Un s – Cata	burnt hyd	vstems – and Study drocarbor verters a	Combust y of Fuel n, Aldehy nd Particu	Tota on chamb Spray – I Tota des, NOx ilate Trap	I Hrs pers – N ntroduct I Hrs , Smok s- Metho I Hrs	9 lormal tion to 9 e and ods of 9
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<ul> <li>2. COMPRESS</li> <li>Stages of col and Abnorma Turbo chargin</li> <li>3. POLLUTAN</li> <li>Pollutant – S Particulate m measurement</li> <li>4. ALTERNAT</li> <li>Alcohol, Hydr fuels, Engine</li> </ul>	SION IGNITION ENGINES mbustion in C.I. Engine – Direct al Combustion – Knock in C.I Er ng T FORMATION AND CONTROL Sources – Formation of carbon atter – Methods of controlling Er ts and Introduction to emission no IVE FUELS rogen, Natural Gas and Liquefie Modifications	and in ngines- monox mission orms	direct in Basic Co kide, Un s – Cata bleum G	burnt hydrafyr a burnt	vstems – and Study drocarbor verters an erties, Su	Combusti y of Fuel n, Aldehy nd Particu	Tota fon chamb Spray – I Tota des, NOx ilate Traps Tota Merits and	I Hrs bers – N ntroduct I Hrs , Smok s- Metho I Hrs I Demei	9 lormal tion to 9 e and ods of 9 rits as
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<ul> <li>2. COMPRESS</li> <li>Stages of col and Abnorma Turbo chargin</li> <li>3. POLLUTAN</li> <li>Pollutant – S Particulate m measurement</li> <li>4. ALTERNAT</li> <li>Alcohol, Hydr fuels, Engine</li> <li>5. RECENT TF</li> <li>Modification i charge comp</li> </ul>	SION IGNITION ENGINES mbustion in C.I. Engine – Direct al Combustion – Knock in C.I Er ng T FORMATION AND CONTROL Sources – Formation of carbon atter – Methods of controlling Er ts and Introduction to emission no IVE FUELS rogen, Natural Gas and Liquefie Modifications RENDS n I.C. engine to suit bio-fuels- Lea ression ignition (HCCI) engines a	and in ngines- monox mission orms d Petro an Burr nd GDI	direct in Basic Co kide, Un s – Cata bleum G	burnt hydrafyr a burnt	/stems – and Study drocarbor verters an erties, Su fied charg	Combusti y of Fuel n, Aldehy nd Particu iitability, I	Tota on chamb Spray – I Tota des, NOx ilate Traps Tota Merits and Merits and s – homog	I Hrs bers – N ntroduct I Hrs , Smok s- Metho I Hrs I Demen I Hrs geneous	9 lormal tion to 9 e and ods of 9 rits as 9
<ul> <li>2. COMPRESS Stages of co and Abnorma Turbo chargir</li> <li>3. POLLUTAN Pollutant – S Particulate m measurement</li> <li>4. ALTERNAT</li> <li>Alcohol, Hydr fuels, Engine</li> <li>5. RECENT TF Modification i charge comp</li> </ul>	SION IGNITION ENGINES mbustion in C.I. Engine – Direct al Combustion – Knock in C.I Er ng TFORMATION AND CONTROL Sources – Formation of carbon atter – Methods of controlling Er ts and Introduction to emission no IVE FUELS rogen, Natural Gas and Liquefie Modifications RENDS n I.C. engine to suit bio-fuels- Lea ression ignition (HCCI) engines a	and in ngines- monox mission orms d Petro an Burn nd GDI	direct in Basic Co kide, Un s – Cata bleum G n Engine concep	burnt hydalytic con as- Prop s – Stratil	/stems – and Study drocarbor verters an erties, Su fied charg	Combusti y of Fuel n, Aldehy nd Particu iitability, I ge Engine	Tota on chamb Spray – I Tota des, NOx late Traps Tota Merits and S – homog	I Hrs bers – N ntroduct I Hrs , Smok s- Metho I Hrs I Demei I Hrs geneous	9 lormal tion to 9 e and ods of 9 rits as 9
<ul> <li>2. COMPRESS Stages of co and Abnorma Turbo chargir</li> <li>3. POLLUTAN Pollutant – S Particulate m measurement 4. ALTERNAT Alcohol, Hydr fuels, Engine 5. RECENT TF Modification i charge comp Text book (s)</li> </ul>	SION IGNITION ENGINES mbustion in C.I. Engine – Direct al Combustion – Knock in C.I Er ng TFORMATION AND CONTROL Sources – Formation of carbon atter – Methods of controlling Er ts and Introduction to emission no IVE FUELS rogen, Natural Gas and Liquefie Modifications RENDS n I.C. engine to suit bio-fuels- Lea ression ignition (HCCI) engines a	and in ngines- monox mission orms orms or Petro an Burr nd GDI	direct in Basic Co kide, Un s – Cata bleum G n Engine concep	burnt hydalytic con as- Prop s – Stratif	/stems – and Study drocarbor verters an erties, Su fied charg	Combust y of Fuel n, Aldehy nd Particu uitability, I ge Engine to be taug	Tota on chamb Spray – I Tota des, NOx late Trap Tota Merits and S – homog	I Hrs bers – N ntroduct I Hrs , Smok s- Metho I Hrs I Demei I Hrs geneous	9 lormal tion to 9 e and ods of 9 rits as 9
<ul> <li>2. COMPRESS Stages of co and Abnorma Turbo chargir</li> <li>3. POLLUTAN Pollutant – S Particulate m measurement 4. ALTERNAT Alcohol, Hydr fuels, Engine 5. RECENT TF Modification i charge comp Text book (s) 1. Obert, E.F.II </li> </ul>	SION IGNITION ENGINES mbustion in C.I. Engine – Direct al Combustion – Knock in C.I Er ng T FORMATION AND CONTROL Sources – Formation of carbon atter – Methods of controlling Er ts and Introduction to emission no IVE FUELS rogen, Natural Gas and Liquefie Modifications RENDS n I.C. engine to suit bio-fuels- Lea ression ignition (HCCI) engines a nternal Computation Engines Har	and in ngines- monox mission orms orms or Petro an Burn nd GDI	direct in Basic Co kide, Un s – Cata bleum G n Engine concep	burnt hydalytic con as- Prop s – Stratif ts To	/stems – and Study drocarbor verters an erties, Su fied charg tal hours	Combusti y of Fuel n, Aldehy nd Particu nitability, I ue Engine to be taug	Tota on chamb Spray – I Tota des, NOx late Traps Tota Merits and S – homog	I Hrs bers – N ntroduct I Hrs , Smok s- Metho I Hrs I Demen I Hrs geneous	9 lormal tion to 9 e and ods of 9 rits as 9
<ul> <li>2. COMPRESS Stages of co and Abnorma Turbo chargir</li> <li>3. POLLUTAN Pollutant – S Particulate m measurement 4. ALTERNAT Alcohol, Hydr fuels, Engine 5. RECENT TF Modification i charge comp Text book (s) 1. Obert, E.F.In 2. GILL, P.W.a</li> </ul>	SION IGNITION ENGINES mbustion in C.I. Engine – Direct al Combustion – Knock in C.I Er ng T FORMATION AND CONTROL Sources – Formation of carbon atter – Methods of controlling Er ts and Introduction to emission no IVE FUELS rogen, Natural Gas and Liquefie Modifications RENDS n I.C. engine to suit bio-fuels- Lea ression ignition (HCCI) engines a hternal Computation Engines Har and Smith (Jr,J.H, fundamentals o	and in ngines- monox mission orms d Petro an Burn nd GDI	direct in Basic Co kide, Un s – Cata bleum G n Engine concep Row, Put al comb	burnt hyd alytic con as- Prop s – Stratil ts To blishers N ustion En	/stems – and Study drocarbor verters an erties, Su fied charg tal hours I.Y3rd edi igines, O	Combust of Fuel n, Aldehy nd Particu itability, I ge Engine to be taug tion 1973 (ford & IB	Tota on chamb Spray – I Tota des, NOx late Traps Tota Merits and S – homog oht H publishi	I Hrs Ders – N ntroduct I Hrs , Smok s- Metho I Hrs I Demei I Hrs geneous	9 lormal tion to 9 e and ods of 9 rits as 9
2. COMPRESS Stages of co and Abnorma Turbo chargir 3. POLLUTAN Pollutant – S Particulate m measurement 4. ALTERNAT Alcohol, Hydr fuels, Engine 5. RECENT TF Modification i charge comp Text book (s) 1. Obert, E.F.Ir 2. GILL, P.W.a Co.New Del Poforenzez	SION IGNITION ENGINES mbustion in C.I. Engine – Direct al Combustion – Knock in C.I Er ng T FORMATION AND CONTROL Sources – Formation of carbon atter – Methods of controlling Er ts and Introduction to emission no IVE FUELS rogen, Natural Gas and Liquefie Modifications RENDS n I.C. engine to suit bio-fuels- Lea ression ignition (HCCI) engines a nternal Computation Engines Har nd Smith (Jr,J.H, fundamentals o hi, 1967.	and in ngines- monox mission orms d Petro an Burn nd GDI	direct in Basic Co kide, Un s – Cata Dleum G n Engine concep Row, Put al comb	burnt hydrig burnt hydrig alytic con as- Prop s – Stratif ts To plishers N ustion En	/stems – and Study drocarbor verters an erties, Su fied charg tal hours I.Y3rd edi gines, Ox	Combusti y of Fuel n, Aldehy nd Particu iitability, I ge Engine to be taug tion 1973 (ford & IB	Tota on chamb Spray – I Tota des, NOx late Traps Tota Merits and S – homog ht H publishi	I Hrs pers – N ntroduct I Hrs Smok S- Metho I Hrs I Demei I Hrs geneous	9 Iormal tion to 9 e and ods of 9 rits as 9
2. COMPRESS Stages of co and Abnorma Turbo chargin 3. POLLUTAN Pollutant – S Particulate m measurement 4. ALTERNAT Alcohol, Hydr fuels, Engine 5. RECENT TF Modification i charge comp Text book (s) 1. Obert, E.F.Ir 2. GILL, P.W.a Co.New Del References: 1. Howwood	SION IGNITION ENGINES mbustion in C.I. Engine – Direct al Combustion – Knock in C.I Er ng TFORMATION AND CONTROL Sources – Formation of carbon atter – Methods of controlling Er ts and Introduction to emission no IVE FUELS rogen, Natural Gas and Liquefie Modifications RENDS n I.C. engine to suit bio-fuels- Lea ression ignition (HCCI) engines a meternal Computation Engines Har and Smith (Jr,J.H, fundamentals o hi, 1967.	and in ngines- monox mission orms orms od Petro an Burr nd GDI	direct in Basic Co kide, Un s – Cata oleum G n Engine concep	burnt hydrogenergy a burnt hydrogenergy a burnt con as- Prop as- Stratif ts To blishers N ustion En	/stems – and Study drocarbor verters an erties, Su fied charg tal hours I.Y3rd edi igines, Ox	Combusti y of Fuel n, Aldehy nd Particu uitability, I ge Engine to be taug tion 1973 (ford & IB	Tota on chamb Spray – I Tota des, NOx late Trap Tota Merits and S – homog ght H publishi	I Hrs bers – N ntroduct I Hrs , Smok s- Metho I Hrs Jeneous	9 Iormal tion to 9 e and ods of 9 rits as 9
<ul> <li>2. COMPRESS Stages of co and Abnorma Turbo chargir</li> <li>3. POLLUTAN Pollutant – S Particulate m measurement 4. ALTERNAT Alcohol, Hydr fuels, Engine 5. RECENT TF Modification i charge comp Text book (s) 1. Obert, E.F.Ir 2. GILL, P.W.a Co.New Del References: 1. Heywood, J 2. Taylor C Fall</li> </ul>	SION IGNITION ENGINES mbustion in C.I. Engine – Direct al Combustion – Knock in C.I Er ng T FORMATION AND CONTROL Sources – Formation of carbon atter – Methods of controlling Er ts and Introduction to emission no IVE FUELS rogen, Natural Gas and Liquefie Modifications RENDS n I.C. engine to suit bio-fuels- Lea ression ignition (HCCI) engines a nternal Computation Engines Har ind Smith (Jr,J.H, fundamentals o hi, 1967. B, Internal Combustion engine fu	and in ngines- monox mission orms orms orms or Petro an Burr nd GDI per & F f Intern	direct in Basic Co kide, Un s – Cata oleum G n Engine concep Row, Put al comb	burnt hyd alytic con as- Prop s – Stratif ts To blishers N ustion En cGrave H	/stems – and Study drocarbor verters al erties, Su fied charg tal hours I.Y3rd edi gines, Ox fills, Book	Combusti y of Fuel n, Aldehy nd Particu iitability, I ge Engine: to be taug tion 1973 (ford & IB	Tota on chamb Spray – I Tota des, NOx late Trap Tota Merits and Merits and Tota s – homog ght H publishi	I Hrs pers – N ntroduct I Hrs , Smok s- Metho I Hrs I Demei I Hrs geneous ng 38. 1968	9 Iormal tion to 9 e and ods of 9 rits as 9
<ul> <li>2. COMPRESS Stages of co and Abnorma Turbo chargir</li> <li>3. POLLUTAN Pollutant – S Particulate m measurement</li> <li>4. ALTERNAT</li> <li>Alcohol, Hydr fuels, Engine</li> <li>5. RECENT TF Modification i charge comp</li> <li>Text book (s)</li> <li>1. Obert, E.F.Ir</li> <li>2. GILL, P.W.a Co.New Del References:</li> <li>1. Heywood, J</li> <li>2. Taylor C.F.a</li> <li>3. Mathur,M.L.</li> </ul>	SION IGNITION ENGINES mbustion in C.I. Engine – Direct al Combustion – Knock in C.I Er ng T FORMATION AND CONTROL Sources – Formation of carbon atter – Methods of controlling Er ts and Introduction to emission no IVE FUELS rogen, Natural Gas and Liquefie Modifications RENDS n I.C. engine to suit bio-fuels- Lea ression ignition (HCCI) engines a nternal Computation Engines Har and Smith (Jr,J.H, fundamentals o hi, 1967. .B, Internal Combustion engine fu and Taylor, E,S,The Internal Combustion and Sharma,R.PInternal Combustion	and in ngines- monox mission orms an Burr nd ODI an Burr nd GDI per & F of Intern undame ibustion ustion E	direct in Basic Co kide, Un s – Cata oleum G n Engine concep Row, Put al comb entals, M n Engine Engine, D	burnt hyd alytic con as- Prop s – Stratil ts To olishers N ustion En cGrave H in Theory hanpat R	/stems – and Study drocarbor verters an erties, Su fied charg tal hours I.Y3rd edi igines, Ox Hills, Book y and Pra	Combusti y of Fuel n, Aldehy nd Particu nitability, I uitability, I ge Engine to be taug tion 1973 (ford & IB cford & IB cford & IB	Tota on chamb Spray – I Tota des, NOx late Traps Tota Merits and Merits and Tota s – homog ght H publishi	I Hrs pers – N ntroduct I Hrs , Smok s- Metho I Hrs I Demen I Hrs geneous ng 38. 1968 ,1990	9 Iormal tion to 9 e and ods of 9 rits as 9

CBIT	Autonomous Regulation									
Department	Mechanical Engineering	Program	nme Co	de & l	Name	M.E. Th	nermal Er	ngineerir	ng	
	1	Programme Code & Name       M.E. Thermal Engineering         Semester-I       Hours/ Week       Credit       Maximum Marks         L       T       P       C       E       I       Total         3       1       0       4       70       30       100         uations and concept of CFD.       rn concept of PDEs and finite difference methods.       id generation and errors in numerical solution.         on, Implicit and Explicit methods       n Jacobi, Gauss Seidel and ADI methods       portance of FVM         tions and turbulence models.       d hyperbolic PDEs and forward, backward and center difference         consistency and develop O,H and C grid generated models.       Nihcolson, Implicit and Explicit methods.         Gauss Seidel and ADI methods.       gauss Seidel and ADI methods.         S       Total Hrs       9								
Course Code	Course Name	Hours/	Week		e & Name       M.E. Thermal Engineering         Credit       Maximum Marks         P       C       E       I       Total         0       4       70       30       100         t of CFD.       and finite difference methods.       and finite difference methods.         store of CFD.       and finite difference methods.       and forward.         icit methods       idel and ADI methods         e models.       and forward, backward and center difference         evelop O,H and C grid generated models.       and Explicit methods.         ADI methods.       models.         mg FVM       Total Hrs       9         ons, Reynolds and Favre averaged N – S       gth model, K-ε turbulence Model.       9         ditions.       Total Hrs       9					
		Programme Code & Name       M.E. Thermal Engineering         Semester-I       Hours/ Week       Credit       Maximum Marks         L       T       P       C       E       I       Tota         3       1       0       4       70       30       100         ations and concept of CFD.       n concept of PDEs and finite difference methods.       d generation and errors in numerical solution.       n, Implicit and Explicit methods         Jacobi, Gauss Seidel and ADI methods       Jacobi, Gauss Seidel and ADI methods       Joortance of FVM         ons and turbulence models.       I hyperbolic PDEs and forward, backward and center difference       Consistency and develop O,H and C grid generated models         Jacobi, Gauss Seidel and ADI methods.       Gauss Seidel and ADI methods.       Gauss Seidel and ADI methods.         Gauss Seidel and ADI methods.       Ction problems using FVM       Total Hrs         Semester-Name       Total Hrs       Maximum Marks         vier Stokes equations, Reynolds and Favre averaged N – S       Models.         models-mixing length model, K-ε turbulence Model.       Total Hrs       9         and boundary conditions.       Dackward and central difference.       Total Hrs       9							otal	
16MEC 205	COMPUTATIONAL FLUID DYNAMICS	3	1	0	4	70	30	10	00	
Objective (s)	1. To understand the basic equ	ations ar	nd conc	ept of	CFD.					
	2. To make the students to lear	rn concep	ot of PD	Es and	d finite di	fference	methods			
	3. To study various types of gri	a genera n Impliai	tion and	a error	s in num mothodo	erical sol	ution.			
	5 To prepare the students with	n, implici Lacobi	Gauss S	Seidel	and ADI	methods	:			
	6. To enkindle the students imp	portance	of FVM							
Outcome (s)	Students will be able to	ione and	turbulo		adole					
	2 apply elliptical parabolic and	hvnerbc	lic PDF	s and	forward	backwa	rd and ce	nter diffe	erence	
	methods .									
	3. understand errors, stability,	consister	ncy and	devel	op O,H a	and C gri	d generat	ted mode	els.	
	4. evaluate the use of Crank-N	lihcolson	, Implici	t and I	Explicit m	nethods.				
	5. analyze problem by Jacobl, 6. solve conduction and conve	Gauss Se	alome u	a ADI Isina F	methoas VM					
				Singr						
1 BASIC E	QUATIONS IN FLUID DYNAMIC	S					To	tal Hrs	9	
Continuity, Mor	nentum and Energy equations, Na	vier Stok	es equa	ations,	Reynold	s and Fa	vre avera	aged N -	- S	
equations. Intro	duction to turbulence, Turbulence	models-r	nixing l	ength	model, K	ε turbul	ence Moo	del.		
2 CLASSI	FICATION OF PDEs						Tota	al Hrs	9	
Elliptic, parabo	ic and hyperbolic equations, Initial	and bour	ndary co	onditio	ns.					
Concepts of Fi	hite difference methods – forward,	backward	d and ce	entral	difference	e.				
3 GRID GI	ENERATION	$\sim$					Tot	al Hrs	9	
Grid Generatio	n- Types of grid O,H,C. Coordinate	e transfor	mation,	Unstru	uctured g	grid gene	ration, Er	rors,		
Consistency, S	tability analysis by von Neumann.	Converge	ence cri	teria.						
	DIFFERENCE SOLUTIONS						Tot	al Hrs	9	
Finite difference	e solutions-Parabolic PDEs – Eu	ler. Cran	k Nicho	lson.	Implicit r	nethods.	Elliptic F	PDEs –	Jacobi.	
Gauss Seidel,	ADI, methods. FD- solution for	Viscous i	ncompi	essibl	e flow u	sing Stre	eam func	tion $-$ \	/orticity	
method & MAC	method					•			-	
							<b>.</b>			
5 FINITE	COLUME METHOD	umo form	ulation	for a	liffuncion	aquation	IOt	al Hrs	9	
equation Solut	ion algorithm for pressure velocit	v couplin	a in ste	adv fl	ows lls	equation	, convect naered a	ride SIM		
Algorithm.	ion algorithm for pressure versel	y coupini	y 11 310	auy n	0.03. 03		ygered g			
			Т	otal ho	ours to be	e taught		45		
Text book (s)						_	l			
1										
John D	Anderson, 'Computational Fluid D	ynamics',	Mc Gra	aw Hill	, Inc., 20	15.				
2 H.K.Ver	steeg - 2015, Malala Shekara, Intr	oduction	to " Fini	ite Vol	ume Met	hod" Pea	arson			
3 Muralid	nar K, Sundararajan T, 'Computati	onal Fluic	l flow a	nd Hea	at transfe	er', Naros	a Publish	ning Hou	se,	
4 Patanka	r, S.V, 'Numerical Heat transfer an	d Fluid flo	ow', Her	nisphe	ere Publi	shing Co	mpany, N	lew York	k,1980	

CBIT		Autono	omous I	Regul	ation			
Departmer	t Mechanical Engineering	Progra	amme (	Code	&	M.E. Th	nermal En	gineering
		Name	)					
		Semest	er-l					
Course	Course Name	Hours	/Week		Credit	Maximu	um Marks	
Code								
16MEE 20		L	Т	P	C	E		Total
	COMPUTER AIDED GRAPHICS AND DESIGN	3	0	0	3	70	30	100
Objective (	s) 1. Understand the basics of compu	uter aide	ed desig	jn.				
	2. To impart knowledge on design	process	5					
	3. Recognize and explain the uses	of wire	frame a	nd su	irface en	tities		
	4. Understand solid modeling rep	resenta	tion sch	emes	S			
	5. Understand and apply various G		ic trans	iorma oto	ations			
		loueiing	Conce	ριδ				
Outcomo (	x) Students are able to:						-	
Outcome (	1 apply design concepts in design	analys	is and	can	/isualize	the mode	els throug	h the graphics
	standards	, anarys		canv	nsualize			in the graphics
	2. implement Various transformatio	ns on a	eometri	ic mo	dels for n	nanipulat	tion	
	3. recognize various wireframe en	tities an	d mode	el ther	m.			
	4. apply surface modeling technique	ues for tl	he gene	erating	g various	parts ar	nd implem	ent
	5. differentiate various solid mode	ling tech	nniques		-	-	-	
	6. able to perform modeling using the	e softwar	re by un	dersta	anding adv	vanced m	odeling co	ncepts
	RODUCTION TO CAD				Total	Hrs		9
Criteria foi	selection of cad workstations, Shigle	aesign	process	s, Des	SIGN Crite	eria, Geo	metric m	odeling,
Entities, 20	Transformations : 2d Translation	ign , iter ling Do	ative D	Poflo	, CAD pr	OCESS d. obooriu	na Unmo	2000010
Coordinate	s Rotation and Scaling about arbitrary r	ning, ru	3D tran	sform	ations	u sneam	ig, nomo	geneous
Windowind	- View ports - Clipping transformations	501110, 1		510111				
Graphics s	tandards: GKS, IGES, PDES and their I	relevano	ce					
2 MOI	ELING of CURVES			-	Total Hrs	3		9
Analytic cu	irves : Lines, Circles, Ellipse, Conics.					-	1	~
Synthetic	curves – Cubic, Bezier, B-Splines, NURB	S. Curv	e Mani	pulatio	ons			
Wireframe	Modeling and its advantages and Limitat	ions						
3 SUR	FACE MODELING				Total	Hrs		9
Analytic S	urraces: Plane Surface, Ruled Surface, S	Surface	of Revo	UUTION	n, Labulat	ted Cylin	aer. Ioling Tor	hniquos
Synthetic	Sunace - Cubic, Bezier, B-spline, Coons	,Surface	e manip	Julatic	ns, Sun		ieling red	nniques
Boundary I	Penresentation (B-ren) & Constructive Sc	lid Geo	metry (	CSCI	Modelin	n 2		3
Graph Ras	ed Model Boolean Models Instances C	ell Decc	mposit	ion &	Snatial -	9 - Occupa	ncy Enur	peration
5 SOI	ID MODELING USING SOFTWARF		mpoon		Total	Hrs		9
Feature B	ased Modeling, Conceptual Design .N	lodeling	of oil	stora	age tank	s, Cylind	ler head	, Piston,
Cylinder lir	er, Crank Shaft, Exhaust manifold, Catal	ytic Cor	nverter		-		T	
			Тс	otal ho	ours to be	e taught		45
Text book	(s)							
1 Ibral	im Zeid, "CAD/CAM, Theory and Practic	e", McG	Graw Hi	II, 199	98.			
1 1 -						Dractico		
Fole	y, Van Dam, Feiner and Hughes, "Comp	uter Gra	aphics I	Princi	ples and	FIACUCE	, Z EU.,	Addison –
2 Fole	y, Van Dam, Feiner and Hughes, "Comp ley, 2000.	uter Gra	aphics I	Princi	pies and	FIACUCE	, 2 Eu.,	Addison –
2 Fole 2 Wes	y, Van Dam, Feiner and Hughes, "Comp ley, 2000. <b>Book(s)</b>	uter Gra	aphics I	Princi	pies and	Flacilice	, 2 Eu.,	Addison –
2 Fole 2 Wes <b>Reference</b> 1 E. M	y, Van Dam, Feiner and Hughes, "Comp ley, 2000. <b>Book(s)</b> icheal, "Geometric Modelling", John Wile	y & Sor	aphics I	Princi		Flactice	, Z EU.,	Addison –

CBIT	Autonomous Regulation		Sem	ester-1			AY - 200	6-17	
Department	Mechanical Engineering	Progra	amme C	ode & Na	ame	M.E. Th	ermal Eng	ineering	3
Course Code	Course Name	Hours	/Week		Credit	Maximu	m Marks		-
16MEE105	OPTIMIZATION	L	Т	Р	E		Тс	otal	
	TECHNIQUES	3	1	0	30	1	00		
Objective (s)	1. To Understand the need of	the opt	imizatior	n method	S.				
, , ,	2. To introduce the fundament	tal conc	epts of 0	Optimizat	tion Techr	iques			
	3. To provide students with th	ie mode	eling skil	lls neces	sary to de	scribe an	d formula	te optim	nization
	problems								
	4. To make the learners aware	e of the	importa	nce of op	otimization	s in real s	scenarios		
	5. To provide the concepts	of vario	ous class	sical and	d modern	methods	of for co	onstraine	ed and
	Unconstrained problems in	both sir	igle and	multivari	able	mathada	upod in o	adinaari	'na
Outcome (s)	6. Get a bload picture of the v	anous a	application	roblem	oumization	methous	used in el	ngineen	ng.
Outcome (s)	2 Apply different techniques to	piograi S solve	Non Lin		ammina n	roblem			
	3 Implement constrained optic	nizatior	technic	ues	aming p	nobiciti			
	4. Analyze dynamic programm	ning and	l integer	program	mina prob	olems			
	5. Develop schedule for project	ts and	apply PE	RT/CPM	1 techniqu	es			
	6. Apply Queuing theory to rea	al life sit	uations						
1. LINEAR AN	ID TRASPORTATION PROBLE	EMS					Tota	Hrs	9
Statement of O	ptimization Problem, Linear Pro	ogramm	ning: Sin	nplex Me	ethod, Rev	vised Sim	plex Meth	nod, Sei	nsitivity
Analysis, Param	etric Programming, and Transpo	ortation	Problem						
2. NON-LINEAF	R PROBLEMS						Tota	Hrs	9
Nonlinear Proc	gramming: Approach, Converge	nce and	Scaling	of Desig	gn variable	es; Uncon	strained		
Methods: Stee	Prect Search Methods: Random	Search	i, Univar	late, Sim		oa; indire Acthode:	ct Search		
3 NON-I INFAF	PROGRAMMING	ent, Nev		asinewi	.011, DTF 1	netrious,	Tota	Hrs	9
Constrained Or	timization Direct Methods: Lag	range I	Multiplie	rs. Kuhn-	-Tucker. c	onditions	Beal's m	ethod.	Indirect
Method: Penalty	Function and Applications			e,			,		
4. DYNAMIC P	ROGRAMMING						Tota	Hrs	9
Introduction to	Dynamic Programming; Conce	ot of Su	b optimi	zation an	d the prin	ciple of o	otimality; L	inear	
and Continuou	s Dynamic Programming with A	pplicati	ons; Intr	oduction	to Integer	Program	ming; Cutt	ing	
Plane Method;	Branch and Bound method; Int	roductic	on to Ge	netic Algo	orithms, p	article sw	arm optim	ization	
5. PROJECT SO	CHEDULING						Total	Hrs	9
Sequencing an	d Scheduling, Project Schedul	ing by	PERT-C	CPM; Pro	obability a	and cost	considera	tion in	Project
scheduling; Que	euing Theory, Single and mult	i serve	r model	s; Queue	es with co	ombined	arrivais ar	na aepa	artures;
Queues with ph				То	tal hours	to he tauc	tht Tota	l Hre	45
Text book (s)					nal nours			11115	43
1 Rao S S Enc	ineering "Optimization Theory a	nd Pra	ctice" N	ew Age li	nt Pub 3	rd Ed 19	996		
2. Haug.E.J.and	Arora, J.S., "Applied Optimal D	esian".	Wilev In	ter Scien	nce Public	ation. NY	. 1979.		
Reference(s)		( /	,			,	,		
1. Douglas J.	Willde, "Globally Optimal Desigr	ı", Jhon	Wiley 8	Sons, N	lew York,	1978			
2. Johnson Ra	ay C., "Optimum Design of Mech	anical l	Element	s", John \	Wiley & So	ons, 1981			
3. S.D. Sharm	a, S.D. "Operations Research",	Khanna	a Publica	ations, 20	001.				
4. David Goldi	ric "Particle Swarm Ontimization	SUN PUI n" ISTE	Dification:	s, 2000. ations 20	006				
6. Prem Kuma	ar Gupta, "Operations Research"	', S Cha	and publ	ications	2008				
		, e ene							

CBIT	A	utonon	nous R	egula	ntion			
		Pr	ogramn	ne Co	de &	M.E. CA	D/CAM &	Thermal
Department	Mechanical Engineering		Nan	ne		Enginee	ering	
	Ser	nester-l	/ )					
Course Code	Course Name	Hours	/ ичеек	D	Credit		um Marks	Total
16MEE 207	ENGINEERING RESEARCH	L	1	Г	C		1	TOLAI
	METHODOLOGY	3	0	0	3	70	30	100
Objective (s)	1. To motivate the students to choose	resear	ch as c	areer				
	2. To make the students to formulate t	he rese	arch pr	oblen	า.			
	3. To identify various sources for litera	ture rev	/iew an	d data	a collection	on.		
	4. To prepare the research design	thode to	o analv	za tha	collecte	etch h		
	6. To write a report and interpret the re	sults	o analy	26 116	CONCOL	u uala		
Outcome (s)	Students will be able to							
	1. define research problem							
	2. review and asses the quality of liter	ature fr	om var	ious s	ources.			
	4. collect the data by various methods:	observ	/ation. i	s. ntervi	ew. ques	stionnair	es.	
	5. analyze problem by statistical techn	iques: /	ANOVA	, F-te	st, Chi-s	quare		
	6. improve the style and format of writi	ng a re	port for	techr	nical pap	er/ Jourr	nal report	
1 Rese	earch Methodology:					Тс	otal Hrs	9
Objectives an	d Motivation of Research, Types o	f Rese	earch,	Resea	arch Ap	proache	s, Signific	ance of
Research, Res	search Methods verses Methodology, R	esearc	h Proce	ess, C vral	riteria of	Good R	esearch, I	roblems
Defining the	<b>Research Problem</b> : Selection of Re	search	Proble	em. N	ecessitv	of Defi	nina the	Problem.
Technique invo	olved in Defining a Problem.			,	· · · · · <b>,</b>		5	,
2 Life	erature Survey:					1	otal Hrs	9
Importance an	nd purpose of Literature Survey. Source	es of Ir	format	ion. A	ssessme	ent of Q	uality of Je	ournals
and Articles, Ir	nformation through Internet.			,				
Literature Rev	view: Need of Review, Guidelines for Review.	eview, l	Record	of Re	search F	Review.		•
3 Re:	search Design:					<u> </u>	otal Hrs	9
Meaning of R	esearch Design, Need of Research De	sign, F	eature	of a (	Good De	sign, Im	portant C	oncepts
Developing a	Research Plan Steps in sample design	types	S, Bas of samm	ic Pr de de	incipies	or Expe	enmentai	Design,
4 Dat	a Collection:	types	or sam		Signs.		Total Hrs	9
Methods of da	ta collection, importance of Parametric	test, te	esting o	f prop	portions,	testing	of variance	e of two
normal popula	tion, and Non Parametric test, relation I	oetwee	n Spea	rman	s r's and	Kendall	's W	-
Data Analysis	: Tests for significance: Chi-square, AN	OVA, F	-test.					
5 Inte	erpretation and report writing:	man of	roporto	Maa	haniaa a	furition	I otal Hrs	9
Research Pro	posal Preparation: Writing a Research	/pes or n Prop	repons osal an	, web	search	Report	Writing R	esearch
Grant Proposa	al.				ocuron i	toport,	i i i i i i i i i i i i i i i i i i i	oodaron
Text Book (s):								
	Desservels Methodals		Na ^	م م ا	to mostle :			4
2 R Ganasan	Research Methodology, Methods & Tec	nnique; /i io ou	New A	uge In 201	ternation	al Publis	sners, 200	4
z. n. Ganesall,	Research methodology for Engineers, h	NJF FU	DIIGIICIS	s, ∠01	I			
References:								
3. Y.P. Agarwal	, Statistical Methods: Concepts, Applica	tion and	d Comp	outatio	on, Sterli	ng Publs	.,	
Pvt., Ltd., Ne	w Delhi, 2004				-	-		
4. Vijay Upagad	le and Aravind Shende, Research Metho	odology	/, S. Ch	and 8	& Compa	ny Ltd.,		
New Deini, 20	UUY and A Wilson Aruni Research and Writ	ing acr	nee tha	Disci	nlines M		ichore	
5. T . Tamua35		ing acr		1301	pii 103, 1V		51015	

CBIT			Au	tonomous	Regulation			
Department	Mechanical Engineering	I P	rogramm	e Code &	M.E. (THER	MAL ENGINEER	ING)	
-		N	ame	-				
			Sem	ester-l	No. in a No. I			
Course Code	Course Name	HOU	rs/vveek	Credit	End Exam	KS Intornal	Toto	1
16MEE 202		L		C		Assessment	TOLA	LI
	TURBO MACHINES	3	0 0	3	70	30	1	00
Objectives	1 To learn princip	les ar	nd equati	ons of turb	o machinery			
Objectives	2. To know about	veloci	ty triang	e and pow	er developed by	steam turbines.		
	3. To understand t	he wo	orking pr	nciples of	Pelton, Francis	and Kaplan turbir	nes.	
	4. To familiarize t	ne wo	rking pri	nciples of a	axial flow compre	essor		
	5. To understand t	he wo	orking pr	nciple of C	Centrifugal comp	ressor and its pe	rtormar	nce
	turbines	wern	equireu i	UI RUIAIY			eu by G	145
Outcomes	Students will be able to							
	1. apply gas dynai	nics e	equation	dependin	g upon applicati	ons.		
	2. estimate the po	wer d	eveloped	l by steam	turbines			
	3. calculate hydrau		re rise a	of impuise	and Reaction tu	rdines vial flow compres	sor	
	5. analyze the slip	facto	r and pe	formance	of centrifugal co	mpressor	501	
	6. understand cycl	es ar	d improv	e the cycle	e efficiency in ga	s turbines		
1 FUNDA	MENTALS OF TURBO M	ACH	NES:			Total	Hrs	7
Classifications	, Applications, Isentropic	flow.	Energy	transfer. E	fficiencies, Stat	ic and Stagnatio	n cond	litions,
Continuity equ	ations, Euler's flow throug	h vari	able cro	ss sectiona	al areas.			
2 STEAM	TURBINES:					Total	Hrs	9
Convergent an Steam Turbine	TURBINES: d Convergent-Divergent s: Impulse turbines, Work	nozzle done	es, Ener and Ve	gy Balance	e, Effect of back gle, Efficiencies (	Total pressure, Desig Compounding.	Hrs n of no	9 ozzles.
2 STEAM Convergent ar Steam Turbine 3 HYDRA	TURBINES: d Convergent-Divergent s: Impulse turbines, Work ULIC TURBINES:	nozzle done	es, Ener and Vel	gy Balance ocity triang	e, Effect of back gle, Efficiencies (	Total pressure, Desig Compounding. Total	Hrs n of no Hrs	9 ozzles. 9
2 STEAM Convergent ar Steam Turbine 3 HYDRA Introduction, C	TURBINES: Id Convergent-Divergent ( s: Impulse turbines, Work ULIC TURBINES: lassification of turbines, I cis and Kaplan Turbines	nozzle done mpuls	es, Ener and Vel se and re	gy Balance ocity triang eaction turi	e, Effect of back gle, Efficiencies ( bines, constructi	Total pressure, Desig Compounding. Total on, working and	Hrs n of nc Hrs perforr	9 ozzles. 9 mance
2 STEAM Convergent ar Steam Turbine 3 HYDRA Introduction, C of Pelton, Fran	TURBINES: Id Convergent-Divergent s: Impulse turbines, Work ULIC TURBINES: lassification of turbines, I cis and Kaplan Turbines,	nozzle done mpuls Selec	es, Ener and Vel se and re tion of tu	gy Balance ocity triang eaction turn rbines: sp	e, Effect of back gle, Efficiencies ( bines, constructi ecific speed, uni	Total pressure, Desig Compounding. Total on, working and t quantities	Hrs n of nc Hrs perforr	9 ozzles. 9 mance
2 STEAM Convergent ar Steam Turbine 3 HYDRA Introduction, C of Pelton, Fran 4 AXIAL I	TURBINES: Id Convergent-Divergent s: Impulse turbines, Work ULIC TURBINES: lassification of turbines, I cis and Kaplan Turbines, FLOW COMPRESSORS	nozzla done mpuls Selec	es, Ener and Vel se and re tion of tu CENTRI	gy Balance ocity triang eaction turn rbines: sp	e, Effect of back gle, Efficiencies ( bines, constructi ecific speed, uni DMRESSORS:	Total pressure, Desig Compounding. Total on, working and t quantities Total	Hrs n of no Hrs perforr Hrs	9 ozzles. 9 mance 9
2 STEAM Convergent ar Steam Turbine 3 HYDRA Introduction, C of Pelton, Fran 4 AXIAL I Work and ve	TURBINES: Id Convergent-Divergent s: Impulse turbines, Work ULIC TURBINES: lassification of turbines, I cis and Kaplan Turbines, FLOW COMPRESSORS locity triangles, Efficience	mozzle done mpuls Selec AND cies,	es, Ener e and Vel se and re tion of tu CENTRI Stage p	gy Balance ocity triang eaction turl rbines: sp FUGAL CO ressure r	e, Effect of back gle, Efficiencies ( bines, constructi ecific speed, uni <b>DMRESSORS:</b> ise, Degree of	Total pressure, Desig Compounding. Total on, working and t quantities Total reaction, Per	Hrs n of nc Hrs perforr Hrs forman	9 ozzles. 9 mance 9 nce of
2 STEAM Convergent ar Steam Turbine 3 HYDRA Introduction, C of Pelton, Fran 4 AXIAL I Work and ve compressors Types: Velocity	TURBINES: Id Convergent-Divergent s: Impulse turbines, Work ULIC TURBINES: lassification of turbines, I cis and Kaplan Turbines, FLOW COMPRESSORS locity triangles, Efficiencies	mozzle done mpuls Selec AND cies,	es, Ener and Vel se and re tion of tu <b>CENTRI</b> Stage p	gy Balance ocity triang eaction turi rbines: sp FUGAL CO pressure r	e, Effect of back gle, Efficiencies ( bines, constructi ecific speed, unit <b>DMRESSORS:</b> ise, Degree of ce of compressor	Total pressure, Desig Compounding. Total on, working and t quantities Total reaction, Per	Hrs n of nc Hrs perforr Hrs forman	9 ozzles. 9 mance 9 nce of
2 STEAM Convergent ar Steam Turbine 3 HYDRA Introduction, C of Pelton, Fran 4 AXIAL I Work and ve compressors Types; Velocity 5 GAS TU	TURBINES: Id Convergent-Divergent s: Impulse turbines, Work ULIC TURBINES: lassification of turbines, I cis and Kaplan Turbines, FLOW COMPRESSORS / locity triangles, Efficiencies / triangles and efficiencies IRBINES:	mpuls Selec AND cies,	es, Ener and Vel se and re stion of tu <b>CENTRI</b> Stage p factor; p	gy Balance ocity triang eaction turn rbines: sp FUGAL CO ressure r performance	e, Effect of back gle, Efficiencies ( bines, constructi ecific speed, unit <b>DMRESSORS:</b> ise, Degree of ce of compressor	Total pressure, Desig Compounding. Total on, working and t quantities Total reaction, Per	Hrs n of nc Hrs perforr Hrs forman	9 ozzles. 9 mance 9 nce of 9
2     STEAM       Convergent ar     Steam Turbine       3     HYDRA       Introduction, C     of Pelton, France       4     AXIAL I       Work and ver     compressors       Types; Velocity     5       GAS TU       Principle of work	TURBINES: Id Convergent-Divergent s: Impulse turbines, Work ULIC TURBINES: lassification of turbines, I cis and Kaplan Turbines, FLOW COMPRESSORS locity triangles, Efficience y triangles and efficiencies IRBINES: prking – Classification – A	nozzle done mpuls Selec AND cies, ;; slip Joule'	es, Ener and Vel se and re tion of tu CENTRI Stage p factor; p s cycle	gy Balance ocity triang eaction turk rbines: sp FUGAL CO pressure r performance - workdon	e, Effect of back gle, Efficiencies ( bines, constructi ecific speed, uni <b>DMRESSORS:</b> ise, Degree of ce of compressor e and efficiency	Total pressure, Desig Compounding. Total on, working and t quantities Total reaction, Per	Hrs n of nc Hrs perforr Hrs forman Hrs e – Op	9 ozzles. 9 mance 9 nce of 9 otimum
2       STEAM         Convergent ar       Steam Turbine         3       HYDRA         Introduction, C       of Pelton, France         4       AXIAL I         Work and ver       compressors         Types; Velocity       5         GAS TU       Principle of wer         Principle of wer       Principle of wer	TURBINES: Id Convergent-Divergent s: Impulse turbines, Work ULIC TURBINES: lassification of turbines, I cis and Kaplan Turbines, FLOW COMPRESSORS / locity triangles, Efficiencies / triangles and efficiencies JRBINES: prking – Classification – of for maximum power a	nozzle done mpuls Selec AND cies, s; slip	es, Ener and Vel se and re stion of tu <b>CENTRI</b> Stage p factor; p s cycle aximum	gy Balance ocity triang eaction turl rbines: sp FUGAL CO pressure r performance - workdon efficiency	e, Effect of back gle, Efficiencies ( bines, constructi ecific speed, uni <b>DMRESSORS:</b> ise, Degree of ce of compresson e and efficiency y – P <sub>max</sub> and ŋ	Total pressure, Desig Compounding. Total on, working and t quantities Total reaction, Per rs Total r – Brayton Cycle max – Improver	Hrs n of nc Hrs perforr Hrs forman Hrs e – Op hent in	9 ozzles. 9 mance 9 nce of 9 ottimum cycle
2       STEAM         Convergent ar       Steam Turbine         3       HYDRA         Introduction, C       of Pelton, France         4       AXIAL I         Work and ver       compressors         Types; Velocity       5         GAS TU       Principle of wor         Pressure ratio       performance –	TURBINES: Id Convergent-Divergent s: Impulse turbines, Work ULIC TURBINES: lassification of turbines, I cis and Kaplan Turbines, FLOW COMPRESSORS locity triangles, Efficience (riangles and efficiencies IRBINES: prking – Classification – of for maximum power a Intercooling, Reheating a	nozzle done mpuls Selec AND cies, ; slip Joule' nd m	es, Ener and Vel se and re tion of tu <b>CENTRI</b> Stage p factor; p s cycle aximum egenerat	gy Balance ocity triang eaction turk rbines: sp FUGAL CO ressure r berformance - workdon efficiency on (Heat e	e, Effect of back gle, Efficiencies ( bines, constructi ecific speed, unit <b>DMRESSORS:</b> ise, Degree of ce of compresson e and efficiency r – P <sub>max</sub> and n exchanging) – Pr	Total pressure, Desig Compounding. Total on, working and t quantities Total reaction, Per rs Total r – Brayton Cycle Imax – Improvem oblems using the	Hrs n of nc Hrs perforr Hrs forman Hrs e – Op hent in ese prir	9 ozzles. 9 mance 9 nce of 9 nce of 9 ottimum cycle nciples
2       STEAM         Convergent ar       Steam Turbine         3       HYDRA         Introduction, C       of Pelton, France         4       AXIAL I         Work and ver       compressors         Types; Velocity       5         GAS TU       Principle of wor         Pressure ratio       performance –	TURBINES: Id Convergent-Divergent s: Impulse turbines, Work ULIC TURBINES: lassification of turbines, I cis and Kaplan Turbines, FLOW COMPRESSORS / locity triangles, Efficience / triangles and efficiencies IRBINES: orking – Classification – of for maximum power a Intercooling, Reheating a	nozzle done mpuls Selec and cies, ; slip Joule' nd m nd Re	es, Ener and Vel se and re stion of tu <b>CENTRI</b> Stage p factor; p s cycle aximum egenerat	gy Balance ocity triang eaction turk rbines: sp <b>FUGAL CO</b> pressure r performance - workdon efficiency on (Heat e	e, Effect of back gle, Efficiencies ( bines, constructi ecific speed, unit <b>DMRESSORS:</b> ise, Degree of ce of compresson e and efficiency y – P <sub>max</sub> and η exchanging) – Pr	Total pressure, Desig Compounding. Total on, working and t quantities Total reaction, Per rs Total r – Brayton Cycle max – Improvem roblems using the otal hours to be t	Hrs n of nc Hrs perforr Hrs forman Hrs e – Op nent in ese prir aught	9 ozzles. 9 mance 9 nce of 9 nce of 9 otimum cycle nciples 43
2 STEAM Convergent ar Steam Turbine 3 HYDRA Introduction, C of Pelton, Fran 4 AXIAL I Work and ve compressors Types; Velocity 5 GAS TU Principle of wo Pressure ratio performance – Text book (s)	TURBINES: Id Convergent-Divergent s: Impulse turbines, Work ULIC TURBINES: lassification of turbines, I cis and Kaplan Turbines, FLOW COMPRESSORS A locity triangles, Efficiencies Intercooling, Reheating a Intercooling, Reheating a	nozzle done mpuls Selec AND cies, s; slip Joule' nd m nd Re	es, Ener and Vel se and re tion of tu CENTRI Stage p factor; p s cycle aximum egenerat	gy Balance ocity triang eaction turk rbines: sp FUGAL CO ressure r berformance - workdon efficiency on (Heat e	e, Effect of back gle, Efficiencies ( bines, constructi ecific speed, unit <b>DMRESSORS:</b> ise, Degree of ce of compresson e and efficiency y – P <sub>max</sub> and η exchanging) – Pr	Total pressure, Desig Compounding. Total on, working and t quantities Total reaction, Per rs Total r – Brayton Cycle max – Improvem roblems using the otal hours to be t	Hrs n of nc Hrs perforr Hrs forman Hrs e – Op hent in ese prin aught	9 pzzles. 9 mance 9 nce of 9 ptimum cycle nciples 43
2     STEAM       Convergent ar     Steam Turbine       3     HYDRA       Introduction, C     of Pelton, France       4     AXIAL I       Work and ver     compressors       Types; Velocity     5       GAS TU       Principle of work       Pressure ratio       performance –       Text book (s)       1     S.M.*       2010	TURBINES: Id Convergent-Divergent s: Impulse turbines, Work ULIC TURBINES: lassification of turbines, I cis and Kaplan Turbines, FLOW COMPRESSORS / locity triangles, Efficiencies / triangles and efficiencies IRBINES: orking – Classification – of for maximum power a Intercooling, Reheating a Yahya, Turbines, Comprese	nozzle done mpuls Selec AND cies, s; slip Joule' nd m nd Re	es, Ener and Vel se and re- tion of tu <b>CENTRI</b> Stage p factor; p s cycle aximum egenerat	gy Balance ocity triang action turi ribines: sp FUGAL CO ressure r performance - workdon efficiency on (Heat e	e, Effect of back gle, Efficiencies ( bines, constructi ecific speed, unit <b>DMRESSORS:</b> ise, Degree of ce of compresson e and efficiency y – P <sub>max</sub> and η exchanging) – Pr T edition, Tata Mo	Total pressure, Desig Compounding. Total on, working and t quantities Total reaction, Per rs Total reaction, Per rs Total r – Brayton Cycle max – Improvem oblems using the otal hours to be t	Hrs n of nc Hrs perforr Hrs forman Hrs e – Op hent in ese prir aught tion Pv	9 pzzles. 9 mance 9 nce of 9 nce of 43 t. Ltd.,
2     STEAM       Convergent ar     Steam Turbine       3     HYDRA       Introduction, C     of Pelton, France       4     AXIAL I       Work and ver     compressors       Types; Velocity     5       GAS TU       Principle of work       Principle of work       Principle of work       Text book (s)       1     S.M. `       2010       2     Gopala	TURBINES: Id Convergent-Divergent s: Impulse turbines, Work ULIC TURBINES: lassification of turbines, I cis and Kaplan Turbines, FLOW COMPRESSORS locity triangles, Efficience / triangles and efficiencies IRBINES: orking – Classification – , for maximum power a Intercooling, Reheating a Yahya, Turbines, Compre- akrishnan G, Prithvi Raj D	nozzle done mpuls Selec AND cies, ; slip Joule' nd m nd Re essor	es, Ener and Vel se and re- stion of tu CENTRI Stage p factor; p s cycle aximum egenerat s and Fa eatise o	gy Balance ocity triang eaction turk rbines: sp FUGAL CO ressure r berformance - workdon efficiency on (Heat e ns, Fourth	e, Effect of back gle, Efficiencies ( bines, constructi ecific speed, unit <b>DMRESSORS:</b> ise, Degree of ce of compresson e and efficiency r – P <sub>max</sub> and n exchanging) – Pr T edition, Tata Mo chines", Scitec F	Total pressure, Desig Compounding. Total on, working and t quantities Total reaction, Per rs Total r – Brayton Cycle max – Improvem roblems using the cotal hours to be t coraw-Hill Educa Publications, Che	Hrs n of nc Hrs perforr Hrs forman Hrs e – Op hent in ese prin caught tion Pv	9 Dzzles. 9 mance 9 nce of 9 nce of 9 nce of 43 rt. Ltd., 2002
2       STEAM         Convergent ar       Steam Turbine         3       HYDRA         Introduction, C       of Pelton, France         4       AXIAL I         Work and vere       compressors         Types; Velocity       5         GAS TU       Principle of word         Pressure ratio       performance –         Text book (s)       1         S.M. `       2010         2       Gopala         3       Seppo	TURBINES: Id Convergent-Divergent s: Impulse turbines, Work ULIC TURBINES: lassification of turbines, I cis and Kaplan Turbines, FLOW COMPRESSORS / locity triangles, Efficience / triangles and efficiencies JRBINES: orking – Classification – , for maximum power a Intercooling, Reheating a Yahya, Turbines, Compre- akrishnan G, Prithvi Raj D . A. Korpela, Principles of	nozzle done mpuls Selec AND cies, ; slip doule' nd m nd Re essor , "A tr	es, Ener and Vel se and re stion of tu <b>CENTRI</b> Stage p factor; p s cycle s cycle s cycle s and Fa eatise of omachin	gy Balance ocity triang eaction turk rbines: sp FUGAL CO pressure r performance - workdon efficiency on (Heat e ns, Fourth n Turboma ery, John V	e, Effect of back gle, Efficiencies ( bines, constructi ecific speed, unit <b>DMRESSORS:</b> ise, Degree of ce of compresson e and efficiency r – P <sub>max</sub> and η exchanging) – Pr T edition, Tata Mo chines", Scitec F Viley & sons Inc	Total pressure, Desig Compounding. Total on, working and t quantities Total reaction, Per rs Total r – Brayton Cycle max – Improvem roblems using the cotal hours to be t coraw-Hill Educa Publications, Che Publications, 20	Hrs n of nc Hrs perforr Hrs forman Hrs dorman Hrs tion Pv ennai, 2 11	9 ozzles. 9 mance 9 nce of 9 nce of 9 nce of 43 timum cycle nciples 43
2       STEAM         Convergent ar       Steam Turbine         3       HYDRA         Introduction, C       of Pelton, France         4       AXIAL I         Work and veressors       Types; Velocity         5       GAS TU         Principle of work         Principle of work         Principle of work         1       S.M. Yes         2010       2         3       Sepport         Reference(s)       Steam	TURBINES: Id Convergent-Divergent s: Impulse turbines, Work ULIC TURBINES: lassification of turbines, I cis and Kaplan Turbines, FLOW COMPRESSORS / locity triangles, Efficience / triangles and efficiencies IRBINES: orking – Classification – , for maximum power a Intercooling, Reheating a Yahya, Turbines, Compre- akrishnan G, Prithvi Raj D . A. Korpela, Principles of	nozzle done Selec AND cies, s; slip Joule' nd m nd Re essor	es, Ener and Vel se and re- stion of tu <b>CENTRI</b> Stage p factor; p s cycle aximum egenerat s and Fa eatise of omachin	gy Balance ocity triang eaction turk rbines: sp FUGAL CO ressure r berformance - workdon efficiency on (Heat e ns, Fourth n Turboma	e, Effect of back gle, Efficiencies ( bines, constructi ecific speed, unit <b>DMRESSORS:</b> ise, Degree of e and efficiency r – P <sub>max</sub> and n exchanging) – Pr T edition, Tata Mo chines", Scitec F Viley & sons Inc	Total pressure, Desig Compounding. Total on, working and t quantities Total reaction, Per rs Total reaction, Per rs Total reactions using the cotal hours to be t cofraw-Hill Educa Publications, Che Publications, 20	Hrs n of nc Hrs perforr Hrs forman hent in ese prin aught tion Pv ennai, 2	9 ozzles. 9 mance 9 nce of 9 otimum cycle nciples 43 rt. Ltd., 2002
2     STEAM       Convergent ar     Steam Turbine       3     HYDRA       Introduction, C     of Pelton, France       4     AXIAL I       Work and ver     compressors       Types; Velocity     5       GAS TU       Principle of word       Pressure ratio       performance -       Text book (s)       1     S.M. `       2010       2     Gopala       3     Seppo       Reference(s)     1	TURBINES: Id Convergent-Divergent s: Impulse turbines, Work ULIC TURBINES: lassification of turbines, I cis and Kaplan Turbines, FLOW COMPRESSORS / locity triangles, Efficience / triangles and efficiencies IRBINES: orking – Classification – , for maximum power a Intercooling, Reheating a Yahya, Turbines, Compre- akrishnan G, Prithvi Raj D . A. Korpela, Principles of urton, Principles of Turbon	nozzle done mpuls Selec AND cies, ; slip Joule' nd m nd Re essor , "A tr Turb	es, Ener and Vel se and re stion of tu <b>CENTRI</b> Stage p factor; p s cycle aximum egenerat s and Fa eatise on omachin	gy Balance ocity triang eaction turk rbines: sp FUGAL CO ressure r berformand - workdon efficiency on (Heat e ns, Fourth n Turboma ery, John V	e, Effect of back gle, Efficiencies ( bines, constructi ecific speed, unit <b>DMRESSORS:</b> ise, Degree of e and efficiency r – P <sub>max</sub> and n exchanging) – Pr T edition, Tata Mo chines", Scitec F Viley & sons Inc	Total pressure, Desig Compounding. Total on, working and t quantities Total reaction, Per rs Total r – Brayton Cycle max – Improvem oblems using the corau-Hill Educa Publications, Che Publications, Che don & New York	Hrs n of nc Hrs perforr Hrs forman Hrs e – Op nent in ese prin aught tion Pv ennai, 2	9 ozzles. 9 mance 9 nce of 9 nce of 9 otimum cycle nciples 43 t. Ltd., 2002

CBIT	Autono	mous Regulation	on Semester-1 AY - 2006-17					17	
Department	Mecha	anical Engineering	Progr	amme C	ode & Na	ime	M.E. Th	ermal Eng	ineering
Course Code	Cours	e Name	Hours	s/ Week		Credit	Maximu	ım Marks	
16MEE 203	FLUID	POWER SYSTEMS	L	Т	Р	С	E	I	Total
			3	1	0	4	70	30	100
Objective (s)	Studen	t will understand							
	1.	behavior and propertie	es of flu	iids					
	2.	working principles of h	ydrauli	c pumps	& motors	5			
	3.	working principles of h	ydrauli	c control	valves	لمط يسأنك لم	vdraulia r	ower	
	4.	characteristics and an	anous	ns of pp	s associa	tea with h	yuraulic p	bower	
	5. 6	working and operating	princir	bles of pri	neumatic	transmiss	ion lines		
Outcome (s)	A stude	ent will be able to	<u>p</u>	<u></u>					
	1.	understand various typ	bes of f	luids alo	ng with p	roperties	used for a	different ap	plications
	2.	select motor and pum	o depei	nding on	applicatio	on			•
	3.	analyze the various ty	pes of l	hydraulic	valves				
	4.	calculate design nozz	les an	d other of	elements	used for	hydraulio	c purposes	such as i
		pneumatics							
5. apply the principles of engineering for linear dynamics									
6. Design feedback control of elements									
1. HYDRAULIC	FLUIDS							Total	Hrs 9
Advantages and	d Disadv	antages of Fluid cont	rol, Ty	pes of I	Hydraulic	Fluids, p	physical,	chemical	and therma
properties of hyd	araulic fil	uids, selection of hydrau		a, fiula fic	ow fundar	mentals		Tatal	
2. HTDRAULIC	PUIVIPS	AND CONTROL VAL	VES	struction	, ideal n	ump and	motor a	nolveie Dr	rformance
curves and para	meters	notors. Dasic Types at		Struction	s, iueai p	ump and	motor a	11a1y515, Ft	enormance
Hydraulic Contro	ol Valves	s- Valve configurations	gener	al valve	analysis	critical ce	enter ope	en center t	hree wav
spool valve and	alvsis ar	nd Flapper valve analy	sis. pr	essure o	control va	alves, sin	ale and t	two stage	pressure
control valves, f	ow conti	rol valves, introduction t	o elect	ro hydra	ulic valve	S	0	0	•
3. HYDRAULIC	POWER							Total	Hrs 9
Hydraulic Powe	r Eleme	nts: Valve controlled m	notor, v	alve con	ntrolled p	iston, thr	ee way v	alve contr	olled pistor
pump controlled	motor, p	pressure transients in po	ower el	ements					
4. PNEUMATIC	S							Total	Hrs 9
Characteristics	of Pne	umatics, Applications o	f Pneu	matics,	Basic Pn	eumatic e	elements,	Steady flo	w of Ideal
gases, orifice	and noz	zie calculations, capilla	ry now	, flow of	real gase	es, linear	ised flow	equations	in Orifices
Steady state	analysis	of pneumatic compo	nonte:	Multiple	restricti	ion and	volume	calculation	e concina
chambers, val	es. Sinc	le acting actuators.	mento.	multiple	1630160		volume	calculation	s, sensing
5. TRANSIENTS	S IN ELE	MENTARY PNEMATIC	C SYST	EMS				Total	Hrs 9
Linear dynamic	s-linear	pneumatic spring rat	e, line	ar dyna	mics of	a variab	le volum	e of gas,	Pneumati
transmission line	es, linea	r dynamics in single ac	ting ac	tuators.	Applicatio	ons in ind	lustrial pr	ocess con	trols: On-O
pneumatic feed	back sys	tems, feedback control	of prop	ortional	gain, der	ivative ac	tion, integ	gral action,	Design of
Pneumatic Pres	sure Reg	gulator						-	
					То	tal hours	to be taug	ght	4
Text book (s)									
1. Herbert	E. Merri	tt, "Hydraulic Control Sy	/stems	', John V	Viley & So	ons, 1967			
2. W. Ande	erson, Th	ne Analysis and Design	of Pne	umatic S	Systems,	Wiley, 19	67.		
Deferre									
	odwin ⊑	luid Power Sveteme M	acmillo	n 1076					
2. Anthony	/ Esposit	o. "Fluid nower with an	olicatio	ns". Prer	tice Hall	7 <sup>th</sup> Editio	n. 2002		
3. Arthur A	Akers, M	lax Gassman, Richard	Smith	, "Hydra	ulic Powe	er System	Analysi	s", Taylor	and Franci
Group, 2	2006	<b>AT I I I I I I I I I I</b>			rd			-	
4. John Pi	openger	& Tyler Hicks, "Industria	al Hydr	aulics", 3	3 <sup>rd</sup> edition	, McGraw	<i>ı</i> Hill, 198	0	

CBIT	Autonomous Regulation									
Department	Mechanical	Pro	aramm	e C	ode	&	M.E	E. Therr	nal Engin	eerina
	Engineering	Nar	ne					-	5	5
Semester-I	5 . 5		-							
Course Code	Course Name		Hours	/Weel	<	Cre	dit	Maxim	um Mark	S
			L	Т	P	C	;	E		Total
16MEE 204	DESIGN FOR THERM SYSTEMS	IAL	3	0	0	3	5	70	30	100
Objective (s)	Student will understand									
	1.working principles of va	rious	s heat e	xchan	gers					
	2.design principles of hea	t exc	change	rs	5					
	3. constructional features	and	design	metho	ds of	doub	le pi	ipe hea	t exchan	gers
	4. constructional features and design principles of shell and tube heat changers									
	5. operating principles of cooling towers									
	6. parameters affecting design of cooling towers									
Outcome (s)	(s) Student will be able to									
	1. select heat exchangers depending on application and need									
	2. design heat exchanges using LMTD & NTU approach									
	3. understand the importance of double principle & exchanger in industry and its									
	design methods.									
	4. specify shell and the heat exchanger depending upon application in industry									
	5. design shell and tube heat exchanger based on importance and specifications									
	6. know the necessity of cooling towards in industry and its design methodology									
					_					-
	ON TO HEAT EXCHANGE	RS						Т	otal Hrs	9
Introduction, Recu	uperation & regeneration,	Tab	ular he	eat exc	chang	ers,	Dou	ble pipe	e, shell &	& tube heat
exchanger, Plate	neat Exchangers, Gasketer	d pla	ite heat	excha	inger.	Spir	al pl	ate hea	t exchang	ger, Lamella
heat exchanger, E	xtended surface heat exchange	ange	er, Plate	e fin an	d Tab	oular f	fin			
2 DESIGN MET	HODS OF HEAT EXCHAN	IGE	RS					T	otal Hrs	9
Basic Design Met	hods of Heat Exchanger: I	Intro	duction	, Basic	equa	ations	in o	design.	Overall h	eat transfer
coefficient, calcula	tions using LMTD method	for h	neat ex	change	er ana	lysis:	Par	allel flo	w, Counte	er flow
,				0		,				
3 DOUBLE PIF	PE HEAT EXCHANGER								otal Hrs	9
Film coefficient fo	or fluids in pipes and tul	bes,	Fluid	flowing	g in a	annul	i: th	e equi	valent di	ameter, film
coefficients, foulin	g factors, pressure drop	in pi	pes an	d pipe	annu	וו. וו די	he c	alculati	on of a l	Double pipe
exchanger. Double	e pipe exchangers in serie	es-pa	rallel a	rrange	ments	s. The	e tru	le temp	erature d	ifference for
series- parallel arr	angements.									
								<b>– –</b>	atal Ura	0
4 1-2 STELL-A	ND-IUDE EAGRAINGER	or t	uboo	Poffloo	The			ion of		
introduction. Tube	aida film acofficiant Shall	jer i Loida	ubes, i	Dames	, me	or T	juiai		snell and	difference in
a 1-2 exchangers. Shell	Shell- side pressure drop	The	equiv		anie	man	ne u so ir		perature	
Heat recovery in a	1-2 exchanger	, 1110	analy	313 01	pento	man	50 11		isting 1-2	excitatiget.
								<b>– –</b>	atal Ura	0
5 DIRECT CON	TACT HEAT EXCHANGER	<b>X</b>		wat h	م مالي	مائام م				9
Lowis number co	boling towers, Relation be		en the fill Apr	wet- D	f coo	na tri ling tr		ew-poi	nt tempel	ratures, The
Lewis number, coo	bing lower internals and for	ie oi	IIII. Alla			ing u	Jwei	siequi	ements	
Total hours to be tau	ught									45
Text book (s)										
1. Prescribed	book: Process Heat Transfer/E	D.Q.K	Kern/ TN	IH						
2.Heat Exchar	2.Heat Exchanger Design/ A.P.Fraas and M.N.Ozisicj/ John Wiely& sons, New York.									
3. Cooling Tov	vers / J.D.Gurney and I.A. Cot	ter/ N	/laclarer	1						

CBIT	Autonomous Regulation		Sem	ester-1			AY - 200	)6-17	
Department	Mechanical Engineering	Progra	amme C	ode & N	lame	M.E. Th	ermal End	gineering	a
Course Code	Course Name	Hours	/Week		Credit	Maximu	ım Marks		<u> </u>
16MEE 205	DESIGN OF GAS TURBINES	L	Т	Р	C	E	I	То	tal
		3	0	0	3	70	30	10	00
Objective (s)	Student will understand								
, , ,	1. To create awareness of the	e import	ance of	principle	es of desig	gn of gas	turbine ar	nd meth	ods of
	improvement of efficiency.								
	2. the principles of design of r	otary co	ompress	ors and	its classi	fication			
	3. the operating principles of a		stion cha	mber to	r gas turb	ine appli	cations	•	
	4. to familiarize the design of 5 the principles of axial flow of		and their	cooling	systems	used in	gas turbin	е	
	6 the design principles of gas	turbine	e blades						
Outcome (s)	utcome (s) Student will be able to								
	1. thermal efficiency of gas tu	rbine cy	cle and	its impre	ovements	by differ	ent metho	ds	
	2. various methods used in im	proving	g perforn	nance of	f the gas	turbine c	ycle		
	<ol><li>design elements in rotary control</li></ol>	ompres	sors						
	4. understand the importance	of vario	ous types	of com	bustion c	hambers	used in ga	as turbin	es
	5. design or analyze the force	s on bla	ade of ga	as turbin	ie Is da s				
	6. suggest different cooling m	ethoas	of gas tu	irbine bi	ades		Tate		0
	Den and Closed Cycles Methods		roving	uclo offic	riency – I	nter-cool	ing Reher	ating and	4 9
Regeneration	open and closed cycles. Methods	s or imp		yele ente	Siency – I		ing. Renea	ating and	u
2. DESIGN OF	ROTARY COMPRESSORS						Tota	Hrs	9
Applications of	Turbo Compressors (Centrifugal	and ax	ial flow)	in Gas	turbine p	ower pla	ant. Euler	equation	n of
energy transfer	in a turbomachine. Design of	two sta	age cent	trifugal	compress	sor with	vaneless	and va	ned
diffusers. Desigi	n of multi stage axial flow compres	ssors							
3. COMBUSTIC	IN CHAMBERS OF GAS TURBIN	IES					Tota	Hrs	9
Types of combu	stion chambers. Combustion cha	mber d	esign for	moderr	n gas turb	oines. Ca	n type, an	nular an	id tube
type of combust	ors								
4. DESIGN OF	AXIAL FLOW TURBINES						Tota	Hrs	9
Matching of co	mpressor and turbine for varying	load	operatior	n. Gas	turbine fo	or super	charging	and cry	ogenic
applications. Sm	nall gas turbines for space applica	tions							-
5. DESIGN AND	CONSTRUCTION OF GAS TUR		ROTORS	<u>S AND E</u>	BLADES	<u>.</u>	Total	Hrs	9
Blade materials.	. Blade attachment techniques. Co	poling n	nethods	of turbin	e blades.	Simple a	analysis of	turbine	
blade vibrations	Didue vibrations and balancing of fotors.								
<b>-</b>				TOL	al nours l		jrit		40
1 ext book (s)	The Design of High officiency Tur	homes	hinory		Turbinas		Droop Co	mbridee	
1. D.G.Wilson	The Design of High efficiency Tur	bomac	hinery ar	nd Gas	Turbines,	The MIT	Press, Ca	mbridge	e, U.K.
1. D.G.Wilson 2. M.P.Boyce	,The Design of High efficiency Tur , Gas Turbine Engineering hand b	bomac book, G	hinery ar ulf Publis	nd Gas <sup>-</sup> shing Co	Turbines, b., New Y	The MIT ork.	Press, Ca	Imbridge	e, U.K.

2. J.S. Rao, Rotor Dynamics, Wiley Eastern Publication, New Delhi.

CBIT	Autonomous Regulation	Semester-1 AY - 2006-17							
Department	Mechanical Engineering	Progr	amme C	ode & N	lame	M.E. Tł	nermal Eng	gineering	g
Course Code	Course Name	Hours	/Week		Credit	Maximu	um Marks		
16MEE 206		L	Т	Р	С	E	I	То	tal
	SYSTEMS	3	0	0	3	70	30	10	00
Objective (s)	Student will understand			-	_				
	1. to create awareness of the	import	ance of	the prine	ciples of v	arious no	on- convei	ntional e	nergy
	resources power and desig	gn cono	cepts of v	winḋ tun	nel				
	<ol><li>the working principles of value</li></ol>	arious d	collectors	s used ir	n solar				
	3. the importance of biogas a	ind its p	productio	n and th	ne princip	les of wa	ste heat re	ecovery	
	4. stress the need for cogene	eration a	systems	ofwind	turbing				
	6 the principles of waste bea	t recov	places	or wind	luibine				
Outcome (s) A student will be able to									
	1. design solar collectors, wind mill as per specifications								
	2. understand the potential of	inderstand the potential of biogas plants and need for waste heat recovery in the scenario of							
energy savings									
<ol><li>understand the need for cogeneration and various methods adopted for it</li></ol>									
4. optimize the power plant efficiency									
5. optimize power plant efficiency									
		ccorum	g to con:	sueratic		uynamic	5 Tota	ul Hre	٩
Solar energy:	solar radiation – measurement	colle	ction ar	d store	ane des	ian of f	lat plate	and na	rabolic
concentrating c	ollectors Solar power plants Pho	to volt	aic nowe	r syster	ns Appli	cation of	SPV and	Solar T	hermal
Systems				i bybloi	no. Appin			Colui II	lonnai
2. WIND ENRG	Y						Tota	Hrs	9
Estimation of	wind energy potential. Horizonta	al and	vertical	axis w	ind turbi	ne rotors	. Aerodyr	namic d	esign
considerations	for wind rotor blades. Wind elect	ric gen	erators-c	peration	n and cor	ntrol. Aero	o generato	ors for b	attery
charging.									-
3. BIO MASS							Tota	Hrs	9
Bio mass ener	gy: Sources of biomass. Energy	y from	solid w	astes. I	Biomass	tor ener	gy produc	tion. M	ethane
production. Bio	mass energy conversion technological design of Hybrid energy	ologies	. Use o	r Bio-ga	asifier. Bi	o mass	power ge	neration	using
	TRECOVERY	y syste	ms				Toto	Hro	0
Principles of y	vaste best recovery and co-gen	oration	Analysi	s of ho	at recove	any eveto	me Pogo	norators	9 and
recuperators for	or waste heat recovery Advantage	eration.	idized b	ed hoile	rs Atmos	spheric fli	uidized be	d combi	istion
(AFBC). Press	urized fluidized bed combustion (F	PFBC a	nd Circu	lation fl	uidized be	ed combi	ustion (CF	BC).	
(								/	
5. CO-GENERA	TION POWER SYSTEMS						Tota	Hrs	9
Co-generation p	ower systems, Condensate and	back p	ressure	steam t	urbines.	Design o	f waste he	eat reco	very
boilers. Combin	ed cycle power plants based on	waste	heat re	covery.	Integrate	ed gasific	ation com	ibined c	ycle
(IGCC) power p	lants. Optimization of Power plant	cycle e	efficiency	. Clean	coal tech	nologies	T		
Total hours to be taught 45									
Text book (s)	Text book (s)								
1. D.A. Relay, Waste Heat Recovery System.									
2. G.C. Drydin,	The efficient Use of Energy.								
References:					_				
	The and W.A. Beckmen, Solar Energy	ergy Th	ermal Pi	ocesses	5				
2. A.D. Me 3. V D Hu	nt. Wind Power.								
4. N.H Ra	vindranath and D O Hall, Bio Mas	ss, Ene	ergy and	Enviror	ment, O	kford Uni	versity Pre	ess .V J	adhav,
Energy and Environment, Himalaya publishing house, Mumbai									

CRIT	Autono	mous Pequilation	Samastar-1 AV - 2006-17							
Department	Mach		Drage							
Department	Mech	anical Engineering	Progra					iermai Eng	lineering	
Course Code	Cours	e Name	Hours	/ Week		Credit	Maximu	im Marks		
16MEE 207			L	Т	Р	С	E	I	Total	
	FUEL	S & COMBUSTION	3	0	0	3	70	30	100	
Objective (s)	Tomal	ke student understand		-	_	-	_			
	1	conventional energy re	source	s and c	lifferent	types of	solid fu	els availa	ble with the	əir
		properties	000100			.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				
	2.	various processing meth	nods of	solid fue	els					
	3.	the principles of refining	liquid f	uels and	their pr	operties.	analvsis	and handli	na	
	4.	various types of gaseous	s fuels	and their	r propert	ies. proce	ess and c	leaning		
	5.	the thermodynamics of o	combus	tion and	stoichic	metric re	lations.			
	6.	features of different type	s of bu	rners						
Outcome (s) A student will be able to										
	1.	list different solid fuels for	or differ	ent appli	ications					
	2.	know the various metho	ds of pr	ocessin	g solid fu	uels				
	3.	3. know the properties handling and storage of liquid fuels								
	4. understand the production of various methods of gaseous fuels and identify fuels for									
various applications										
	5.	understand different met	thods o	f combu	stion an	d estimate	e the a	air fuel rat	io,	
		adiabatic flame tempera	ture ba	sed on t	he fuel.					
6. understand design considerations of burners										
1.CONVENTIONAL AND NON-CONVENTIONAL ENERGY RESOURCES Total Hrs 9										
Introduction: General, Conventional energy resources, Solar energy, Nuclear power, Energy from biomass, Wind										
power. Tidal pov	wer. Geo	othermal energy. Energy s	urvev f	or India.	Rocket	Fuels. De	efinitions.	, Units. Me	asures	
2. SOLID FUEL	-CÓAL					,		Total	Hrs 9	
Solid Fuels: Ge	eneral B	iomass Peat Lignite or	Brown	Coal S	Sub-bitu	minous C	oal or B	lack Ligni	e Bituminou	JS
Coal Semi-anth	nracite A	Anthracite Cannel coal a	nd Bog	head co	al Natu	ral coke	(Jhama)/	SIV fuel	Origin of coa	al
Composition of	coal Ar	alvsis and properties of	coal A	ction of	heat on	coal Ox	idation of	f coal Hy	drogenation (	of
coal Classifica	tion of	coal Processing of Sc	olid Fu	els: Ge	neral C	coal nren	aration	Storage	of coal Co	al
carbonization R	Rriquettin	a of solid fuels. Liquefacti	on of s	olid fuels		our prop	aradon,	otorage		u
	S	g of colla facio, Elquoraci			,			Total	Hrs 9	
	Gonor	al Potroloum Origin of	Potrolo		troloum	productio	on Com		f petroleum	
Classification	of notro	leum Nature of Indian	crudo's	Dotrol			Importa	pusilium u nt natrola	i petroleum,	•
Droportion on	d tostino	of potroloum and potro		o, i cuor	Dotrol	oum rofir	inporta	nt petrole	d fuels from	', `
sources other	than not	colour Gasification of lig	uid fuol	Storad	, relion	andling o	f liquid fu	iula, Liyu iole		I
		oleum, Gasincation of liqu		s, Silia	je anu n	anuing o	i iiquiu iu	Total		
4. GASEOUS F	Canaral		Natura	Laco M				TOLA		
Gaseous lueis:	General,	, Types of gaseous fuels,	Natura	i gas, ivi	ethane i	rom coal	mines, P	roducer g	as, vvater ga	s,
Carbureted wate	er gas, C	complete gasilication of co	Dai, Uno	Jergrour	ia gasilio			i gas, bias	st lumace gas	s,
Gases from bio	mass, R	efinery gases, Liquefied p	petrolet	im gase	s (LPG)	, Oli gasli	ication, C	Jeaning a	nd purificatio	วท
of gaseous fuels	3									
5. COMBUSTIC	DN PROC				2		1.1.1.1.1.1.1	lotal	Hrs 9	
Combustion P	rocess	(Stoichiometry and Therr	nodyna	mics): (	Combust	tion Stold	chiometry	: Genera	al, Examples	\$,
Rapid methods	s of com	bustion stolchlometry.	- 4 <sup>1</sup>		/:	. N				
	nermody	namics : General Combus	stion Pr	ocess (r	(inetics)	: Nature d	of combu	stion proce	ess,	
Types of comb	oustion p	rocesses, Mechanism of o	combus	stion read	ction, Sp	ontaneou	is Ignition	n Tempera	ture (SIT),	
Velocity of flan	ne propa	gation, Limits of inflamma	adility, S	structure	of flame	e, Flame s	stadility, I	Cinetics of	liquid fuel	
combustion, Kinetics of solid fuel combustion.										
Combustion Ap	oplication	ns: General, Gas burners	, Oil bu	irners, C	oal burn	ing equip	ment	• • •		
					Tot	al hours t	o be taug	ht	45	)
Text book (s)										
1. Loftness	s, R.L.,"	Energy hand book", New	York, V	'an Nost	rand 199	98.				
2. Wilson,	P.J. and	<u>l J.H. Wells, "Coal, Coke a</u>	and Coa	al Chem	icals", N	lew York	: McGrav	v-Hill, 196	0	
References:										
1. "Gas Er	ngineers	Handbook", New York : Ir	ndustria	al Press,	1966.					
2. Williams, D.A. and G. James, "Liquid Fuels", London Pergamon, 1963										
3. Minkoff,	G.J., ar	Id C.F.H. Tipper, "Chemis	stry of C	ombusti	on Read	ction", Lor	ndon Butt	erworths,	1962.	
J. IVIINKOIT,	, G.J., ar Sarkar "F	u c.r.n. hpper, chemis	ant Long	JULIUUSTI 1 man 10	011 Kea(	JUON, LOP	IUON BUT	erworths,	1902.	

CBIT	Autonomous Regulation	Semester-1			AY - 2006-17					
Department	Mechanical Engineering	Progra	amme C	ode & N	lame	M.E. Th	ermal En	gineering		
Course Code	Course Name	Hours	/Week		Credit	Maximu	ım Marks			
16MEE 208	POWER PLANT	L	Т	Р	С	E		Total		
	CONTROL AND	3	0	0	3	70	30	100		
	INSTRUMENTATION	•	•	•						
Objective (s)	<ul> <li>Student will understand <ol> <li>the principles of static and dynamic characteristics of instruments</li> <li>working principles of feedback control concepts of electrical parameters</li> <li>To create awareness of the importance of working principles of various measuring instruments and their applications in engineering industry</li> <li>To understand characteristics of instruments</li> <li>To familiarize the principles of data acquisition along influence of electrical parameters on instrumentation</li> <li>To understand the principles of modeling of power systems</li> </ol> </li> </ul>									
Outcome (s)	<ul> <li>A student will be able to</li> <li>1. estimate static and dynamic</li> <li>2. estimate the influence of ele</li> <li>3. understand theory on stabil</li> <li>4. model power systems using</li> <li>5. estimate the role of comput</li> <li>6. represent various types of power systems</li> </ul>	c charac ectrical ity of in g variou ers for process	cteristics paramet strumen s numer data acc control	of instru- ers on r ts used ical met uisition system	uments neasuren for therma hods	nents al system	IS			
1. STATIC & DY	(NAMIC CHARACTERISTICS OF	F INSTE	RUMENT	S			Tota	al Hrs 9		
Static & dynam	ic characteristics of instruments, s	sensors	, signal j	processi	ing & data	a transmi	ssion elen	nents,		
Indicating & rec							Tata			
Z. DATA ACQU	ISTIION Iters for data acquisition & instr	umonto	tion for	measu	ring tom	oraturo		flow speed		
vibration & nois		umente		measu	ning terrip	ciature,	pressure	now, speed,		
3. ELECTRICAL	PARAMETERS	$\sim$					Tota	Hrs 9		
On-line proces	s instruments. Automatic proces	s contr	ol syste	ms Rep	resentatio	on. Feed	back con	rol concepts.		
Transient & Fre	equency response. Types of contr	ollers		•						
4. STABILITY C	OF INSTRUMENTS						Tota	Hrs 9		
Stability, Digital	Control System Modern Control th	neory. E	Boiler Co	ntrol, G	overning	& Contro	l of turbo-	machines		
5. COMPUTER	AIDED POWER SYSTEMS ANA	LYSIS					Tota	Hrs 9		
Modeling of pov solution Gauss- of power system	wer system, components, Forma Seidel, Newton Raphson, and fas a, Basic concepts of security analy	ation of at de-co vsis anc	bus ad upled lo state es	mittance ad flow, stimatior	e and imp Short Cir n.	pedance rcuit stud	matrices, ies, Static	Power flow equivalents		
Total hours to be taught 45										
Text book (s)										
Beckwith and Bu	uck, Mechanical Measurements									
A.K.Tayal, Instru	uments and Mechanical Measurer	nents, (	Galgotia	Publicat	tion					
<ul> <li>References:</li> <li>1. McCloy and Martin H.R., The Control of Fluid Power, Longman Publication, 1973</li> <li>2. Williams, D.A. and G. James, "Liquid Fuels", London Pergamon, 1963</li> <li>3. David Lindsley "Power-Plant Control and Instrumentation "IEE Control Engineering Series 585</li> </ul>										

W.Bolton "Instrumentation and Control Systems", 1st Edition Elsevier, 2004

CBIT	Autonomous Regulation	Semester-1 ΔΥ - 2006-17													
Department	Mechanical Engineering	Progr	amme C	00101 1 0000 & N	lame		ermal End		n						
Course Code	Course Name	Hours	/ Week		Credit	Maximi	ım Marks	gineening	9						
16MEE 209		Tioure	т	D		F		То	tal						
	DESIGN OF PUMPS	2	1	0	2	70	20	10							
Obientive (a)	AND COMPRESSORS	5	0	0	- 3	70	30	10	0						
Objective (s)	Student will understand		honion (			of fluid fl									
	1. The basic concepts of bu		namus c		af pumps		JW								
	2. The various principles in	the im	nortanc		rking prin	ciples of	docian of	rotary	numne						
	and rotary compressors	d rotary compressors													
	4. To understand the concepts of selection and design of pumps														
	5. To familiarize the princip	principles involved in testing and maintenance of pumps													
	6. To understand the cond	concept of design and selection of drive of rotary compressors alon							s along						
	with impellors	oncept of design and selection of anye of lotary compressors along							5						
Outcome (s)	A student will be able to														
	<ol> <li>apply the laws of fluid m</li> </ol>	echanio	s to turb	o mach	ines										
	<ol><li>install a pumping system</li></ol>	n & mor	nitor the	mainter	ance of th	ne pumps	5								
	3. select pump depending	on appl	ication												
	4. do testing of pumping sy	stems	ut of the			- m									
	5. It select and deve	of imp		contrifu	al compr	lem									
		SODE		centinu	yai compi	62201	Tota	l Hre	٩						
Characteristics	of working fluids. Eluid mechanics		s and a	overning	laws of f	luid flow	1012	11115	3						
		oonoop	lo una gi	ovon mig	j 14110 01 1		Characteristics of working fluids, Fluid mechanics concepts and governing laws of fluid flow.								
2. DESIGN OF PUMPS Total Hrs 9															
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4. Kovats, Andre, Design and performance of centrifugal and axial flow pumps and compressors, Oxford, New York, Pergamon Press, 1964.

CBIT	Autonomous Regulation		Sem	ester-1			AY - 200	5-17	
Department	Mechanical Engineering	Progra	amme C	ode & N	lame	M.E. Tł	nermal End	gineering	a
Course Code	Course Name	Hours	/Week		Credit	Maximu	um Marks		2
16MEE 210			Т	Р	С	E		Tot	al
	NUMERICAL METHODS	3	0	0	3	70	30	10	0
Objective (s)	Student will understand	_			_	_		_	
	<ol> <li>the non-linear set of equ</li> <li>linear set of equations a</li> <li>the importance of work engineering</li> <li>understand the various s</li> <li>familiarize the concept engineering</li> <li>understand various te engineering applications</li> </ol>	ations pplied t king pr sets of of va chnique	in engine o engine rinciples equation rious m es used	eering p eering ap of num s used i ethods d for s	ractice oplication nerical ar n enginee of interp solving d	s nalysis a ering app olation a lifferentia	ind its ap lications and its in I equatio	plicatior nportanc ns use	ıs in æ in d in
Outcome (s)	A student will be able to 1. apply different technique 2. apply different methods 3. solve numerical different 4. apply different technique 5. identify various technique 6. apply different procedure	es in so of inter tiation b s for nu es of n es to so	lving line polation by differe umerical umerical blve ordin	ear and r techniquent meth differen methoc	non linear ues ods conc tiation Is applica erential e	r sets of e erned to ble to en quations	equations engineerir gineering	ng practi applicati	ce ions
1. LINEAR SET	S OF EQUATIONS					qualitie	Tota	al Hrs	9
Gauss Elimina	tion, LV Decomposition, Matrix Inv	version,	, Scalar	Tridiago	nal Matrix	k, Thoma	s Algorithr	n, Gaus	S
Seidel Method	, Secant Method								
2. NON-LINEAF	R SETS OF EQUATIONS						Tota	Hrs	9
Solving nonline	ent Method Figen Values & Vector		tion, ne	wton's in	letnoa, G	luasi-ine	wton wieth	00,	
3. INTERPOLA	FION						Tota	Hrs	9
Interpolation &	Polynomial Approximation Least	Square	s Metho	d, Lagra	inge Inter	polation,	Hermite In	nterpolat	tion,
	DIEFERENTIATION	als & Se	eries				Total	Hre	0
Numerical Diffe	erentiation & Integration Numerica	I Differ	entiation	, Richar	dson's Ex	trapolati	on, Definit	e &	3
Indefinite Integ	rals, Simpson's Rule, Trapezoid F	Rule, Ga	aussian	Quadrat	ure		,		
5. ORDINARY I	DIFFERNENTIAL EQUATIONS						Tota	Hrs	9
First and High Equations, Erro	er Order Taylor Series, First order ors, Convergence Criteria	r Runge	e-kutta N	lethod, I	Fourth or	der Rung	e-kutta Me	ethod, S	tiff
				Tot	al hours t	o be taug	ght		45
Text book (s)									
1. Cheney	E. Ward, Kincaid D.R., Numerical M	Aethods	s and Ap	plications	s, 2008, C	engage l	earning		
2. Gerald	C.F., Wheatley P.O., Applied Num	erical A	Analysis,	7"' Ed,	Pearson	Educatio	n		
References:					- tion - 00				
1. Burden	K.L., Faires J.D., Numerical Analy	/sis: i h	eory and	Applica	ations, 20	05, Ceng	jage Learr	nng	
2. Chapra	S.C., Canale R.P., Numerical Met	nods fo		ers, 4	Ed, lata	McGraw	Hill		
4. Press W Univers	s э.п., гіпк к.р., Numericai Meth .H., Taukolsky S.A., Vetterling W.T., ity Press	oas usi Flanne	ng MA T ry B.P., N	LAB, 4ti Numerica	n Ea, Pea I Recipes	in C++, 2	<sup>nd</sup> Ed, Can	nbridge	

CBIT	Autonomous Regulation		Seme	ester-l		A	A.Y 2016-1	7
Department	Mechanical Engineering	Progra	amme C	ode 8	Name	M.E. Th	nermal	
	Course Neme	Llarer	/ \// !		Orealit	Engine	ering	
Course Code	Course Name	Hours	VVeek	P	Credit	F	Im Marks	Total
16MEE 211	ENVIRONMENTAL	3	1	0	4	70	30	100
	ENGINEERING AND POLLUTION							
	CONTROL							
Objective (s)	Student will understand		п.е					
	1. different methods to control	air po	liution of diffor	cont to	noc of p	ollution	lovole an	d thair
	effect on human beings and	d envir	onment	ent ty	pes of p	onution		
	3. different techniques adopte	d in so	lid was	te ma	inageme	nt		
	4. causes and remedies for w	ater po	ollution		0			
	5. other types of pollution like	oils, pe	esticide	s, noi	se etc.			
	6. controlling methods adopte	ed to re	educe p	ollutio	on from t	heir pow	er plants	
Outcome (s)	A student will able to	variou	c rocou	roop	and cure	loct cuitr	blo roma	odial
	methods to control them	vanous	5 16500	1662 6	anu sugg			Julai
	2. analyze air pollutants and s	uaaes	t contro	ollina i	nethods			
	3. suggest a suitable solid wa	ste dis	posal s	ystem	1			
	<ol><li>suggest suitable remedy to</li></ol>	contro	l water	pollu	tion			
	5. suggest suitable remedy to	contro	l other	pollut	ants like	oils, pes	sticides, ı	noise
	etc.	strumentation for pollution control						
1 AIR POLLUT				mution	TCOILLOI	-		9
Sources and Ef	ffoot Acid Doin Air Sompling or	d Mor	aurom	ont	Analyzi	l C	Delluton	to Air
	nect - Acid Rain - An Sampling a			ent -	Analysis		Foliulari	15 - All
Pollution Contro	I Methods and Equipments - Issues in	n Air P	ollution	conti	rol.			
2 SOLID WAST	E MANAGEMENT					Тс	otal Hrs	9
Sources and Cl	assification - Characteristics of solid	waste-	Potenti	al me	thods of	solid wa	ste Disp	osal –
Process and Eq	uipments for Energy Recovery from N	Municip	oal Soli	d Wa	ste and li	ndustrial	Solid W	aste
3 WATER POL	LUTION					Тс	otal Hrs	9
Sources and C	lassification of Water Pollutants - C	Charact	teristics	s - W	aste Wa	ter Sam	pling An	alysis -
Waste Water Tr	eatment - Monitoring compliance with	h Stan	dards -	Trea	tment, U <sup>.</sup>	tilization	and Disp	oosal of
Sludge								
4 OTHER TYPE	ES OF POLLUTION					Тс	otal Hrs	9
Noise Pollution a	and its impact - Oil Pollution - Pesticio	des - R	adioac	tivity	Pollution	Prevent	tion and (	Control
5 POLLUTION	FROM THERMAL POWER PLANTS	AND C	ONTRO	OL ME	THODS:	Тс	otal Hrs	9
Instrumentation	for pollution control - Water Pollution	ion fro	m Tan	neries	and ot	her Indu	ustries ar	nd their
control								
					Tatal	hours t-	ha tauri-t	AE
					Total	nours to	be laught	45
Text book (s)								
1. G.Masters" Introduction to Environmental Engineering and Science, Prentice -Hall 1998 International Editions.								
2. S.Peavy, D. Book Compa	RRowe, G.Tchobanoglous "Environ any,NewYork.1985.	mental	l Engine	eering	j" - McGı	aw- Hill		
References								
1. H.Ludwig, W.	Evans :" Manual of Environmental Te	chnolc	gy in D	)evelo	ping Co	untries.	1991	
2. Environmenta Manilla 1991	I Considerations in Energy Developm	Technology in Developing Countries, 1991 pment, Asian Development Bank (ADB),						

CBIT		А	utonomo	ous Reg	gulatio	n				
Department	Mechanical Engineering Programme Code & Name M.E. Thermal Engineering									
		Sem	ester-l							
Course Code	Course Name		Hours	Week T	D	Credit	Maxim	num Marks	Total	
16MEE 212	REFRIGERATION MAC & COMPONENTS	HINERY	3	0	0	3	70	30	100	
Objective (s)	Student will understan	d					•			
	1. different types comp	ressors an	d their	working	g					
	2. the importance of de	SIGN OF COP	idensoi	S						
	4. different types of eva	erant drier	s strair	ers. R	eceiv	ers. Accı	umulato	ors		
	5. other types of pollution	on like oils	pestic	ides, n	oise e	etc.				
	6. System Accessories	and Contr	ols							
Outcome (s)	A student will able to		acte of	Uormo	tic co	mproceo	re			
	2. analyze heat transfe	r coefficier	t. Foul	ing fac	tor. F	riction fa	ctor			
	3. design of evaporator	rs	.,		, .					
	4. evaluate different type	oes Refrige	erant dr	iers str	rainer	s, Receiv	vers, Ad	ccumulator	s, Low	
	pressure receivers		olina ta	wor fo	nc					
- 1	6. teat air conditioners,	refrigerate	oning to ors, visi	coolers	s, col	d rooms,				
1 REFRIGER	ANT COMPRESSORS				0	V)		Total Hrs	9	
Hermetic com	pressors - Reciprocatir	ng, Rotary	, Scro	ll Cor	mpres	sors, O	pen ty	pe compre	essors-	
Reciprocating, C	Centrifugal, Screw Compre	essors. Ser	ni herm	etic co	mpres	ssors – C	onstruc	ction , worki	ing and	
Energy Efficience	cy aspects. Applications of	f each type.								
2 DESIGN OF	CONDENSERS	(						Total Hrs	9	
Estimation of h	eat transfer coefficient, F	ouling fac	tor, Frid	ction fa	actor.	Design p	procedu	ures, Wilsor	n plots,	
Designing differ	ent types of condensers, I	BIS Standa	rds, Op	timizati	on stu	udies.			-	
3 DESIGN OF	EVAPORATORS							Total Hrs	9	
: Different type	s of evaporators, Desigr	n procedure	e, Sele	ction p	proced	lure, The	rmal S	stress calcu	lations,	
matching of con	nponents, Design of evapo	orative cond	lensers	•				<b>T</b>		
4 REFRIGER	ATION SYSTEM COMPO	NENTS						Total Hrs	9	
Evaporators an	d condensers - Differen	t types, ca	pacity	control	l, circ	uitry, Oil	return	, Oil separ	ators -	
Different types F	Refrigerant driers strainers	s, Receivers	s, Accu	mulator	rs, Lo	w pressu	re recei	ivers, Air Wa	ashers,	
Spray ponds.										
5 SYSTEM A	CCESSORIES AND CON	TROLS						Total Hrs	9	
Refrigerant Pun	nps, Cooling Tower fans,	Compress	or Moto	or prote	ection	devices,	Oil equ	ualizing in r	nultiple	
evaporators, Di	fferent Defrosting and c	apacity co	ntrol m	ethods	and	their im	plicatior	ns -Testing	of Air	
conditioners, Re	efrigerators, Visicoolers, C	old rooms,	Calorim	etric te	ests.					
						Tota	al hours	to be taugh	t <b>45</b>	
Text book (s)									•	
1 Chlumsky,	"Reciprocating & Rotary co	mpressors"	SNTL I	Publish	ers for	<sup>r</sup> Technica	al literatu	ure, 1965.		
2 Hains, J.B,	"Automatic Control of Heat	ing & Air co	nditionir	ng" Mc (	Graw	Hill, 1981.				
Reference(s)		5.7								
1 Althose, A. 1985.	.D. & Turnquist, C.H. "Mod	ern Retrige	ration a	na Air-o	conditi	oning" Go	оо неа	art -vviicox C	0. Inc.,	
2 Recent rele	ease of BIS Code for releva	nt testing pr	actice.							
3 ASHRAE H	land book: Equipments, 19 Villiams B "Commercial I	98 ndustrial In	stitution	al Refri	iderati	on Desig	in Insta	allation and	Trouble	
Shooting "	Eagle Wood Cliffs (NT) Pre	ntice Hall, 1	989.		gerali	51, DC3ly	, məta		TOUDIC	

CBIT	Autonomous Regulation	n Semester-1 AY - 2006-17								
Department	Mechanical Engineering	Progr	amme C	ode & Na	ame	M.E. Th	ermal Eng	ineering	g	
Course Code	Course Name	Hours	/Week		Credit	Maximu	m Marks		-	
16MEE 213	ENERGY	L	Т	Р	С	E	I	Tot	al	
	MANAGEMENT	3	0	0	3	70	30	10	0	
Objective (s)	1. To create awareness	of the ir	nportano	ce of the	energy au	diting and	determin	ation of		
,	<ol><li>evaluation methods of</li></ol>	of engin	eering p	rojects		-				
	<ol><li>To understand the print</li></ol>	nciples	of energ	y manage	ement for	various ty	pes of ind	ustries		
	4. To understand the ne	ed and	necessit	y of energ	gy auditing	g and esti	mate the l	oudget f	or	
	Industry	oortopo	o of rong	wohlo or	orgiog in t	the econe	ric of dop	otion of	:	
	conventional energy r	esource		wable ei	lergies in					
Outcome (s)	A student will be able to	student will be able to								
	1. grasp the importance	nce of energy auditing								
	2. estimate the requirem	irement of any proposed industry								
	3. evaluate the projects	ects and he can act as energy consultant								
	4. realize the importanc	e of alt	ernative	energy t	techniques	s in the c	context of	depletio	on of	
	conventional energy r	esource	es							
	<ol><li>evaluation of projects</li></ol>	: payba	ack – an	nualised	costs – in	vestor's r	ate of retu	ırn – pre	esent	
	worth – internal rate o	rate of return								
	6. Know importance of a	ce of alternative energy sources								
1 PRINCIPLES	OF ENERGY MANAGEMENT						Tota	Hrs	9	
Managerial Orga	anization – Functional Areas for	ori. Ma	nufactur	ina Indus	strv ii. Pro	cess Indu	ustrv iii. C	ommer	ce iv.	
Government. Ro	ble of Energy. Manager in each	of thes	e organi	zations ir	nitiating.					
2. ENERGY AU	DITING				U		Tota	Hrs	9	
Energy Audit:	Definition and Concepts, Type	es of Er	nergy Au	udits – B	asic Ener	gy Conce	epts – Re	sources	for	
Plant Energy	Studies – Data Gathering –	Analytic	cal Tech	niques E	Energy Co	onservatio	on: Techn	ologies	for	
Energy Conse	ervation, Design for Conserv	vation o	of Energ	iy materi	als – en	ergy flow	network	s – cri	tical	
assessment of	energy usage- formulation of	objectiv	es and	constrain	ts – synth	lesis of al	ternative of	options	and	
		ition.					Total	Uro	0	
Economic Analy	ris: Scope Characterization of	f an Inv	ostmont	Project	Types of	f Depreci	rotion – T	ime Val		
money – budget	considerations Risk Analysis		esuneni	Fiojeci -	- Types of					
4. METHODS O	F EVALUATION OF PROJECT	rs					Tota	Hrs	9	
Methods of Ev	aluation of Projects : Payback -	– Annua	alised Co	osts – Inv	estor's Ra	ate of retu	Irn – Pres	ent wor	th –	
Internal Rate of	of Return - Pros and Cons of th	ne comi	non met	hods of a	analysis –	replacem	nent analy	sis. Ene	ergy	
Consultant: Ne	ed of Energy Consultant - Con	sultant	Selectio	n Criteria		•	-		•••	
5. ALTERNATI	/E ENERGY SOURCES						Tota	Hrs	9	
Alternative Ener	gy Sources : Solar Energy –	Types of	of device	es for So	lar Energy	y Collecti	on – Ther	mal Sto	orage	
System – Contr	ol Systems-Wind Energy – Ava	ailability	– Wind	Devices	– Wind C	haracteris	stics – Pe	rforman	ce of	
Turbines and sy	stems									
Total hours to be taught 45										
Text book (s)										
1. W.C. Turner "Energy Management Hand book" 5 edition, the Fair Mount Press										
References:	Comercay Energy Manageme	лі, Du		i i ublicat	10113					
1. C.B.Smith "Er	nergy Management Principles"	Pergam	on Pres	S						
2. Stephen W.F	ardo, Dile, R.Patric, "Energy co	nservat	on Guid	e Book"	Fair Moun	nt Press				
3. Frank Krieth,	D.Yogi Goswamy "Energy man	agemer	nt & cons	servation	hand boo	k" CRC P	ress 2008			

CBIT	Autonomous Regulation	on Semester-1 AY - 2006-17					·17	
Department	Mechanical Engineering	Progr	amme C	ode & Na	ime	M.E. Th	ermal Eng	ineering
Course Code	Course Name	Hours	s/Week		Credit	Maximu	m Marks	
16MEE 214	CONVECTIVE HEAT	L	Т	Р	С	E		Total
	TRANSFER	3	0	0	3	70	30	100
obiective (s)	1. to create the awarene	ss of th	e import	ance of p	rinciples o	of heat tra	ansfer by c	onvection
	and its applications in	engine	ering alc	ng with s	olution		,	
	2. to understand the pri	nciples	, differer	nt types o	of convec	tion heat	transfer	and their
	equations to apply for	various	s engine	ering app	lications			
	3. to familiarize the con	cept of	forced co	privection	and its be	ehavior pi	ipes	
	4. to understand the p	rinciple	s of co	njugate i	neat trans	ster and	its applic	ations in
engineering heat transfer								
outcome (s) a student will be able to								ransfer rate
	depending on the app	lication			i iuto ui			
	2. use this theory in adv	anced s	ubiects	ike cfd ar	nd various	software	packages	
	3. calculate the heat trar	sfer rat	te in con	ugative s	ystem like	e porous i	media,	
	4. calculate the rate of h	eat trai	nsfer wit	n the com	bination (	of conduc	ction and c	onvection in
	applications like heat	exchan	gers					
	<ol><li>evaluate forced and fr</li></ol>	ee conv	vection					
	6. analyse flow through	the porc	ous med	а				
1. NTRODUCTI	ON TO CONVECTIVE HEAT T	RANSF	ER				Total	Hrs 9
Forced, free & o	Combined convection – convect	live hea	at transfe	er coeffici	ent – App	of Con	of dimensio	onal analysis
Continuity Navi	- Filysical interpretation of un	austion	for stea	dv state f	lows – sir	nilarity _	Faulations	for turbulent
convective heat	transfer – Boundary laver e	quation	s for la	minar tu	rhulent fl	ows – R	oundary la	aver integral
equations		quation				5W3 D	oundary it	ayer integral
2. FORCED CO	NVECTION						Total	Hrs 9
External Lamin	ar Forced Convection: Similarit	v soluti	on for flo	w over ar	n isotherm	al plate -	- integral e	quation
solutions							U	
- Numerical solu	utions - Viscous dissipation effe	ects on	flow ove	r a flat pla	ate. Exteri	nal Turbu	lent Flows	: Analogy
solutions for bou	undary layer flows – Integral eq	uation s	olutions	<ul> <li>Effects</li> </ul>	of dissipa	ation on fl	low over a	flat plate.
Internal Lamina	r Flows: Fully developed lamir	ar flow	in pipe,	plane d	uct & duc	ts with o	ther cross	-sectional
shapes – Pipe i	low & plane duct flow with dev	veloping	g tempei	ature fiel	d – Pipe	flows & p	blane duct	flow with
flow Thermally	developing pipe & plane duct fl		Dulent FI	ows: Ana	logy solut	lions for I	ully develo	pped pipe
3 NATURAL C		0w.					Total	Hrs 9
Boussined appr	oximation – Governing equati	ons – S	Similarity	– Boun	darv lave	r equatio	ns for free	e convective
laminar flows –	Numerical solution of boundary	layer e	quations	. Free Co	onvective	flows thro	ough a vert	tical channel
across a rectang	gular enclosure – Horizontal en	closure	- Turbu	ent natur	al convec	tion	0	
4. COMBINED	CONVECTION						Total	Hrs 9
Governing para	ameters & equations – laminar	bounda	ıry layer	flow over	an isothe	rmal vert	ical plate -	- combined
convection ove	er a horizontal plate – correlatio	ons for r		nvection	- effect o	f bounda	ry forces o	n turbulent
nlane channel	& in a horizontal duct	sive no	ws – ru	lly develo	peu mixe	u convec		i a vertical
5. HEAT TRAN	SFER THROUGH POROUS MI	EDIA					Total	Hrs 9
Area weighted	velocity - Darcy flow model	– ene	rav eau	ation – b	oundarv	laver so	lutions for	2-D forced
convection - Fu	ally developed duct flow - Nat	ural co	nvection	in porou	s media -	- filled er	nclosures ·	<ul> <li>stability of</li> </ul>
horizontal porou	slayers			•				,
				То	tal hours t	to be taug	ght	45
Text book (s)								
1. Patrick	H. Oosthuigen & David Naylor "	Introdu	ction to (	Convectiv	e Heat Tr	ansfer Ar	nalysis" (TN	ИH)
2. Kays &	Crawford "Convective Heat & M	iass Ira	anster" I	MH, 2000	J			
References:								
1. Oosthia	en. "Convective Heat and Mass	Transf	er" McG	rawhill. 19	998			
2. Adrian E	Bejan "Convection Heat Transfe	er", 2nd	Edition	lohn Wile	y,1984			
		,						

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CBIT	Autonomous Regulation	Semester-1 AY - 2006-17							
Department	Mechanical Engineering	Programme Code & Name M.E. Thermal Engineering					3		
Course Code	Course Name	Hours/Week Credit Maximum			um Marks	n Marks			
16MEE 215	THERMAL AND NUCLEAR		Т	Р	С	E	1	To	tal
	POWER PLANTS	3	0	0	3	70	30	10	)0
Objective (s)	Student will be able to understar	nd the							
, , , ,	1. Performance of steam powe	r plant a	and to ol	oserve tl	he import	ance of c	combustion	n of coal	
	2. Working principles of steam	genera	tors, turk	oines & d	condense	rs			
	<ol><li>Combined cycle effect in gas</li></ol>	s turbine	e power	plants					
	<ol><li>Compare different nuclear re</li></ol>	actors	and esti	mate the	e econom	ical bene	efits		
	5. Calculate the different energ	y tariffs	under v	arious lo	bad condi	tions			
0	6. pressure, temperature and fl	ow para	ameters	of a pov	ver plant				
Outcome (s)	Students will be able to	ماممطة	المعاممة				r nlant ava	1	
	1. analyze on combustion of co	al and i	ind perio	ormance	e of alffere	ent powe	r plant cyc	les.	
	2. analyze various steam gener	ators, c	cooling to	owers, tu	host roc	condens	ers.		
	<ol> <li>analysis on combined cycle,</li> <li>design various types of puck</li> </ol>	power power p	tore taki	na safat	v precaut	tions and	makina e	conomic	ally
	heneficial	ai ieac		ny salei	y piecau	lions and	making e	CONOTING	any
	5 calculate the energy rates of	nower	distributi	on cons	idering th	e factors	affecting	the ecor	omv
	6. determine the pressure, tem	perature	and flo	w meas	urements	of steam	and wate	er to ope	rate
	the power plant most efficien	tlv and	suaaest	various	remedies	s to contr	ol pollutar	its.	alo
1. Layout of Po	wer Plants						Tota	al Hrs	9
Sources of En	ergy, types of Power Plants, Dire	ect Ene	rgy Con	version	System,	Energy S	Sources in	India, F	Recent
developments	in Power Generation. Combustion	on of C	coal, Vo	lumetric	Analysis	, Gravim	etric Anal	ysis, Flu	le gas
Analysis.						- · ·		_	
Steam Power	Plants: Introduction – General Lay	out of S	Steam P	ower Pla	ant, Mode	rn Coal-f	ired Stean	n Power	
Plants, Power Plant cycles, Fuel handling, Compustion Equipment, Ash handling, Dust Collectors									
2. Combined Cycle Power plant   I otal Hrs 9									
Bed Combustion – Advantages & Disadvantages									
3. Nuclear Pow	er Plant						Tota	Hrs	9
Nuclear Physics, Nuclear Reactors, Classification – Types of Reactors, Site Selection, Methods of enriching									
Uranium, Applications of Nuclear Power Plants.									
Nuclear Power Plants Safety: By-Products of Nuclear Power Generation, Economics of Nuclear Power Plants, Nuclear Power Plants in India, Euture of Nuclear Power									
Nuclear Power Plants in India, Future of Nuclear Power						٩			
Frequencies of Power Generation: Eactors affecting the economics Load Eactor Utilization factor Performance					Jance				
and Operating Characteristics of Power Plants. Economic									
Load Sharing, Depreciation, Energy Rates, Criteria for Optimum Loading, Specific Economic energy problems									
5. Power Plant Instrumentation Total Hrs 9						9			
Classification, Pressure measuring instruments, Temperature measurement and Flow measurement.									
Analysis of Combustion gases, Pollution – Types, Methods to Control.									
Total hours to be taught   45						45			
Text book (s)									
1. EL-Wal	kil, M.M., "Power Plant Technolog	y " <u>M</u> c (	Graw Hil	I, New Y	ork, 1985	5			
2. Weis Man, J.anu Eckerl, R, Modern Power Plant Engineering, PHI, New Deini, 1983									
References:									
Kererences:	ad Domkundwar "A course in Dou		ot Engline	oorina"	Dhannat	Dai 8 aa	00.000		
	a "Dower Dent Engineering " TM		n ⊏ngine ≀	sering ,	Dhanpat	rai & 501	15 2002		
3. P.C.Sharma, "Power Plant Engineering," Kotaria Publications, 2007									

CBIT	Autonomous Regulation									
Department	Mechanical Engineering		Programme Code & Name M.E. Thermal Engineering						gineering	
		Se	emester-l							
Course Code	Course Name		Hours/Week Cre				Maximum Marks			
			L	Т	P	С	E		Total	
	THERMAL SYSTEMS	Н	0	0	3	2		50	50	
16MEC 2062	LABORATORY (Lab-1)									
Objective(s)	1. To evaluate the performance of computerized I.C Engine									
	2. To determine heat transfer coefficient in two phase heat transfer									
	3. To determine effectiveness of cross flow heat exchanger									
	4. To evaluate the performance of heat pipe									
	5. To evaluate the thermal properties of fluids									
	6. To conduct performance test on solar collectors									
	A student will be able to									
Outcome(s)	1. estimate the thermal efficiency of IC engine									
	2. prove that value of convection heat transfer coefficient is very high with two phase heat									
	transfer									
	3. estimate the effectiveness of cross flow heat exchanger and prove that it is very high									
	compared with other configurations									
	4. calculate heat of condensation and vaporization pipe									
	5. estimate the efficiency of solar collector									
	6. find out properties of fluids such as coefficient of thermal expansion, enthalpy of fusion									

### List of Experiments:

- 1. Performance Evaluation on single cylinder 4-stroke SI Engine with alternate fuels with computer interfacing.
- 2. Performance Evaluation on single cylinder 4 stroke CI Engine with alternate fuels with computer interfacing
- 3. Determination of heat transfer coefficient in Film wise and Drop wise condensation
- 4. Cross flow Heat Exchanger.
- 5. Heat Pipe Demonstration
- 6. Performance text on Axial flow compressor
- 7. Performance test on solar collector
- 8. Determination of coefficient of thermal expansion of Solids, Liquids and Gases
- 9. Determination of thermal capacity of Solids
- 10. Determination of isentropic coefficient of air by Clement-Desormes method
- 11. Measure of enthalpy of fusion and solidification
- 12. Measurement of Temperature Distribution in the interior and external Surface of an electric water heater with thermometers and thermo-camera

CBIT	Autonomous Regulation	Semester-1				AY - 2006-17			
Department	Mechanical Engineering	Programme Code & Name			ame	M.E. CAD/CAM			
Course Code	Course Name	Hours/Week			Credit	Maximum Marks			
16MEC 207	COMPUTATIONAL FLUID	L	Т	Р	С	E	I	Total	
	DEYNAMCS LABORATORY (Lab-II)	0	0	3	2		50	50	

#### Objective(s)

#### Student to understand the

- 1. Concept of fluid mechanics
- 2. Basic steps in a CFD simulation: ANSYS Workbench design modular and meshing
- 3. Simulation of steady and unsteady problems
- 4. Physics setup involves boundary conditions
- 5. Solution of Thermal related problems
- 6. Post processor of workbench tool for various problems

#### Outcome(s):

A student will be to

- 1. analyze laminar flow problems in plates and pipes
- 2. solve steady and unsteady flows
- 3. perform analysis free and forced convection
- 4. evaluate thermal flow in hot and cold fluid
- 5. simulate NACA aerofoil blades
- 6. analyze problems related to combustion

#### The following simulations will be performed using ANSYS workbench tools

#### List of Experiments:

- 1. Laminar Flow over Flat plate
- 2. Laminar Pipe Flow.
- 3. Steady Flow past a Cylinder
- 4. Unsteady Flow past a Cylinder
- 5. Two Dimensional Steady Free Convection
- 6. Forced Convection for pipe cross section.
- 7. Study of Hot & Cold Fluid Mix
- 8. Flow analysis of Airfoil.
- 9. Compressible Flow in a Nozzle
- 10. Partially Premixed Combustion
- 11. Supersonic Flow Over Wedge
- 12. Bifurcating Artery

#### 16MEC210

#### MINIPROJECT GUIDELINES

Instruction	2 Hrs / week
Sessional	50 Marks
Credits	01

#### **Objectives:**

First year ME students will each do a 14-week mini project, each generally comprising about one week of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment (see assessment information below). Each student will be allotted to a Faculty supervisor for mentoring.

Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original. Mini projects should have inter disciplinary/ industry relevance. The students can select a mathematical modeling based/Experimental investigations or Numerical modeling. All the investigations are clearly stated and documented with the reasons/explanations. All the projects should contain A clear statement of the research objectives, background of work, Literature review, techniques used, prospective deliverables, benefit from this [line of] research, Detailed discussion on results, Conclusions and references.

#### Outcomes:

Students are able to

- 1. Formulate a specific problem and give solution
- 2. Develop model/models either theoretical/practical/numerical form
- 3. Solve, interpret/correlate the results and discussions
- 4. Conclude the results obtained and write the documentation in standard format

#### Assessment:

- 50 % of marks for a scientific report on the project. Regarding the formatting and structure, the report should be written as a journal article using the style file of a journal appropriate for the field of the research (which journal format is most
  - the style file of a journal appropriate for the field of the research (which journal format is most appropriate should be agreed between student and supervisor). If the journal you selected has a page limit, it can be ignored but the report should not exceed 8000 words (common sense should be used if there are a lot of equations).

Regarding content, the report should be understandable by your fellow students, so the introduction and literature review could be a bit more detailed than in a research paper. The results and discussions are in elaborate form and at end conclusions and include references.

2. 50 % of marks for an oral presentation which will take place at the end of the semester and evaluation by a committee consist of Supervisor, one senior faculty and Head of the department or his nominee.