Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)



Course Contents (Syllabus) for

First Year M. Tech. (Mechanical Heat Power Engineering) Sem - I to II

AY 2020-21

Professional Core (Theory)

Research methodology – 4IC501 L T P Cr 2 0 0 2 Pre-Requisite Courses: Basic courses in Heat and Power engineering andMathematics& Statistics Textbooks: 1. C. R. Kothari, Research Methodology, New Age international 2004
2 0 0 2 Pre-Requisite Courses: Basic courses in Heat and Power engineering andMathematics& Statistics Textbooks: 1. C. R. Kothari, Research Methodology, New Age international 2004 Vite Delivitie
Pre-Requisite Courses: Basic courses in Heat and Power engineering andMathematics& Statistics Textbooks: 1. C. R. Kothari, Research Methodology, New Age international 2004
Textbooks: 1. <i>C. R. Kothari, Research Methodology</i> , New Age international 2004
1. C. R. Kothari, Research Methodology, New Age international 2004
2. Deepak Chopra and NeenaSondhi, Research Methodology : Concepts and cases, Vikas Publishing
House, New Delhi 2012
3. Wayne Goddard and Stuart Melville, Research Methodology: An Introduction
References:
1. E. Philip and Derek Pugh, "How to get a Ph. D. – a handbook for students and their supervisors", open
university press, 2001
2. Kumar R., "Research Methodology- A step by step guide for beginners", SAGE, 3 rd Edition, 2012.
3. G. Ramamurthy, "Research Methodology", Dream Tech Press, New Delhi, 2009.
1. To prepare the students to identify and formulate the research problems, 2. To import the Knowledge of planning and execution of research project. IBPs, Detents at
2. To impart the Knowledge of plaining and execution of research project, IPKs, Patents etc 3. To develop the student to prepare and write papers for publications to Conferences and Journals
5. To develop the student to prepare and write papers for publications to conferences and journals.
Course Learning Outcomes:
CO After the completion of the course the student should be able to Bloom's Cognitive
level Descriptor
CO1Classify the research problem and research plan.IIIApply
CO2Analyze the research problem, literature and methodology.IVAnalyze
CO3Interpret the research papers, reports, case studies, patent informationVEvaluate
and database, etc
CO-PO Mapping :
PO1PO2PO3PO4PO5PO6
CO1 3 2 3
CO2 1 3
CO3 1 2 3
CO3 1 2 3
CO3 1 2 3 Assessments : Teacher Assessment:
CO3 1 2 3 Assessments : Teacher Assessment: Two components of In Semaster Evaluation (ISE) One Mid Semaster Evaluation (MSE) and one End
CO3 1 2 3 Assessments : Teacher Assessment: Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Evamination (ESE) having 20% - 30% and 50% weights respectively.
CO3 1 2 3 Assessments : Teacher Assessment: Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively. Marks

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50
ISE 1 and ISE 2 are based on assignment/declared test/q	uiz/seminar etc. (one assignment per module)
MSE: Assessment is based on 50% of course content (Ne	ormally first three modules)
ESE: Assessment is based on 100% course content with	70-80% weightage for course content (normally last

three modules) covered after MSE.

Course Contents:	
Module 1	5Hrs.
Meaning of research problem, Sources of research problem, Criteria, Characteristics of a good	
research problem, and Errors in selecting a research problem, Scope and objectives of research	
problem. Approaches of investigation of solutions for research problem, data collection,	
analysis, interpretation, Necessary instrumentations	
Module 2	4Hrs.
Effective literature studies approaches, analysis. Plagiarism, Research ethics.	
Module 3	5Hrs.
Effective technical writing, how to write report, Paper.	
Developing a Research Proposal, Format of research proposal, a presentation and assessment by	
a review committee.	
Module 4	4Hrs.
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting	
and Development: technological research, innovation, patenting, development. International	
Scenario: International cooperation on Intellectual Property. Procedure for grants of patents.	
Patenting under PCT.	
Module 5	4Hrs.
Patent Rights: Scope of Patent Rights, Licensing and transfer of technology, Patent information	
and databases. Geographical Indications	
Module 6	4Hrs.
New Developments in IPR: Administration of Patent System New developments in IPR: IPR of	
Biological Systems Computer Software etc. Traditional knowledge Case Studies IPR and IITs	
Module wise Measurable Students Learning Outcomes ·	
Students will able to	
1. Explain the research problem and research plan.	
2. Propose methodology for their research topic and understand various analysis techniques.	
3. Analyze and interpret the research data.	
4. Prepare the conference papers, dissertation report and understand patent related aspects.	
5. Handle issues related to IPR.	
6. Process and interpret the research data.	

Title of	f the Course:								
Therm	odynamics and C	ombustion	- 4HP501			L	Т	Р	Cr
						3	0	0	3
Pre-Re	equisite Courses:	Basic Math	ematics, Ch	emistry,					
Textbo	ooks:								
1. An I	ntroduction to The	rmodynamic	es, Y.V.C. R	ao, University	Press (India	a) Privat	te Limit	ed, R	evised
Edition	n, 2004).								
2. Ther	modynamics: an E	Engineering A	Approach, Y	A.Cengal and	M.A.Boles	, McGra	aw Hill	(Fifth	edition).
3. Fund	damentals of Class	ical Thermo	dynamics, G	B.VanWylen, R	.Sonntag an	d C.Bo	rgnakke	, Johr	ı Willey
& Sons	s (Fourth edition).								
Refere	ences:								
1. Ceng	gel, "Thermodynar	nics", Tata N	McGraw Hil	l Co., New De	lhi, 1980.				
2. How	vell and Dedcius, "	Fundamenta	ls of Engine	ering Thermod	lynamics", l	AcGraw	v Hill In	c.,	
U.S.	А.								
3. Van	Wylen& Sonntag,	"Thermody	namics", Joł	hn Wiley and S	Sons Inc., U	S.A.			
4. Jone	es and Hawkings, "	Engineering	Thermodyn	amics", John V	Wiley and S	ons Inc.	, U.S.A	,	
2004	1.								
5. Holr	nan, "Thermodyna	mics", McG	raw Hill Inc	., New York, 2	2002.				
6. Faire	es V.M. and Simm	ag, "Thermo	odynamics",	Macmillan Pu	blishing Co.	Inc., U	.S.A.		
7. Rao	Y.V.C., "Postulati	onal and Sta	tistical Ther	modynamics",	Allied Pub	ishers I	nc, 199	4.	
Course	e Objectives :								
At the	end of the course,								
1. St	udent will get Kno	wledge of ex	kergy, basic	laws governing	g energy co	iversior	n in mul	ticom	ponent
sy	stems and applicat	ion of chemi	ical thermod	lynamics.					
2. St	udent will be awar	e about adva	inced concep	ots in thermody	ynamics wit	n empha	asis on t	he	
the	ermodynamic relat	ions, equilib	rium and sta	ability of multi	phase multi-	-compo	nent sys	tems.	
3. St	udent will be acqu	ire the confid	dence in ana	lyze the motio	n of combus	sting and	d nonco	mbus	ting
flu	inds whilst account	ing for varia	ble specific	heats, non-ide	al gas prope	rties, ch	nemical	non-	
eq	uilibrium and com	pressibility							
a									
Course	e Learning Outco	mes:	<u> </u>		11 /		DI		
CO	After the complet	ion of the co	urse the stud	lent should be a	able to		Blo	om's C	Jognitive
							leve	1 D	escriptor
CO1	Understand the co	oncepts of the	hermodynan	nics and kineti	cs of combu	stion	11	Un	derstand
CO2	Apply the concept	ots of Therm	odynamics a	and combustion	n phenomen	a in		Δ	oplying
CO2	energy conversio	n devices							
CO3	Analyze the com	bustion mech	hanisms of v	arious fuels.			IV	A	nalyzing
CO-PC	J Mapping :	564							201
		PO1	PO2	PO3	PO4		PO5		PO6
	CO1	1		2					
	CO2		1			3			
	CO3			2	3				
•									
Assess	ments :								
1 eache	er Assessment:								

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50
ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.	
MSE: Assessment is based on 50% of course content (Normally first three modules)	
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.	
Course Contents:	
Module 1	Hrs.
First law and State postulates, Second law and Entropy, Availability and Irreversibility,	7
Transient flow analysis	
Module 2	Hrs.
Nonreactive Ideal-Gas Mixture, PvTBehavior of Real gases and Real Gas mixture	7
Module 3	Hrs.
Generalized Thermodynamic Relationship	7
Module 4	Hrs.
Combustion and Thermo-chemistry, Second law analysis of reacting mixture, Availability	7
analysis of reacting mixture, Chemical equilibrium	
Module 5	Hrs.
Statistical thermodynamics, statistical interpretations of first and second law and Entropy	6
Module 6	Hrs.
Third law of thermodynamics, Nerst heat theorem.	6

Module wise Measurable Students Learning Outcomes :

After the completion of the course the student should be able to:

- 1. Gain Knowledge of exergy, basic laws governing energy conversion in multicomponent systems and application of chemical thermodynamics.
- 2. Understand the advanced concepts in thermodynamics with emphasis on the thermodynamic relations, equilibrium and stability of multiphase multi-component systems.
- 3. Understand the molecular basis of thermodynamics.
- 4. To present theoretical, semi-theoretical and empirical models for the prediction of thermodynamic properties.
- 5. Analyze the motion of combusting and noncombusting fluids whilst accounting for variable specific heats, non-ideal gas properties, chemical non-equilibrium and compressibility
- 6. Apply the fundamental principles of thermodynamics to non-ideal models of numerous engineering devices

Title of	f the Course:								
Advan	ced Fluid Dynam	ics - 4HP502	2		Ι		Т	Р	Cr
					3	3	0	0	3
Pre-Re	equisite Courses:								
Textbo	ooks:								
1. Mu	ralidhar and Biswa	as, Advanced	Engineering	g Fluid Mechai	nics, , A	lpha Sc	cience Int	ernationa	1, 2005
2. Irw	in Shames, <i>Mecha</i>	nics of Fluid	s,, McGraw	Hill, 2003		-			
Refere	nces:								
1. Fox	R.W., McDonald	A.T, Introd	uction to Flu	uid Mechanics,	, John W	/iley an	d Sons Ir	nc, 1985	
2. Piju	ish K. Kundu, Ira I	M Kohen and	l David R. D	awaling, <i>Fluic</i>	d Mecha	<i>nics</i> , Fi	fth Edition	on, 2005	
Course	e Objectives :								
1. To e	nable the students	to analyze a	nd solve fluid	d related proble	ems by a	applyin	g princip	les of	
mat	hematics, science a	and engineer	ing.						
2. To p	prepare students to	use modern	tools, techni	ques and skills	s to fulfi	ll indus	trial need	ls related	to fluid
dyna	amics.								
3. To t	rain students with	effective cor	nmunication	skill to demor	nstrate fl	luid dyr	namics th	eories.	
4. To c	levelop skills in th	e analysis of	fluid system	s with mathen	natical n	nodelin	g for app	lications	of fluid
dyna	amics in research o	or design.							
5. To c	levelop a professio	onal approach	n for lifelong	learning in the	e fluid d	lynamic	es to inclu	ide the av	vareness
of s	ocial and environm	nent issues as	ssociated with	h engineering	practice	s.			
Course	e Learning Outco	mes:	(1 (1					<u> </u>	
CO	After the complet	ion of the cou	irse the stude	ent should be a	ble to		Bloom	s Cognitiv	e
							level	Descrip	tor
CO1	Understand and d	lefine the flu	id flow prob	lems along wit	th range	e of	п	Under	standing
	governing param	eters					11	Unders	standing
CO2	Devise the experi	iments in the	field of fluid	d mechanics.			III	App	lying
CO3	Analyze the flow	patterns and	differentiate	e between the f	flow reg	imes	IV/	Anal	uzing
	and its effects.						1 V	Alla	lyzing
CO-PC) Mapping :								
		PO1	PO2	PO3	PO)4	PO5		PO6
	CO1	1		1	1		2		1
	CO2		2		3				1
	CO3			2	2				1
Assessi	ments :								
Teache	er Assessment:								
Two co	omponents of In Se	mester Evalu	uation (ISE),	One Mid Sem	nester Ex	kaminat	ion (MSI	E) and on	e End
Semest	er Examination (E	SE) having 2	20%, 30% an	d 50% weights	s respect	tively.	,	,	
Assess	sment	, 0		Marks					
ISE 1				10					
MSE				30					
ISE 2				10					
ESE				50					
ISE 1 a	and ISE 2 are based	on assignmen	t/declared test	t/quiz/seminar e	etc.				
MSE:	Assessment is based	l on 50% of co	ourse content ((Normally first t	three mo	dules)			

ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally	last
three modules) covered after MSE.	
Course Contents:	TT
Module 1 Regis equations of flow	Hrs.
Basic equations of flow Control volume engraces Continuity equation Momentum equation Lincon	1
Kinematics of now, Control volume approach, Continuity equation, Momentum equation Linear	
momentum equation and angular momentum equation, Energy equation, Bernoulli equation	
Module 2	Hrs.
Theory of Potential Flow and Hydrodynamic Stability	7
Kelvin's theorem, Stream function and Velocity potential, Irrational flow, Laplace equation and	
various flow fields, Combined flows and super positions, Examples of transition, Theoretical	
determination of Critical Reynolds Number, Stability of Elementary Flow fields, Rayleigh's	
Theorem, Flow in parallel channels, Stability of Boundary Layers, Numerical solution for Orr-	
Somerfield number.	
Module 3	Hrs.
Flow over immersed bodies and boundary layer flow	7
Boundary layer equations, flow over flat plate, Boundary layers with non-zero pressure gradient,	
Approximate methods for boundary layer equations, separation and vertex shedding.	
Module 4	Hrs.
Turbulent flow	7
Characteristics of Turbulent flow, Laminar turbulent transition, Governing equations for	
turbulent flow, Turbulent boundary layer equations, measurement of turbulent quantities, shear	
stress models, universal velocity distribution and friction factor, fully developed turbulent flow,	
Dynamics of turbulence	
Module 5	Hrs.
Turbo machinery	6
Equations of turbo machinery, Axial flow turbines, compressors, pumps and fans, Radial flow	
turbines, compressors, pumps and fans, Power absorbing vs. power producing devices,	
Performance characteristics of centrifugal pumps, Performance characteristics of hydraulic	
turbines	
Module 6	Hrs.
Compressible Fluid Flow	6
One dimensional compressible fluid flow – flow through variable area passage – nozzles and	
diffusers, effect of viscous friction and heat transfer, fundamentals of supersonics flow normal	
and oblique shock waves and calculation of flow and fluid properties over solid bodies (like flat	
plate, wedge, diamond) using gas tables	
Module wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
1. Derive various governing equations in fluid mechanics, heat transfer and interpret the same.	
2. Define different types of flow, their equations and carry out the analysis.	
3. Explain the boundary layer theory and derive/apply the same.	
4. Summaries examples of transition, stability of flow fields. Devise the flow requirements in va	arious
approximations 5 Derive governing equations for turbo machines and analyze performance characteristics	
6 Understand compressible flow and its affect	
o. Onderstand compression now and its affect.	

Professional Core (Lab)

Title of	f the Course:				
Heat Po	ower Engineering lab I-4HP551	L	Т	Р	Cr
		0	0	4	2
Pre-Re	quisite Courses: Thermodynamics, Heat Transfer, Power plant Engineer	ring, A	utomo	bile	
Engine	ering				
Textbo	oks:				
1. P. K.	Nag "Thermodynamics", Tata McGraw Hill Publication, 2006, 3rd Edit	ion.			
2. V. P.	Vasandani and D. S. Kumar, "Heat Engineering", Metropolitan Book C	Compai	ny, 197	75, 2nd	
Edition					
3. R. Y	adav, "Fundamentals of Thermodynamics", Central Publication house, A	llahab	ad, 20	11,	
Revised	1 7th Edition.				
4. Gane	eshan, "Internal Combustion Engines" Tata Mac Hill Publication, 1999, 2	2nd ed	ition.		
5. Math	ur and Sharma, "Internal Combustion Engines" DhanapatRai publication	n, 2000), 2nd	edition.	
6. R. K	. Rajput, "Internal Combustion Engines" Laxmi Publications, 2005, 3rd	edition	l .		
Refere	nces:				
1. Ceng	el and Boles, "Thermodynamics an engineering Approach", Tata McGra	aw-Hil	l publi	cation,	
2011, F	Revised 7th Edition.				
2. R. Y	adav, "Thermodynamics and heat engine", Central Publication house All	ahabao	d, 2007	7,	
Revised	1 7th Edition.				
3. R. Y	adav, "Steam and Gas Turbine", Central Publication house, Allahabad, 2	010, R	levised	l 7 th editio	on.
4. F. O	pert, "Internal Combustion Engines and Air Pollution", In-text Education	nal Puł	olishers	s, 1973	
1st edit	ion.				
5. John	B Heywood, "Internal Combustion Engines fundamentals", McGraw-H	ill, Rev	vised 2	nd	
Edition	, 1988.				
6. Male	ev J P, "Internal Combustion Engines Theory and design", McGraw-Hil	l, Revi	sed 2n	d Editio	n,
1945.					
Course	Objectives :				
Studen	ts should be able to				
1. To le	earnthe techniques to find physical properties of the oils, greases, and sol	id fuel	s used	insteam	
generat	ors.				
2. To a	pply laws of thermodynamics to various thermodynamic devices.				
3. To d	evelop the skills for evaluating performance of thermodynamics systems	•			
4. Dem	onstrate the engine components, systems and its constructional details				
5. To n	easure parameters of the Engines performance				
6. Expl	ain the role of parameters affecting volumetric efficiency, valve timing, a	and poi	rt desig	gn	
7. Mak	e the analysis of working of the engine by studying exhaust gas analysis.				
Course	e Learning Outcomes:				
			Bloom	's Cognit	ive
CO	After the completion of the course the student should be able to	lev	/el	Descri	ptor
	Apply the techniques to determine the properties of fluids used in				
	various industrial systems such as Mechanical Power Production			A 1	•
	systems.		1	Apply	ıng
	Classify and examine the IC engine components and systems				
	Estimate the calorific value of a given fuel by using Bombcalorimeter.				
CO2	To study and test the tools / techniques / instruments for measuring	Г	V	Analyz	zing
	theperformance parameters of engine			2	-
	theperformance parameters of engine				

CO3	Estim the tes compo testing	ate and mo t on steam onentefficie	e asure perfo power plant encies.Asses	rmance of t to determin the perform	hermal sys e plant and ance chara	tems by d acteristic	conductin s during	g V	Ev	aluating
CO-P	O Mapp	ing :								
			PO1	PO2	PO3	•	PO4	PO5		PO6
	CO1			3						
	CO2			2	2	2				
	CO3				1	2				
Lab A There IMP: I Asso 1 1 1 La	ssessme are four Lab ESE essment LA1 LA2 LA3 b ESE	nt: component is a separa Ba Lab a attendar Lab a attendar Lab Perfo related do	ts of lab asse te head of pa sed on ctivities, nce, journal ctivities, nce, journal ctivities, nce, journal prmance and poumentation week of Sen	ssment, LA ssing. Condu Lab Cour Lab Cour Lab Cour Lab Cour	1, LA2, LA cted by se Faculty se Faculty se Faculty rse faculty	A3 and L Condu During Submiss During Submiss During Submiss During Submiss	ab ESE. <u>action and N</u> Week <u>sion at the a</u> Week <u>sion at the a</u> <u>sion at the a</u> Week 1 <u>sion at the a</u>	Marks Submiss 1 to Wee end of Week 5 5 to Wee end of Week 9 0 to Week end of Week 1 5 to Week end of Week 1	sion k 4 k 8 k 8 14 4 18 8	Marks 25 25 25 25 25
drawir Cours Condu List c 1 2 3 4 5 6 7 8 9 1 1 1	 ags, prog ags,	ramming a nts: 0 experim iments for / simulatio / simulation / Simulation y Audit cas m power P mics of po on fuel cells nination of tion of nduct trial o steam po	nd other suit nd other suit course Adva n of solar ther n of solar ther of thermal sy se study. lant Instrume wer plant and s and study of operating ch on condenser on Steam po wer plant.	able activiti ach Module nced Ther mal system. mal/wind hy stem compo- entation. d categorize f Thermoele aracteristic and cooling wer plant.	es, as per t emodynam brid system nents such a power pla ectric and s of roof to g tower to	ics(Min i. as heatEs ant as bas Thermio op PV sy determir	imum 8 E imum 8 E schanger se and pea nic Energy stem. ne its effic	k iency.	20	, course. Hrs.
List c 1 2 3 4 5 6 7 8 9 1	of Experi Study/a asymm Predict Detern Detern Study/a Study/a Study/a Study/a Simula O. Simula	ments for of measurement etric model ion of boun hination/sim hination/sim demonstration simulation of simulation of tion of flow tion of flow	course Adva at of lift and d on wind tunn dary layer this ulation of loss ulation of loss on of different of turbulent flo of compressibly measurement through micr eloping flow th	nced Fluid rag force of A el. ekness over f ses in pipes. ses in ducts. flow visuality w domain. e flow domain. e flow domai devices. o channels. nrough pipes	Dynamics Aerofoil mo flat plate. ization tech in	s (Minin odel, sym: niques.	um 8 Exj	pt.)	20	Hrs.

Professional Elective (Theory) Courses

Title of the Course: PE 1 Computational Mathada in fluid flow and heat transfor _4110511	т	т	D	Cr
Computational Methods in fund now and near transfer - 4HF511	L	1	P	Cr
	3	0	0	3

Pre-Requisite Courses: Fluid Mechanics, Thermodynamics, Mathematics, Heat Transfer, Numerical methods

Textbooks:

- 1. S.V. Patankar, "Numerical Fluid Flow & Heat transfer", Hemisphere Publishing Corp., 1980.
- 2. T. Sundernajan, K. Muralidhar, "Computational Fluid Flow and Heat Transfer", Narosa, 2nd edition, Reprint 2011

References:

- H. K. Versteeg and W. Malalasekera, "An Introduction to Computational Fluid Dynamics", 1. Longman Scientific and Technical, 1st edition, 1995.
- 2. Hoffman Klaus, "Computational Fluid Dynamics", Vol-1 & 2, A Publication of Engineering Education System, Wichita Kansas, USA, 2000.

Course Objectives :

- 1. Enable the students to analyze and solve fluid related problems by applying principles of mathematics, science and engineering.
- 2. Prepare students to use modern tools, techniques and skills to fulfill industrial needs related to computational technique in fluid flow and heat transfer.
- 3. Train students with effective communication skill to demonstrate computational theories.
- 4. Develop skills in the analysis of fluid systems with mathematical modeling for applications of computers in research or design.
- 5. Develop a professional approach to lifelong learning in the numerical analysis to include the awareness of social and environment issues associated with engineering practices.

CO	After the completion of the course the student should be able to	Bloom's Cognitive		
		level	Descriptor	
CO1	Explain prediction methods, PDEs and numerical methods.	Π	Understand	
CO2	Apply the FDM and FVM techniques to solve Fluid and Thermal related problems.	III	Apply	
CO3	Analyze boundary conditions, solution methods and schemes used in fluid flow and heat transfer problems.	IV	Analyze	

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2			2	
CO2	2				2	
CO3	2			2		2

Teacher Assessment:

Course Contents:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Module 1	Hrs.
Comparison of experimental, theoretical and numerical approaches	
Partial differential equations - Physical and mathematical classification - Parabolic,	
Elliptical and Hyperbolic equations. Computational economy, Numerical stability,	
Selection of numerical methods, validation of numerical results: Numerical error and	7
accuracy - Round off error, accuracy of numerical results - Iterative convergence -	
Condition for convergence, Rate of convergence, under-relaxation and over relaxation,	
Termination of iteration: Tridiagonal Matrix algorithm.	
Module 2	Hrs.
Finite Difference method: Discretization – Converting Derivatives to discrete Algebraic	6
Expressions, Taylor's series approach, polynomial fitting approach, Discretization error.	U
Module 3	Hrs.
Heat conduction	
Steady one-dimensional conduction in Cartesian and cylindrical co-ordinates, handling of	
boundary conditions: Two dimensional steady state conduction problems in Cartesian and	-
cylindrical co-ordinates – point by point and line by line method of Solution: Dealing of	/
Dirichlet, Neumann and Robbins type boundary conditions- Formation of discretized	
equations for regular boundaries, irregular boundaries and interfaces.	
Module 4	Hrs.
One dimensional, two dimensional and three dimensional transient heat conduction	
problems in Cartesian and cylindrical co-ordinates	
Explicit, Implicit, Crank Nicholson and ADI methods- stability of each system-	
Conservation form and conservative property of partial differential equations and finite	7
difference equations-Consistency, stability and convergence for marching problems-	
Discrete perturbation stability analysis- Fourier or Von Neumann stability analysis.	

Module 5	Hrs.
Finite volume method 1	
Discretization of governing equations - Diffusion and convection-diffusion problems-	6
steady one-dimensional convection and diffusion, upwind, hybrid and power-law schemes:	
Module 6	Hrs.
Finite volume method 2	
Discretization equation for two-dimensions: False diffusion, calculation for the Flow-	
Field- Stream function- vorticity approach, SIMPLE, SIMPLER, SIMPLEC and QUICK	7
Algorithms. Numerical Marching Techniques. Two dimensional parabolic flows with heat;	
Grid generation methods, Adaptive grids.	

Module wise Measurable Students Learning Outcomes :

- 1. Describe and recall basics of fluid mechanics and mathematics, methods of prediction and its significance.
- 2. Apply the FDM method to discretize of governing equation.
- 3. Solve 1D, 2D conduction problems with discretization method, to apply and interpret different types of boundary conditions.
- 4. Understand and apply the solution techniques for 1D, 2D, 3D problems; carry out the analysis using these methods.
- 5. Design the grid with FVM for diffusion and convection diffusion problem.
- 6. Select the appropriate grid, interpret and apply different solution algorithm.

Title of	f the Course: PE	1							
Nuclear Engineering- 4HP512						L	Т	Р	Cr
						3	0	0	3
Pre-Re	auisite Courses:								
Textho	Tavthaalaa								
1.	 Introduction to Nuclear Engineering (3rd Edition) by John R. Lamarsh, Anthony J.Barrata, Prentice Hall (2001) 								
Refere	References:								
1.	1. Introduction to Nuclear Reactor Theory, by John R. Lamarsh, Addison-Wesley, 1966)								
2.	2. Nuclear Reactor Analysis, by James J. Duderstadt and Lewis J. Hamilton, John Wiley(1976)								
Course	Course Objectives :								
•	Demonstrate the b	basic concepts	s and proces	sses taking pla	ce inside a nuc	lear rea	ctor, su	ch as nu	ıclear
	fission, neutron p	roduction, sca	ttering, diff	fusion, slowin	g down and abs	orption	l .		
•	The student will a	lso be familia	ar with conc	cepts of reacto	r criticality, the	relatio	nship		
٠	The student will a	lso be familia	ar with Time	e dependent (1	ransient) behav	ior of p	ower r	eactor ir	n non-
	steady state opera	tion and the r	neans to con	ntrol the react	or.				
٠	The student will a	llso be familia	ar with conc	cepts of heat re	emoval from re	actor co	ore, read	ctor safe	ety
0	and radiation prot	ection.							
Course	e Learning Outco	mes:				51	• ~		
СО	After the comple	tion of the cou	irse the stud	lent should be	able to;	Blo	om's Co	ognitive	
						leve	l Des	scriptor	
CO1	Understanding	he basic cond	cepts and p	rocesses takir	g place inside	a II	Un	derstand	ling
	nuclear reactor		1 1		01				U
CO2	Analyzing time d	lependent (tra	nsient) beh	avior of powe	r reactor in nor	- IV	An	alvzing	
	steady state oper	ation and the	means to co	ontrol the read	tor			,8	
CO3	Demonstrating co	oncents of her	t removal fi	rom reactor co	re_reactor safet	v IV	An	alvzing	
	and rediction protection								
	Monning .								
	Mapping :	DO1	DO2	DO3	DO4	DO5		DC	
	<u> </u>	POI	POZ	POS	PO4	P	05	PU	0
		1	4	1					
	CO2		1	1					
	CO3				1				
Assessi	ments :								
Two co	omponents of In Se	emester Evalu	ation (ISE)	, One Mid Sei	mester Examina	ation (N	ISE) ar	nd one E	Ind
Semest	er Examination (E	SE) having 2	0%, 30% ar	nd 50% weigh	tage respective	ly.			
Assess	ment			Marks					
ISE1				10					
MSE				30					
ISE2				10					
ESE				50					
ISE 1	and ISE 2 are based	d on assignmen	nt, oral, semi	inar, test (surp	rise/declared/quiz	z), and g	group di	scussion	.[One
assessi	nent tool per ISE. T	The assessment	tool used for	r ISE 1 shall no	ot be used for ISE	E 2]			
MSE:	MSE: Assessment is based on 50% of course content (Normally first three modules)								
ESE: A	ESE: Assessment is based on 100% course content with70-80% weightage for course content (normally last three								
module	modules) covered after MSE.								

Module 1 : Basics of nuclear fission and power from fission	Hrs.
Radioactivity, nuclear reactions, cross sections, nuclear fission, power from fission,	6
conversion and breeding	U
Module 2: Neutron transport and diffusion	Hrs.
Neutron transport equation, diffusion theory approximation, Fick's law, solutions to	
diffusion equation for point source, planar source, etc., energy loss in elastic collisions,	6
neutron slowing down	
Module 3 :Multigroup, multiregion diffusion equation, concept of criticality	Hrs.
Solution of multigroup diffusion equations in one region and multiregion reactors, concept	7
of criticality of thermal reactors	/
Module 4 : Reactor kinetics and control	Hrs.
Derivation of point kinetics equations, inhour equation, solutions for simple cases of	6
reactivity additions, fission product poison, reactivity coefficients	0
Module 5 :Heat removal from reactor core	Hrs.
Solution of heat transfer equation in reactor core, temperature distribution, critical heat flux	7
Module 6: Reactor safety, radiation protection	Hrs.
Reactor safety philosophy, defence in depth, units of radioactivity exposure, radiation	(
protection standards	0
Module wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
1. Demonstrate basics of nuclear fission and power from fission	
2. Formulation of Neutron transport equation and its solution	
3. Solution to diffusion equation	

Applying and solving heat transfer equation fo
 Demonstrating philosophy of reactor safety

Title o	of the Course:									
Energ	y Conservation a	nd Manage	ment - 4HP	513			L	Т	Р	Cr
							3	0	0	3
Pre-R	Pre-Requisite Courses: Environment Studies, Elements of Mechanical Engineering, Thermodynamics							CS		
Textb	ooks:									
1.	1. Witte L.C. Schmidt P.S. and Brown D.R., Industrial Energy Management and Utilization, Hemisphere Publ., Washington, 1988.									
2.	2. Callaghn P.W., Design and Management for Energy Conservation, Pergamon Press, Oxford, 1981.									
3.	3. Murphy W.R. and McKay G., Energy Management, Butterworths, London, 1987. Energy Manager Training Manual, Bureau of Energy Efficiency (BEE) under Ministry of Power,									
	GOI, 2004 (available at www.energymanager training.com).									
Refer	ences:									
1.	Recent reports of	agencies: Ir	ternational	Energy Agency	(IEA), M	/linistr	y of N	ew and	Renewa	ble
	energy (MNRE),	Technology	and Action	for Rural Adva	incement	(TAR	A)			
2.	Energy Conservat	tion Guideb	ook, Dale R	Patrick, Stephe	en W Fare	do, 2nd	d Editi	on, CRO	C Press	
з. 4	Handbook of Energy	rgy Audits,	Albert Inun Reference h	nann, 6th Editic	on, The F Λ	airmoi	nt Pres	SS		
List of	f Open Source Sof	ftware/lear	ning website	e:	-					
1. http	://nptel.iitm.ac.in/		9							
2. ww	w.bee.com									
3 . ww	w.powermin.nic.in									
Cours	e Objectives :									
1.	To introduce ener	gy and pow	er scenario,	electrical system	ms, energ	gy audi	iting, e	energy c	onserva	tion
2	To provide knowl	t on enviror	iment.	ment energy or	uditing on	d anar		ncorvati	01	
2. 3.	To develop skill to	o carry out (energy audit	and to suggest	methodo	logies	for en	ergy say	vings	
4.	To prepare the stu	idents for hi	gher studies	and research in	the field	l ofene	ergy co	onservat	ion and	
	management.									
Cours	e Learning Outco	mes:								
CO	After the comple	tion of the c	ourse the stu	dent should be a	able to	Bloor	n's Co	gnitive		
						Level	vel Descriptor			
CO1	Explain: energy	and powe	r scenario,	electrical, med	chanical	II	U	nderstan	ding	
	systems, energy	auditing,	energy con	servation and	energy					
	impact on enviro	onment								
CO2	Carryout energy	accounting	and balanci	ng		III	A	Applying		
CO3	Exercise energy	audit and	suggest met	hodologies for	energy	IV	A	Analyzing		
	savings			-						
CO-P	O Mapping :					I				
PO		PO 1	PO 2	PO 3	PO 4		PO	5	PO 6	
C01		1		2				2		
CO2		1		2				2	2	
CO3		1			3	1			3	,
Assess	sments :	1							1	
Teach	Teacher Assessment:									

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks			
ISE 1 10				
MSE	30			
ISE 2	10			
ESE	50			
ISE 1 and ISE 2 are based on assignment/declared test/qui	z/seminar etc.			
MSE: Assessment is based on 50% of course content (Nor	mally first three modules)			
ESE: Assessment is based on 100% course content with60	-70% weightage for course content (normally la	st thre		
modules) covered after MSE.				
Course Contents:				
Module 1 Introduction		Hrs.		
Commercial and non-commercial energy, Primary	energy resources, Commercial energy			
production, Final energy consumption, Indian energy	scenario, Sectorial energy consumption,			
Energy needs of growing economy, Energy intensity	on purchasing power parity (PPP) basis,	5		
Long term energy scenario, Energy pricing, Energy	security, Energy strategy for the future,			
Energy conservation and its importance.				
Module 2 Energy Management & Audit		Hrs.		
Definition, energy audit, need, types of energy audit	. Energy management (audit) approach –			
understanding energy costs, Bench marking, energ	y performance, matching energy use to	_		
requirements, maximizing systems efficiencies, optin	nizing the input energy requirements, fuel	7		
and energy substitution, energy audit instruments and	1 metering.			
Module 3 Energy Economics		Hrs		
Financial Management – Investment need Appraisal	and criteria Financial Analysis techniques	111.5.		
Simple Payback Period Return On Investment Net I	Present Value Interest rate of return Risk	7		
and sensitivity analysis. Financing Options, ESCOS	resent value, interest fate of feturit, Kisk	1		
Module 4Energy Conservation in Major Utilities		Una		
Frances Conservation in an area latencing in dustries	Connection Need Driverials Technical	nrs		
Energy Conservation in energy intensive industries. C	-ogeneration – Need, Principle, Technical			
Options for Cogeneration. Classification, Factors Influ	lencing choice, Heat to Power ratios, Load	8		
Patterns, Prime movers used in Conservation. Ad	vantages and Disadvantages of various			
systems. Case Studies.				
Module 5 Energy conservation in Mechanical and	Electrical systems	Hrs		
Energy conservation in compressed air systems, HVA	C and refrigeration systems, Fans blowers,	6		
pumps and pumping systems, cooling towers, motors	and lighting systems.	Ũ		
Module 6 Energy and environment, air pollution,	climate change:	Hrs.		
Energy and environment, Air pollution, Climat Convention on Climate Change (UNFCCC), Kyoto Clean Development Mechanism (CDM), CDM n Development.	e change, United Nations Framework o Protocol, Conference of Parties (COP), nethodology and procedure, Sustainable	6		

Module wise Measurable Students Learning Outcomes :

Student will be able to:

- 1. Understand and analyze the energy data of industries.
- 2. Employ energy audit and conservation practices
- 3. Understand efficient electricity utilization, saving and recovery in different and electrical system.
- 4. Understand energy conservation in major mechanical utilities
- 5. Understand efficient heat /power, saving and recovery in different thermal system.
- 6. Learn effect of energy consumption on environment and measures to reduce it.

Interior file course. FER L T P Cr Design of Thermal Turbo Systems-4HP514 L T P Cr 3 0 0 3 3 Pre-Requisite Courses: Textbooks: 1. S M Yahya , " Turbines, Compressors and Fans, McGrawHill Publication 2. Shepherd, D.G., "Principles of Turbomachinery", Macmillan, 1969. References: Image: Course of Turbomachinery, Marcel Dekker Inc., 1992. 3. Dixon, S.I., "Fluid Mechanics and Thermodynamics of Turbomachinery", Pergamon Press, 1990. 4. Gopalakrishnan .G and Prithvi Raj .D, "A Treatise on Turbo machines", Scifech Publications (India) Pvt. Ltd., 2002. Course Objectives : At the end of the course, Image: Course of turbomachines and Explain the working principles of turbomachines and apply it to various types of machines 2. Determine the velocity triangles in turbomachinery stages operating at design and off-design conditions. 2. Determine the velocity triangles in turbomachinery stages operating at design and off-design conditions.
Design of Therman Turbo Systems - An S14 L I <thi< th=""> I</thi<>
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 2. Earl Eogan, J., Hand book of Furboniachinery, Marcer Decker Inc., 1992. 3. Dixon, S.I., "Fluid Mechanics and Thermodynamics of Turbomachinery", Pergamon Press, 1990. 4. Gopalakrishnan .G and Prithvi Raj .D, "A Treatise on Turbo machines", Scifech Publications (India) Pvt. Ltd., 2002. Course Objectives : At the end of the course, 1. Recognize typical designs of turbomachines and Explain the working principles of turbomachines and apply it to various types of machines 2. Determine the velocity triangles in turbomachinery stages operating at design and off-design conditions. 2. Determine the velocity triangles of turbomachinery stages operating at design and off-design conditions.
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 4. Gopatakristinal .C and Finiter Raj .D, "A freatise on Furbo machines", serie of Furbonations (india) Pvt. Ltd., 2002. Course Objectives : At the end of the course, 1. Recognize typical designs of turbomachines and Explain the working principles of turbomachines and apply it to various types of machines 2. Determine the velocity triangles in turbomachinery stages operating at design and off-design conditions. 2. Determine the velocity triangles in turbomachinery stages operating at design and off-design conditions.
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 Determine the velocity thangles in taroonachinery stages operating at design and off design conditions. Derform the preliminery design of turbemechines (Fore compression) on a 1 D basis
2 Deferments and incident design of the the machines (Fore compressions) on a 1 D havin
The perior in the preliminary design of throunachines (Fans compressors) on a 1-D pasis
4. Use design parameters for characterizing turbomachinery stages and determine the off-design
behavior of turbines and compressors and relate it to changes in the velocity triangles • Explain and
understand how the flow varies downstream of a turbomachinery blade row
5. Recognize relations between choices made early in the turbomachinery design process and the final
components and operability
6. Explain the limits of safe operation of compressors
Course Learning Outcomes:
CO After the completion of the course the student should be able to Bloom's Cognitive
CO1 Understand the basics of turbe sustained the grant transformation in them. U. Understand
CO2 Apply the knowledge on design of centrifugal and axial turbo systems. III Applying
CO3 Analyze the turbo systems at different operating conditions. IV Analyzing
CO-PO Mapping :
P01 P02 P03 P04 P05 P06
CO1 1 2
CO2 2 3
CO3 2 3
Assessments :
Teacher Assessment:
Two components of In Semester Evaluation (ISE). One Mid Semester Examination (MSE) and one End
Semester Examination (ESE) having 20%, 30% and 50% weights respectively.
Assessment Marks
ISE 1 10
MSE 30
ISE 2 10

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

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Hrs 7 ty S. Hrs 6 Hrs 6

3. Perform the dimensional analysis of Turbo Machines.

4. Carry out the Thermal Design of Compressors.

5. Carry out Thermal Design of Axial Fans and Propellers.

6. Carry out Thermal Design of Centrifugal Fans and Blowers.

Design of Hydro Turbo machines - 4HP515 L 3 3 Pre-Requisite Courses: Textbooks: 1. 1.Nechleba M., "Hydraulic Turbine their Design and Equipments", Constable & 2. Lazarkieniz&Troskolanrkis, "Impeller Pumps", Pergamon Press, 1 st edition, 196. 3. Robinson J.A., "Hydraulic Engineering", Jaico Publishing House, Bombay, 2 nd Ed References: 1. Andre Kovats, "Design and Performance of Centrifugal & Axial flow pump Pergamon, 1 st edition. 1964. 2. Stapanoff, A.J., "Centrifugal & Axial Flow Pumps", John Wiely, Rev ed, 1993. 3. Editor Brown, J.G., "Hydroelectric Engineering Practice", Vol-I & II, 1 st , edition Course Objectives : 1. To enable the students to analyze and solve hydrodynamic machine related p principles of mathematics, science and engineering. 2. To prepare students to handle various strategic issues related to hydrodynamic turbines, pumps etc. 3. To train students with effective communication skill to demonstrate hydrodynam4.	T 0 CO., 1 55. dition, ps & 0 on,1958 oroblem nic mad	P 0 957. 1998 <i>Compre</i> 3.	Cr 3 ssors",								
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 Course Objectives : To enable the students to analyze and solve hydrodynamic machine related p principles of mathematics, science and engineering. To prepare students to handle various strategic issues related to hydrodynam turbines, pumps etc. To train students with effective communication skill to demonstrate hydrodynam 4. To develop skills in designing the hydrodynamic machine component. 	problem nic mac mic the	ns by aj	pplying such as								
 To enable the students to analyze and solve hydrodynamic machine related p principles of mathematics, science and engineering. To prepare students to handle various strategic issues related to hydrodynam turbines, pumps etc. To train students with effective communication skill to demonstrate hydrodynam 4. To develop skills in designing the hydrodynamic machine component. 	problem nic mac mic the	ns by ag chines s	pplying such as								
To develop a professional approach to lifelong learning in the hydrodynamic m awareness of social and environment issues associated with engineering practic Course Learning Outcomes:	nachine ces.	e to incl	 To enable the students to that yie and solve hydrodynamic indefinite related problems by apprying principles of mathematics, science and engineering. To prepare students to handle various strategic issues related to hydrodynamic machines such as turbines, pumps etc. To train students with effective communication skill to demonstrate hydrodynamic theories. To develop skills in designing the hydrodynamic machine component. To develop a professional approach to lifelong learning in the hydrodynamic machine to include the awareness of social and environment issues associated with engineering practices. 								
CO After the completion of the course the student should be able to Bloom's Cogr	nitive										
level Des	escripto	r									
CO1 Describe: different types of hydrodynamic machines and its I R component.	D1 Describe: different types of hydrodynamic machines and its I Remembering component. I I I I										
CO2 Apply knowledge of mathematics, science, and engineering for III the needs in hydrodynamic machine design.	CO2 Apply knowledge of mathematics, science, and engineering for III Applying the needs in hydrodynamic machine design										
CO3Carry out analysis and interpret results.IV	Analyz	zing									
CO-PO Mapping :			1								
PO1 PO2 PO3 PO4 PO	05	P	06								
CO1 1 1 1 1 1 2	2		1								
CO2 2 1 3 3	3		2								
CO3 2 3 2	2		2								

L

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1	Hrs.
Introduction to Hydrodynamic Machines	
Classification of turbines and various forms of turbine runners, Impulse turbines; general	
theory of impulse machines; performance characteristics, Reaction turbines; general theory of	
reaction machines; performance characteristics, types; Francis and Kaplan turbines; theory of	7
cavitation flows in hydrodynamic runners. Hydrodynamic pumps; classification of pumps and	
various forms of pump impellers; general theory of centrifugal pumps; performance	
characteristics	
Module 2	Hrs.
Design of centrifugal pumps, selection of speed, determination of impeller inlet and outlet	
dimensions, meridional geometry inlet and exit blade angles, blade geometry, mixed flow	_
pumps, elementary pump, design of twisted blade, design of volute, vaned diffuser and return	7
passage, suction spiral,	
Module 3	Hrs.
Axial flow pumps, selection of speed, pump casing geometry hub diameter, number of blades	
and cascade solidity, selection of blade geometry on different flow surfaces, diffuser design.	6
Module 4	Hrs.
Introduction to hydraulic turbine design, Type series and diameter series, selection of type and	
diameter, Reaction turbine runner spaces, meridional velocity field, elementary turbines,	
Hydraulic design of Francis turbine, Choice of basic parameters, Inlet and Outlet edges of	
runner blade, blade profiles on flow surfaces, shape of blade duct-velocity diagrams on	8
different flow surfaces, certain guide lines to finalize the runner design, Guide wheel, Vane	
geometry and torque on controlling mechanism, Discharge and circulation, spiral, speed ring,	
draft tube.	
Module 5	Hrs.
Hydraulic design of axial turbine runners, characteristics of some aerofoils, meridional flow	
field, blade geometry on each flow surface, procedure to finalize the runner design.	7

Module 6	Hrs.
Hydraulic design of pelton wheel, number of nozzles and their diameter, runner diameter, number of buckets, positioning of buckets, bucket geometry and size,- needle regulator, deflector.	7
Module wise Measurable Students Learning Outcomes :	
Students should be able to	
1. Recall and explain basics of Hydrodynamic Machines	
2. Select centrifugal pump, design geometrical and operating parameters of Centrifugal pump.	
3. Interpret and design axial flow pump.	
4. Carry out design of reaction turbine	
5. Explain flow field, blade geometry around runner and its effects on design.	
6. Apply and analyze design procedure for Pelton wheel.	

Title of	f the Course: PE	2									
Air-Co	Air-Conditioning System Design -4HP516								Cr		
					·	3	0	0	3		
Pre-Requisite Courses: Thermodynamics, Fluid Mechanics, Heat Transfer, Refrigeration and Air-											
Condit	tioning.										
Textb	ooks:										
1 Mar	nohar Prasad, "Ref	rigeration & A	Air Conditio	ning", New A	ge Publishers.						
2 Sto	ecker, "Refrigerati	on & Air Cor	nditioning",	McGraw Hill,	1992.						
3 Arc	ora C.P., "Refrigera	ation & Air C	onditioning'	', Tata McGra	w Hill, 1985.						
4. "Ref	rigeration and air-	conditioning"	, ARI, Prent	ice Hall, New	Delhi, 1993.						
5. Stoe	cker, "Design of T	hermal System	ms", McGra	w Hill, 1992.							
Refer	ences:										
1 "Ha	ndbook of air-cond	litioning syste	em design",	Carrier Incorp	oration, McGi	aw Hill	Book	Co.,			
U.S.A,	1965.		-	-							
2 ASH	IRAE Handbook.:	HVAC System	ms and Equi	pment, 1996.							
3 Hain	er R.W., "Control	Systems for I	Heating, Ver	ntilation and A	ir-Conditionir	ıg", Van	n Nosti	rand			
4 Nor	man C. Harris, "M	odern Air Co	nditioning",	New York, M	lcGraw-Hill,19	974.					
5. Jone	s W.P., "Air Cond	itioning Engi	neering", Ed	ward Arnold I	Publishers Ltd	, Londo	on,198	4.			
Course	e Objectives :										
1.	To enable the stud	lents to analyz	ze and solve	air conditioni	ng related prol	olems by	y apply	ying			
	principles of math	ematics, scien	nce and engi	neering.			_		_		
2.	To prepare studen	ts to use mod	ern tools, teo	chniques and s	skills to fulfill	industria	al neec	ls relate	ed to		
2	low temperature s	ystems.	aannaniaa	tion abill to de	monstrata air	aanditia	ninat	haamiaa			
з. Л	To train students v	in the analysi	communica s of air cond	tion skill to de	monstrate air	or desig	ming t	neories	•		
	To develop skills	ssional approa	s of all collu	ng learning in	the air condition	on ucsig	311.	inclu	le the		
awaren	ess of social and e	nvironment is	sues associa	ted with engin	neering 1	oractices	s	1110144			
Course	e Learning Outco	mes:									
CO	After the complet	ion of the cou	rse the stude	ent should be a	ble to	Bloo	m's Co	ognitive			
						level	Ι	Descript	or		
CO1	Apply knowledge	of mathematic	s, science and	d engineering fo	or the needs in	III	A	Applyin	g		
	air-conditioning.			-					-		
CO2	Analyze different	Air-Conditionir	ig systems an	d their charact	eristics.	IV	A	Analyzi	ng		
CO3	Evaluate the perf	formance and	interpret the	report in the	field of Air-	V	E	Evaluati	ing.		
	Conditioning										
CO-PC) Mapping :										
		PO1	PO2	PO3	PO4	PC)5	P	06		
	CO1			3							
	CO2			2	2						
	CO3 1										

Assessments :

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ESE	50	
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MSE: Assessment is based on 50% of course content (No	ormally first three modules)	
ESE: Assessment is based on 100% course content with three modules) covered after MSE	/0-80% weightage for course content (normally I	last
Course Contents:		
Module 1		Hrs.
Psychrometry.		
Moist Air properties, use of Psychometric Chart, Va	arious Psychometrics processes, Air Washer	
, Adiabatic Saturation. Fundamental properties of a	air and water vapor mixtures Definitions,	
equations and explanations, psychometric t	able and charts, Enthalpy deviation	
curve, psychometric processes and their analysis, SH	IF, effective surface temperature and bypass	6
factor. Air quality required. Analysis of combination	on of processes psychometric system. Load	
Analysis: Inside design conditions, outside design c	conditions, sensible heat load and latent heat	
loads, heat gains from infiltration ventilation, solar	r radiation from walls, occupants and other	
sources. Heating load, Load estimation chart.		
Module 2		Hrs.
Summer And Winter Air Conditioning	Air	
conditioning processes-RSHF, summer Air conditio	ning, Winter Air conditioning,	6
Applications with specified ventilation air quantity-	Use of ERSHF, Application with low	-
latent heat loads and high latentheat loads, performa	ince and selection.	
Module 3		Hrs.
Heating & Cooling Load Calculations		
introduction, Health & comfort criteria, thermal com	front, air quality, estimating neat loss & neat	6
galin, design conditions, thermal transmission, initial cooling load internal loads solar load through trans	infation & ventilation loads, components of	U
Selection of components and system performance	parent surfaces, opaque surfaces, problems.	
Module 4		Hrs
Air Distribution		111.5.
Flow through Ducts. Static & Dynamic Losses. Air	outlets. Duct Design–Equal Friction	
Method, Duct Balancing, Indoor Air Ouality, Therm	al Insulation. Fans & Duct System	6
Characteristics, Fan Arrangement Variable Air Volu	me systems, Air Handling Units and Fan	_
Coil units.		
Module 5		Hrs.
Air Handling Equipments		
Fans, air conditioning apparatus, unitary equipment,	accessory equipment, Classification - all	6
air- system, air water system, heat recovery system,	radiation panel system, heat pump, air	U
washers.noise control.		
Module 6		Hrs.
Industrial Applications of A.C		
Major uses of air conditioning of medium sized & l	arge buildings, industrial air conditioning,	6
residential air conditioning, air conditioning of vehic	cles, food storage & distribution, food	

processing, pharmaceutical, chemical & process industry, special applications of air conditioning.

Module wise Measurable Students Learning Outcomes :

After the completion of the course the student should be able to:

1. Student should understand construction and design features Air-conditioning system.

2. Student should understand various types and its adoptability in the various environmentand application areas.

3. Student should understand various health issues

4. Student should design seasonal energy efficient system

Tit	le of th	e Course: PE	2									
Gas	s Turbir	es - 4HP517		L	Т	Р	Cr					
							3	0	0	3		
Pre	e-Requi	site Courses:	Thermodyna	mics, Math	ematics, Flui	d Mechanic	s, Nume	erical M	lethods			
Textbooks:												
3.	3. V. Ganesan "Gas Turbine" Tata McGraw-Hill Education, 2 nd edi. ,2003											
Ref	References:											
1.	1. Cohan, Rogers " <i>Gas Turbine</i> " Person, 5 th edition. ,2001											
2.	Dr.Mel	nerwan P. Boy	ce, P.E "Gas	Turbine Eng	<i>ineering</i> " Ha	ndbook, 3rd	edition,	2011.				
3. I an	Earl Lo	ogan" <i>Handboo</i>	k of Turboma	chinery" CR	C press, 2003	3.						
JOU	Irnai	l of Turboman	hinam ASM	E Dub								
1. 2.	Journa	l of Engineerin	nery - ASM ng for Gas Tu	rbines and P	ower - ASMI	E Pub.						
Co												
C00	To e	nable the stude	ents to analyz	e and solve g	as turbine rel	ated problem	ns by an	nlving 1	orinciple	es of		
	matl	nematics, scien	ice and engine	ering.		alled problem	iis o'y up	p171151	, interpre	5 01		
6	5. Top	repare student	s to use mode	rn tools, tech	nniques and sl	kills to fulfil	l industr	ial need	ls related	l to		
_	gas 1	urbine system	S.		1-11 41 -							
5	/. 10t 8 To a	rain students w	vith effective (of gas turbin	ON SKIII to de	monstrate ga	ls turbino design	e theori	es.			
Ģ	9. To c	levelop a profe	essional appro	ach to lifelor	ng learning in	the gas turb	ine to in	clude th	e aware	ness		
	of so	cial and envir	onment issues	s associated v	with engineer	ing practices	•					
Co	urse Le	arning Outco	mes:									
	CO	After the com	pletion of the	course the st	udent should	be able to	Bloom's	s Cognit	ive			
						-	level					
	CO1	Apply knowl	edge of mathe	ematics, scie	nce, and engi	neering for	III	Applying				
		design gas tu	rbine system.									
	CO2	Analyze diffe	erent gas turbi	ne systems a	and their chara	acteristics	IV	Analy	zing			
	CO3 Evaluate the performance of gas turbine systems.						V	Evalu	ating			
CO	PO M	anning ·										
		ահհարը •	PO1	PO2	PO3	PO4	1	205	PC)6		
		C O 1	2		1.00	101	2					
		CO2	2			2	2					
	(C O 3	2						2			

CO3

Assessments :

Teacher Assessment:

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MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents: Module 1 Hrs. **Gas Turbine Plant:** Historical review. Thermodynamic analysis of practical gas turbine cycles. The turboprop engine. The compressor, combustor, turbine and exhaust nozzle characteristics. Performance characteristics of the stationary and turboprop and turbojet engine. The 7 turbojet engine, components. Specific thrust and overall efficiency. Static and flight performance at the design point. Fundamentals of rotating machines. Impulse and reaction machines. The centrifugal compressor: Works done and pressure rise. Design of centrifugal compressor, surge & stall. Module 2 Hrs. **Axial Flow Compressor:** Principle of operation, velocity triangles. Design procedure for single and multistage 6 compressors. Three dimensional effect compressor performance. Description and problems of transonic and supersonic compressors. Module 3 Hrs. **Turbine:** The impulse turbine. Single and multi wheel turbine efficiency, Number of stages blade 6 passages, Vortex design of turbine blades. Blade design & manufacture blade material and blade cooling, limiting factors in turbine design. Module 4 Hrs. **Combustion in Gas Turbine:** Problem to be faced in the design of gas turbine combustion systems. Fuel injection 7 system. Combustion chamber designs. Pressure loss. Temperature distribution, Reaction time, Flame stabilization. Module 5 Hrs. **Turbine Characteristics:** Off design performance of gas turbine plant, Matching of the engine components, 7 equilibrium running diagram. Specific thrust and specific fuel consumption in such case for stationary turbojet and turboprop units. Module 6 Hrs. Materials used in Gas Turbine system, Environmental Considerations and Applications, 5 Failure analysis.

Module wise Measurable Students Learning Outcomes :

Student will be able to

- 1. Summarize Gas Turbine plant and performance characteristics.
- 2. Interpret compressors and its design.
- 3. Select and design various parameters of turbine.
- 4. Explain combustion phenomenon in Gas Turbine plant and combustion chamber design.
- 5. Describe Gas Turbine characteristics.
- 6. Explain Gas Turbine applications in various fields.

Professional Elective (Lab) Courses

T	Title of the Course:													
P	rofess	ional El	ective Hea	t Power Engir	neering Lab.	2 - 4HP5	52			L	Т	Р	0	Cr
									-	0	0	4	2	2
P	re-Re	quisite	Courses:B	asics and son	ne application	ons and flu	uid n	nechanic	s. Bas	ic of	numerica	al tec	chniqu	les.
Т	extbo	oks:												
	1. From respective theory courses													
R	References:													
	1. From respective theory courses													
С	Course Objectives :													
1. To introduce the students about the techniques used to measure properties of various substances.														
	2.	To educ	cate the stu	dent about use	e of numeric	cal technic	ques	and com	imerci	al too	ols availa	ble f	or	
	3	To pren	are the stud	dent to do exr	periment and	l calculate	e the	various	param	eters	in the fie	eld of	f Fluic	1
	0.	Mechan	nics, Heat T	Transfer.					P ••• •••	••••				
	4.	To train	the studen	its to analyze	the perform	ance of va	ariou	s therma	al syste	ems s	ystems.			
С	ourse	Learni	ing Outcor	nes:										
	CO	After t	he complet	tion of the cou	urse the stud	ent shoul	d be	able to	Bloo	m's (Cognitive	;		
									level	evel Descriptor				
	C O1	Perfor	m the exp	eriments to f	ind thermal	propertie	es of	f given	III	III Applying				
		substa	nces.											
	C O2	Carry	out the ana	lysis of variou	is thermal sy	stems by	thro	ugh lab	IV		Analy	/ze		
		set ups	8											
	C O3	Evalua	ate the pe	rformances of	of various	thermal s	syste	ems by	V		Evalu	ate		
		conduc	cting exper	iments.										
С	O-PC) Mapp	ing :											
				PO1	PO2	PO3		PO)4		PO5		PO6	
		CO1			3									
		CO2			2	2		2						
		CO3	•			1		2						
L	ab As	sessme	nt:											
T	here a	re four	component	s of lab assess	sment, LA1,	, LA2, LA	A3 ar	nd Lab E	SE.					
IN	IMP: Lab ESE is a separate head of passing.													
	Asse	sessment Based on Conducted by Conduction and				and N	larks	Submissio Week	$\frac{1}{2}$	Mark	S			
	L	A1.	1 attendance, journal Lab Course Faculty		ty Submission at the end of			of Week 5		25				
	T	Δ2	Lab a	ctivities,	Lab Course Ecoultry		During Week 5 to Week			8	25			
		11 12	attendar	nce, journal	Lao Course	e i acuity	Submission at the end of Week 9				25			
	L	A3	Lab a	ctivities,	Lab Course	e Faculty	Dur	ing We	ek 10 at the e	U to	Week	14	25	
	. .	ECE	Lab Perfe	ormance and		6 1	Dur	ing We	$\frac{1}{2}$ ek 1:	5 to	Week	18	~~	\neg
	Lab) ESE	related do	ocumentation	Lab Cours	e faculty	Sub	mission	on at the end of Week 18					

Week 1 indicates starting week of Semester.

Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course.

Course Contents: Experiments from PE 1 and PE 2 based on elective selected.	
DE1 Commutational matheda in fluid flow and heat therefore	20 II.m
FEI- Computational methods in fluid flow and heat transfer	20 HIS.
Computational methods in fluid flow and neat transfer (any 10 experiments from given	
1. Introduction to prediction methods	
2. Numerical simulation of 1D conduction problem using FDM.	
3. Numerical simulation of 2D conduction problem using FDM	
4. Numerical simulation of 1D conduction problem using FVM.	
5. Numerical simulation of 2D conduction problem using FVM	
6. Numerical simulation of mass diffusion problem using FVM.	
7. Study of different schemes used computational methods.	
8. Computer programming for numerical simulation of conduction problem using FDM.	
9. Computer programming for numerical simulation of conduction problem using FVM.	
10. Computer programming for numerical simulation of Convection problem using FVM	
11. Computer programming for numerical simulation of mass diffusion problem using FVM	
PE1- Nuclear Engineering	20 Hrs
1. Eight assignments based of theory.	201113.
PE1- Energy conservation and management	20 Hrs.
1. Six assignments based of theory.	
2. Four case studies: two commercial and two industrial applications	
PE1- Design of thermal turbo systems	20 Hrs.
1. Two assignments on first three modules (Total 6 assignments)	
2. Trial on two stage air compressor	
3. Two assignments each on 5 and 6 modules. (Total 4 assignments)	
Note: Instructor may take some trials or give assignments other than mentioned based on the course modules.	
	20.11
PE 2- Design of hydro turbo machines	20 Hrs.
1. Derivation of Eulers equation for Rotodynamic machines.	
2. Study of cavitation phenomenon in hydrodynamic machines.	
5. Study of effect of unferent blade angles and types of runner snapes of performance of hydrodynamic machines	
4. Study of effects of numbers blades in axial flow machines on their performance	
5. Study of design of volute casing in hydrodynamic machines.	
6. Study of governing mechanisms in hydraulic machines.	
7. Trial on Centrifugal pump.	
8. Trial on centrifugal pump in series.	
9. Trial on centrifugal pump in parallel.	
10. Trial on Pelton Turbine.	
11. Trial on Francis Turbine.	
PE 2- Air conditioning system design	20 Hrs.

1. Design / simulation of residential air conditioning systems.	
2. Design and analysis of commercial air conditioning system	
3. Design/Simulation of compressors for A.C. systems	
4. Design / simulation of Flow through ducting system	
5. Performance study of different types of air conditioning systems.	
6. Design of ducting systems using different duct designing methods.	
7. Cost estimation for air conditioning system.	
8. Use of commercially available component/equipment selection soft wares for	
design of air conditioning system.	
9. Air distribution and air distribution testing methods .	
10. Study and performance analysis of different types of air outlets.	
PE 2- Gas turbines	20 Hrs.
Gas turbines (any 10 experiments from given list)	
1. Trial on Compressor (Centrifugal/Reciprocating/Axial)	
2. Study of transonic and supersonic compressors.	
3. Study of transonic and supersonic Turbines.	
4. Study of materials and manufacturing techniques for gas turbine.	
5. Study of different cooling methods used in gas turbine.	
6 Study of component matching and performance evaluation in gas turbine	
7. Study on Environmental considerations used in gas turbine design	
7. Study on Environmental considerations used in gas turbule design.	
8. Sketch a component layout diagram for a turbojet, a turbojan, a turboprop and a	
gas turbine for power generation.	
9. Gas Turbine Thermodynamic and Performance Analysis Methods	
10. Study of real time gas turbine model and simulation.	
11. Study of design criteria and performance of gas turbine in combined power	
cycle.	
12 Study of commercial tools used to simulate gas turbine system	

Professional Core (Theory) Courses

Title o	of the Course:										
Advan	Advanced Heat Transfer - 4HP521							ТР			
						3	0	0	3		
Pre-R	equisite Courses:										
Textbo	Textbooks:										
1.	1. S. P. Sukhatme, "A Text Book on Heat Transfer", Universities Press, 4 th Edition, 2006.										
2.	Yunus. A. Cengel,	, "Heat Trans	fer – A Prac	ctical Approac	h", Tata McG	raw Hi	ill, 3 rd 1	Edition,	2006.		
3.	3. Incropera and Dewitt, <i>"Fundamentals of Heat and Mass Transfer"</i> , Wiley publications, 2 nd Edition,										
4											
4.	4. P. K Nag, "Heat and Mass transfer", Tata McGraw Hill, 2 nd Edition,										
Refere	References:										
1.	Eckert and Drabe,	"Analysis of	Heat and M	ass Transfer",	McGraw Hill	Highe	r Educ	ation, 20	03.		
2.	Latif M. Jiji, "Hea	t Conduction	", Springer,	3rd edition, 20)09.	0		,			
3.	H. Schlichting, K	. Gersten, " B	oundary La	yer Theory" S	pringer, 8th ed	ition, 2	2000.				
4.	J. P. Holman, "He	eat Transfer",	McGraw H	ill Book Com	oany, New Yor	k, 199	0.				
5.	Frank Kreith,"Prir	nciples of Hea	it Transfer",	Harper and R	ow Publishers,	New	York,	1973.			
6.	Donald Q. Kern, "	Process Heat	t Transfer",	Tata McGraw	Hill Publishin	g Com	ipany I	_td., New	V		
7.	R. C. Sachdeva."F	Sundamentals	of Engineer	ing Heat and I	Mass Transfer"	. Wile	v Easte	ern Ltd	India.		
Cours	e Objectives :					,	<u>j 2000</u>	,			
1.	To provide the stu	dent with gen	eral techniq	ues to formula	ite, model and	mathe	matica	lly solve			
	advanced heat trar	nsfer problem	s;								
2.	To provide the stu	dent with a de	etailed, but r	not exhaustive	presentation of	of sele	cted ad	lvanced t	opics		
	in convective heat	transfer that	are represen	tative of "real	world" engine	ering	orobler	ns;	1		
3.	To introduce basic	numerical m	ethods and s	software tools	for solving hea	at trans	sfer pro	oblems.			
4.	To use appropriate	e analytical ar	nd computati	ional tools to i	nvestigate heat	and n	nass tra	ansport			
	Phenomena.	·	-		-			-			
Cours	e Learning Outco	mes:									
CO	After the complet	ion of the cou	rse the stude	ent should be a	ble to	Blo	Bloom's Cognitive				
						leve	level Descriptor				
CO1	Understand the ph	ysical modelin	ng aspects of	heat transfer a	and an ability to) II	1	Understa	nding		
	make the appropri	ate choice bet	ween exact a	and approximat	e calculations in	ı			C		
	solving problems of	of heat transfer	in complex s	ystems.							
CO2	Identify the analog	ogy of flow ar	nd momentu	m diffusion to	heat and mass	Ι	1	Remembe	ering		
	transfer and ident	tify the interd	isciplinary c	haracter of rea	al-life thermal						
	engineering.										
CO3	Analyze heat trar	nsfer in comp	lex internal f	flow systems a	ind in	IV	V Analyzing				
	boundary layers a	and external f	low configu	rations							
CO-PO	O Mapping :										
		PO1	PO2	PO3	PO4	Р	05	PC)6		
	CO1	1		1							
	CO2		2		2						
	CO3		1			L					
l		L	1					1			
Assessments :

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Course Contents:

Module 1	Hrs.
Conduction- One and Two Dimension.	7
Module 2	Hrs.
Fins, conduction with heat source, unsteady state heat transfer.	6
Module 3	Hrs.
Natural and forced convection, integral equation, analysis and analogies.	6
Module 4	Hrs.
Transpiration cooling, ablation heat transfer, boiling, condensation and two phase flow mass	6
transfer, cooling, fluidized bed combustion.	0
Module 5	Hrs.
Heat pipes, Radiation, shape factor, analogy, shields.	7
Module 6	Hrs.
Radiation of gases, vapors and flames, Network method of analysis for Radiation Problem.	7

Module wise Measurable Students Learning Outcomes :

After the completion of the course the student should be able to:

The students are expected to understand the subject of Heat Transfer in detail with capability to solve Industrial Problems. This will also base and interest among the students to carry out the Future Research. Student will be able to

- 1. Interpret Heat Transfer by conduction and advances in conduction.
- 2. Analyze Heat Transfer by forced convection.
- 3. Explain Heat Transfer by Radiation.
- 4. Summarize Condensation and boiling phenomenon.
- 5. Paraphrase Heat Transfer by natural convection.

6. Apply knowledge of Heat transfer to design and evaluate the performance of thermal system.

Title of	the Course:					L	Т	Р	Cr		
Steam 2	Engineering - 4H	P522		3 0 0							
Pre-Re	re-Requisite Courses:										
Textbo	oks:										
1. T. D.	1. T. D. Estop, A. McConkey, Applied Thermodynamics, Parson Publication.										
2. Dom	kundwar; A Cours	se in Power F	lant Enginee	ering; Dhanap	atRai and Sons	•					
3. Yunu	is A. Cengel and H	Boles, "Engin	eering Thern	modynamics "	, Tata McGraw	-Hill P	ublish	ing Co. I	Ltd.		
Referen	nces:										
 Energies Edite P. Chulte Ltd, 2 	gy Performance A ed by J. B. Kitto& natopadhyay; <i>Boile</i> N Delhi	ssessment fo S C Stultz; S er Operation	r Equipment team: Its Ge Engineering.	& Utility System neration and U Cuestions an	tems; Bureau o Use; The Baboo d Answes; Tata	f Energ ock and McGra	y Eff Wilc wHil	iciency. ox Comp l Educati	oany. on Pvt		
Course	Objectives :										
1.To a	nalyze different ty	pes of steam	cycles and e	stimate efficie	ncies in a stear	n powe	r plan	it.			
2.To de	esign pipe insulati	on trough pro	oper selection	n of materials	with the help o	f basic	heat t	ransfer th	neory.		
3.10 a	evelop a profession	mance for di	for lifelong	ng conditions.	steam engine	ring to	inch	ıde the			
awar	eness of social and	d environmer	it issues asso	ciated with en	gineering prac	tices.					
Course	Learning Outco	mes:			<u> </u>						
CO	After the complet	tion of the cou	irse the stude	ent should be a	ble to	Bloo	m's C	ognitive			
						level		Descriptor	r		
CO1	Explain working	of different	boilers and s	ignificance of	mountings and	and					
	accessories. and	to use techni	ques, skills,	and modern er	igineering tool	s I	I Remembering				
	necessary for boiler performance assessment								C		
CO2	CO2 Design a steam piping system, its components for a process and also										
	design economical and effective insulation. And to analyze a thermal							A			
	system for sources of waste heat design a systems for waste heat								ing		
	recovery										
CO3	Design and de	evelop contr	ols and in	strumentation	for effective	e n	τ	Analyz	vina		
monitoring of the process								Anaryz	ling		
CO-PO	Mapping :										
		PO1	PO2	PO3	PO4	PO)5	PO	6		
	CO1	1	1	2	1	2	2	1			
	CO2	1	1	1	3	2		2			
	CO3	1	1	2	3	(*) (*)	5	2			
Assess	nents :										
Teache	r Assessment:										
Two co	omponents of In S	emester Eva	luation (ISE)), One Mid Se	emester Exami	nation	(MSE	E) and on	e End		
Semeste	er Examination (E	SE) having 2	0%, 30% and	d 50% weight	s respectively.						
Assessment Marks											
	15	SE 1				10					
		ASE NE 2				30 10					
	IS					50					
ISE 1 a	and ISE 2 are based	on assignmen	t/declared test	/quiz/seminar e	tc.						
MSE: A	Assessment is based	l on 50% of co	ourse content (Normally first	three modules)						
				5							

ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents: Module 1Introduction Fundamentals of steam generation, Quality of steam, Use of steam table, Mollier Chart Boilers Hrs ,Types, Mountings and Accessories, Combustion in boilers, Determination of adiabatic flame 7 temperature, quantity of flue gases, Feed Water and its quality, Blow down; IBR, Boiler standards. Module 2 Piping & Insulation Water Line, Steam line design and insulation; Insulation-types and application, Economic thickness Hrs of insulation, Heat savings and application criteria, Refractory-types, selection and application of 8 refractory, Heat loss. Module 3Steam Systems Hrs Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash 8 steam recovery system, Steam Engineering Practices; Steam Based Equipment's Systems. Module 4 Boiler Performance Assessment Hrs Performance Test codes and procedure, Boiler Efficiency, Analysis of losses; performance 8 evaluation of accessories; factors affecting boiler performance. Module Energy Conservation and Waste Minimization Hrs Energy conservation options in Boiler; waste minimization, methodology; economic viability of 5 waste minimization. Module 6 Instrumentation & Control Hrs Process instrumentation; control and monitoring. Flow, pressure and temperature measuring and 6 controlling instruments, its selection. Module wise Measurable Students Learning Outcomes : After the completion of the course the student should be able to: 1. UnderstandFundamentals of steam generation and other necessary factors. 2. design pipe insulation trough proper selection of materials with the help of basic heat transfer theory 3. Understand the working principles of different steam systems through leakages and losses. 4. Analyze boiler performance and factors affecting it.

- 5. Comprehend Energy Conservation and Waste Minimization
- 6. Select different types of instruments for various applications.

Professional Core (Lab) Courses

Title of	the Course:									
Heat Po	wer Engineering lab 3-4HP571	L	Т	Р	Cr					
		0	0	4	2					
Pre-Re	quisite Courses: Thermodynamics, Heat Transfer, Power plant Engineer	ring, A	utomot	oile						
Enginee	ering	U.								
Textbo	Textbooks:									
1. P. K.	1. P. K. Nag "Thermodynamics", Tata McGraw Hill Publication, 2006, 3rd Edition.									
2. V. P.	2. V. P. Vasandani and D. S. Kumar, " <i>Heat Engineering</i> ", Metropolitan Book Company, 1975, 2nd									
Edition	Edition.									
3. R. Yadav, "Fundamentals of Thermodynamics", Central Publication house, Allahabad, 2011,										
Revised 7th Edition.										
4. Ganeshan, "Internal Combustion Engines" Tata Mac Hill Publication, 1999, 2nd edition.										
5. Math	ur and Sharma, "Internal Combustion Engines" DhanapatRai publicatio	n, 2000), 2nd e	dition.						
6. R. K.	Rajput, "Internal Combustion Engines" Laxmi Publications, 2005, 3rd	edition								
Refere	nces:									
1. Ceng	el and Boles, "Thermodynamics an engineering Approach", Tata McGra	aw-Hil	l public	ation,						
2011. Revised 7th Edition.										
2. R. Yaday, "Thermodynamics and heat engine". Central Publication house Allahabad. 2007.										
Revised 7th Edition.										
3. R. Yadav, "Steam and Gas Turbine", Central Publication house, Allahabad, 2010. Revised 7 th edition.										
4. F. Obert, "Internal Combustion Engines and Air Pollution". In-text Educational Publishers, 1973										
1st edit	on.									
5. John B Heywood, "Internal Combustion Engines fundamentals", McGraw-Hill, Revised 2nd										
Edition	, 1988.	,								
6. Male	ev J P, "Internal Combustion Engines Theory and design", McGraw-Hil	l. Revi	sed 2nd	d Edition	n,					
1945.		,			,					
Course	Objectives :									
Studen	ts should be able to									
1. To le	arnthe techniques to find physical properties of the oils, greases, and sol	id fuel	s used i	nsteam						
generat	Drs.									
2. To a	pply laws of thermodynamics to various thermodynamic devices.									
3. To de	evelop the skills for evaluating performance of thermodynamics systems	•								
4. Dem	onstrate the engine components, systems and its constructional details									
5. To measure parameters of the Engines performance										
6. Expl	ain the role of parameters affecting volumetric efficiency, valve timing,	and por	rt desig	n						
7. Make the analysis of working of the engine by studying exhaust gas analysis										
Course	Learning Outcomes:									
Rloom's Cognitive										
CO After the completion of the course the student should be able to Bloom's Cogning										
	Apply the techniques to determine the properties of fluids used in			_ 0.5011						
various industrial Systems such as Mechanical Power Production										
CO1	systems.	II	Ι	Apply	ing					
	Classify and examine the IC engine components and systems									
CO2	Estimate the calorific value of a given fuel by using Bombcalorimeter	T I	V	Analvz	zing					
		1	·		0					

	To stu theper	Idy and tes formance r	st the tools / te parameters of	chniques / in engine	nstrumen	ts for	measuring			
	Estimate and measure performance of thermal systems by conducting							7		
CO3	the tes	st on steam	power plant f	o determine	nlant and	1 con	nonent	V	Ev	aluating
cO3 the test on steam power plant to determine plant and component v efficiencies. Asses the performance characteristics during testing								·	1	uruuting
CO PO Mapping :										
	0 Mapp	ing :	D O1	DOA	DOJ		D O 4		-	DOC
			POI	P02	P03		P04	PO:	5	POo
	CO			3						
	CO2	2		2	2		2			
	COS	3			1		2			
Lab A	ssessme	ent:								
There a	are four	component	ts of lab asses	sment, LA1	, LA2, LA	A3 an	nd Lab ESE.			
IMP: L	Lab ESE	1s a separa	te head of pas	ssing.	. 11		1 13	<u> </u>	• •	N 1
Asse	essment	Ba	sed on	Conduc	ted by		induction and M	larks Subi	mission	Marks
I	LA1	LaD a attendar	cuvilles,	Lab Course	e Faculty	Sub	mission at the e	nd of Wee	ek 5	25
		Lab a	ctivities			Dur	ing Week '	5 to W	Veek 8	
I	LA2	attendar	nce, journal	Lab Course	e Faculty	Sub	mission at the e	and of Wee	ek 9	25
т	12	Lab a	ctivities,	Lab Cours	- Ecoulty	Dur	ing Week 1	0 to W	eek 14	25
	LAS	attendar	nce, journal	Lab Course	Faculty	Sub	mission at the e	nd of Wee	ek 14	23
Lab ESE Lab Performance and Lab Course faculty During Week 15 to								5 to W	eek 18	25
Week 1 indicates starting week of Somester								and of Wee	ek 18	_
Week	I indicat	tes starting	week of Sem	ester.						
Lab ac	tivities/l	Lab perform	nance shall in	clude perfor	rming exp	perim	ents, mini-pro	ject, pres	entations	,
drawin	igs, prog	ramming a	nd other suita	ble activitie	s, as per t	the na	ature and requi	irement o	of the lab	course.
Cours	e Conte	nts:								
1.	List of	f Experime	nts for course	Advance H	eat transf	er(N	linimum 8 Ex	xpt.)		
2.	Detern	nination of t	hermal conduc	tivity: Comp	osite wall	appar	atus	-		
3.	Detern	nination of t	hermal conduc	tivity- Solids	•					
4.	Detern	nination of t	hermal conduc	tivity- fluids						
5.	Detern	nination of f	orced convecti	on heat trans	fer coeffic	ient.				
6.	Detern	nination of f	ree convective	heat transfer	coefficier	nt				
7.	Detern	nination of I	Emissivity of a	given surface	e				20	Hrs.
8.	Heat tr	ansfer throu	igh extended si	urfaces.	<i>a</i> .					
9.	Detern	nination of S	Stefan –Boltzm	ann constant	: Stefan –	Boltz	mann Apparatu	S		
	J. Pool B	oiling and c	ritical heat flux	X						
	L Perior	mance study	of cooling tov	ver						
Listo	2. Unstea	internet	a transfer appa	ratus.	Minimu	m 8	Funt)			
			theiler mean			41 o	Expl.)			
1.	oduce	tional mod	l boner moun	lings and ac	cessories	unro	ugn available			
2	Deter	nination of	zis. Endinbatic fla	ma tamparat	ure of dif	foror	t fuels at cons	tont		
۷.	volum	and cons	tant pressure	conditions	uie of ui		it fuels at colls	lan		
3	Study	and unders	standing of be	viler regulati	ons and h	oiler	standards			
5. 4	 Study and understanding of boller regulations and boller standards. Design of piping for steam line 									
5	Design	n of proper	insulation on	on nining thro	ugh heat	trans	fer considerati	ons	20	Hrs.
6	Trial	on steam no	ower plant to	calculate ho	iler effici	encv				
7.	Trial	on steam po	ower plant to	calculate ise	ntropic e	fficie	ncy of single s	stage		
	impul	se turbine.	P	150			- J			
8.	Trial	on steam po	ower plant to	calculate con	ndenser e	ffecti	veness.			
9.	Study	and demor	stration of w	orking princ	iple of co	oling	g tower and			
	calcul	ation of co	oling tower p	erformance.	-	L L	-			
10	0. Study	of differen	t losses in bo	iler.						

11. Study of different methods of energy conservation in all components of steam power plant unit.	
12. Study of different types of flow, pressure and temperature measuring	
instruments.	1

Image: Construction of the course the student should be able to Bloom's Cognitive CO1 Apply the existing knowledge on real life problems III Applying CO2 Verify the outcomes of the work have solved the specified problems. V Evaluating CO3 Verify the outcomes of the work have solved the specified problems. V Evaluating CO4 After the completion of the course the student should be able to Bloom's Cognitive Level Descriptor CO3 Verify the outcomes of the work have solved the specified problems. V Analyzing CO3 Verify the outcomes of the work have solved the specified problems. V Evaluating Resessment: There are four components of assessment, LA1, LA2, LA3 and Lab ESE. Marks 10 Marks 25 LA1 Project Progress Course Faculty/ Industrial Guide Submission at the end of Week 14 25 LA2 Project Progress Course Faculty/ Industrial Guide During Week 15 0 25 LA3 Project Progress Course Faculty/ Industrial Guide During Week 14 25 25 <td cols<="" th=""><th>Τ</th><th>Title of the C</th><th>ourse: Industrial Proje</th><th>ct 4HP</th><th>572</th><th></th><th></th><th></th><th></th><th></th><th></th><th>L</th><th>Т</th><th>]</th><th>P</th><th>Cr</th></td>	<th>Τ</th> <th>Title of the C</th> <th>ourse: Industrial Proje</th> <th>ct 4HP</th> <th>572</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>L</th> <th>Т</th> <th>]</th> <th>P</th> <th>Cr</th>	Τ	Title of the C	ourse: Industrial Proje	ct 4HP	572							L	Т]	P	Cr
Pre-Requisite Courses: Textbooks: As per topic Selected and Journal papers, Conference papers, Handbook. References: As per topic Selected and Journal papers, Conference papers, Handbook. Course Objectives: 1. To Review and increase students' understanding of the specific topics. 2. To induce Learning management of values. 3. To teach how research papers are written and read such papers critically and efficiently and to summarize and review them to gain an understanding of a new field, in the absence of a textbook. 4. To teach how to judge the value of different contributions and identify promising new directions in specified area. Course Learning Outcomes: CO After the completion of the course the student should be able to Bloom's Cognitive CO1 Apply the existing knowledge on real life problems III Applying CO2 Investigate the selected topic/ system. IV Analyzing CO3 Verify the outcomes of the work have solved the specified problems. V Evaluating CO-PO Mapping: PO 1 2 3 4 5 6 CO2 3 1 1 1 2 2 1 CO2 </td <td></td> <td>-</td> <td>-</td> <td>4</td> <td>4</td> <td>2</td>												-	-	4	4	2	
Textbooks: As per topic Selected and Journal papers, Conference papers, Handbooks. References: As per topic Selected and Journal papers, Conference papers, Handbook. Course Objectives: 1. To Review and increase students' understanding of the specific topics. 2. To induce Learning management of values. 3. To teach how research papers are written and read such papers critically and efficiently and to summarize and review them to gain an understanding of a new field, in the absence of a textbook. 4. To teach how to judge the value of different contributions and identify promising new directions in specified area. Course Learning Outcomes: CO After the completion of the course the student should be able to Bloom's Cognitive CO1 Apply the existing knowledge on real life problems III Applying CO2 Investigate the selected topic/ system. IV Analyzing CO3 Verify the outcomes of the work have solved the specified problems. V Evaluating Co-PO Mapping: Assessment: There are four components of assessment, LA1, LA2, LA3 and Lab ESE. IMP: Lab ESE is a separate head of passing. Course Faculty/ During Week 1 to Week 4 25 LA1 Project Progress Cour	P	re-Requisite	Courses:														
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3. To teach how research papers are written and read such papers critically and efficiently and to summarize and review them to gain an understanding of a new field, in the absence of a textbook. 4. To teach how to judge the value of different contributions and identify promising new directions in specified area. Course Learning Outcomes: CO After the completion of the course the student should be able to Bloom's Cognitive CO1 Apply the existing knowledge on real life problems III Applying CO2 Investigate the selected topic/ system. IV Analyzing CO3 Verify the outcomes of the work have solved the specified problems. V Evaluating Co-PO Mapping: Assessment: There are four components of assessment, LA1, LA2, LA3 and Lab ESE. IMP: Lab ESE is a separate head of passing. Submission at the end of Week 5 25 LA1 Project Progress Course Faculty/ Industrial Guide During Week 1 to Week 8 25 LA3 Project Progress Course Faculty/ Industrial Guide During Week 15 to Week 14 25 LA3 Project Progress Course Faculty/ Industrial Guide During Week 15 to Week 14 25	2.	To induce L	earning management of v	alues.													
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$\begin{tabular}{ c c c c c c } \hline Uick Conduction and Marks Submission Marks Submission At the end of Week 5 to Week 8 25 to Week 14 25 LA3 Project Progress Course Faculty/ During Week 15 to Week 14 25 LA3 Project Progress Course Faculty/ During Week 15 to Week 18 25 to Week 18 25$		CO After	the completion of the cou	irse the	stud	lent	t sho	ould	be a	ble	to	Bl	oom's	Cognit	ive		
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CO3 Verify the outcomes of the work have solved the specified problems. V Evaluating CO-PO Mapping: PO 1 2 3 4 5 6 CO1 2 2 1 - - CO2 3 1 1 - - CO2 3 1 1 CO2 3 2 1 Assessment: There are four components of assessment, LA1, LA2, LA3 and Lab ESE. IMP: Lab ESE is a separate head of passing. Course Faculty/ During Week 1 to Week 4 25 LA1 Project Progress Course Faculty/ During Week 5 to Week 8 25 LA2 <td colspan="6">CO2 Investigate the selected topic/ system.</td> <td>IV</td> <td colspan="2">Analyzing</td>	CO2 Investigate the selected topic/ system.						IV	Analyzing									
CO-PO Mapping: PO 1 2 3 4 5 6 CO1 2 2 1 - 1 - - - - - - - - - - - - - - - - - - -	CO3 Verify the outcomes of the work have solved the specified problems. V							Evalu	ıatin	g							
PO 1 2 3 4 5 6 CO1 2 2 1 1 1 CO2 3 1 1 1 CO3 3 2 1 1 Kinestein Based on Conducted by Conduction and Marks Submission Marks LA1 Project Progress Course Faculty/ During Week 1 to Week 4 25 LA2 Project Progress Course Faculty/ During Week 5 to Week 8 25 LA3 Project Progress Course Faculty/ During Week 10 to Week 14 25 LA3 Project Progress Course Faculty/ During Week 15 to Week 18 25 Lab ESE Project Progress Course Faculty/ Durin	C	CO-PO Map	oing:														
PO 1 2 3 4 5 6 CO1 2 2 1 1 1 CO2 3 1 1 1 CO3 3 2 1 1 CO3 3 2 2 1 Assessment: There are four components of assessment, LA1, LA2, LA3 and Lab ESE. IMP: Lab ESE is a separate head of passing. Assessment Based on Conducted by Conduction and Marks Submission Marks LA1 Project Progress Course Faculty/ During Week 1 to Week 4 25 LA2 Project Progress Course Faculty/ During Week 5 to Week 8 25 LA3 Project Progress Course Faculty/ During Week 10 to Week 14 25 LA3 Project Progress Course Faculty/ During Week 15 to Week 14 25 Lab ESE Project Progress Course Faculty/ During Week 15 to Week 18 25																	
CO1 2 2 1 1 CO2 3 1 1 CO3 3 2 1 Assessment: Co3 3 2 1 Assessment: Co3 3 2 1 Merican and the end of parameters of assessment, LA1, LA2, LA3 and Lab ESE. Conducted by Conduction and Marks Submission Marks Assessment Based on Conducted by Conduction and Marks Submission Marks LA1 Project Progress Course Faculty/ During Week 1 to Week 4 25 LA2 Project Progress Course Faculty/ During Week 5 to Week 8 25 LA3 Project Progress Course Faculty/ During Week 10 to Week 14 25 Lab ESE Project Progress Course Faculty/ During Week 15 to Week 14 25 Lab ESE Project Progress Course Faculty/ During Week 15 to Week 18 25				PO	1	2	3	4	5	6							
CO2 3 1 CO3 3 2 Assessment: There are four components of assessment, LA1, LA2, LA3 and Lab ESE. IMP: Lab ESE is a separate head of passing. Assessment Based on Conducted by Conduction and Marks Submission Marks LA1 Project Progress Course Faculty/ Industrial Guide During Week 1 to Week 4 25 LA2 Project Progress Course Faculty/ Industrial Guide During Week 5 to Week 8 25 LA3 Project Progress Course Faculty/ Industrial Guide During Week 10 to Week 14 25 Lab ESE Project Progress Course Faculty/ Industrial Guide During Week 15 to Week 14 25 Lab ESE Project Progress Course Faculty/ Industrial Guide During Week 15 to Week 18 25 Lab ESE Project Progress Course Faculty/ Industrial Guide During Week 15 to Week 18 25				CO1	2	2	1										
CO332Assessment:There are four components of assessment, LA1, LA2, LA3 and Lab ESE.IMP: Lab ESE is a separate head of passing.AssessmentBased onConducted byConduction and Marks SubmissionMarksLA1Project ProgressCourse Faculty/DuringIndustrial GuideSubmission at the end of Week 5LA2Project ProgressCourse Faculty/During Week 5 to Week 8LA3Project ProgressCourse Faculty/During Week 10 to Week 14Lab ESEProject ProgressCourse Faculty/During Week 15 to Week 18Lab ESEProject ProgressCourse Faculty/During Week 15 to Week 18Lab ESEProject Progress				CO2	3				1								
Assessment: There are four components of assessment, LA1, LA2, LA3 and Lab ESE. IMP: Lab ESE is a separate head of passing. Assessment Based on Conducted by Conduction and Marks Submission Marks LA1 Project Progress Course Faculty/ During Week 1 to Week 4 25 LA2 Project Progress Course Faculty/ During Week 5 to Week 8 25 LA2 Project Progress Course Faculty/ During Week 5 to Week 8 25 LA3 Project Progress Course Faculty/ During Week 10 to Week 14 25 LA3 Project Progress Course Faculty/ During Week 15 to Week 14 25 LA3 Project Progress Course Faculty/ During Week 15 to Week 18 25 Lab ESE Project Progress Course Faculty/ During Week 15 to Week 18 25				CO3		3			2								
There are four components of assessment, LA1, LA2, LA3 and Lab ESE. IMP: Lab ESE is a separate head of passing. Assessment Based on Conducted by Conduction and Marks Submission Marks LA1 Project Progress Course Faculty/ During Week 1 to Week 4 25 LA2 Project Progress Course Faculty/ During Week 5 to Week 8 25 LA2 Project Progress Course Faculty/ During Week 5 to Week 9 25 LA3 Project Progress Course Faculty/ During Week 10 to Week 14 25 LA3 Project Progress Course Faculty/ During Week 15 to 25 Lab ESE Project Progress Course Faculty/ During Week 15 to 25 Lab ESE Project Progress Course Faculty/ During Week 15 to 25	A	ssessment:															
IMP: Lab ESE is a separate head of passing. Assessment Based on Conducted by Conduction and Marks Submission Marks LA1 Project Progress Course Faculty/ During Week 1 to Week 4 25 LA2 Project Progress Course Faculty/ During Week 5 to Week 8 25 LA2 Project Progress Course Faculty/ During Week 5 to Week 9 25 LA3 Project Progress Course Faculty/ During Week 10 to Week 14 25 LA3 Project Progress Course Faculty/ During Week 10 to Week 14 25 Lab ESE Project Progress Course Faculty/ During Week 15 to Week 18 25	Т	here are four	components of assessm	ent, LA	1, L	A2	, LA	A3 a	nd L	ab l	ESE.						
AssessmentBased onConducted byConduction and Marks SubmissionMarksLA1Project ProgressCourse Faculty/ Industrial GuideDuring Submission at the end of Week 4 Submission at the end of Week 525LA2Project ProgressCourse Faculty/ Industrial GuideDuring Submission at the end of Week 8 Submission at the end of Week 925LA3Project ProgressCourse Faculty/ Industrial GuideDuring Submission at the end of Week 14 Submission at the end of Week 1425LA3Project ProgressCourse Faculty/ Industrial GuideDuring Submission at the end of Week 14 Submission at the end of Week 1425Lab ESEProject ProgressCourse Faculty/ Industrial GuideDuring Week 15 to Week 18 Submission at the end of Week 1825	Π	MP: Lab ESE	is a separate head of pa	ssing.													
LA1Project ProgressCourse Faculty/ Industrial GuideDuring Submission at the end of Week 4 Submission at the end of Week 525LA2Project ProgressCourse Faculty/ Industrial GuideDuring Submission at the end of Week 8 Submission at the end of Week 925LA3Project ProgressCourse Faculty/ Industrial GuideDuring Submission at the end of Week 14 Submission at the end of Week 1425LA3Project ProgressCourse Faculty/ 		Assessment	Based on	Co	ondu	cteo	l by		Co	ondu	ction and N	Aarks S	Submis	sion	Ma	arks	
LA1 Project Progress Industrial Guide Submission at the end of Week 5 25 LA2 Project Progress Course Faculty/ During Week 5 to Week 8 25 LA3 Project Progress Course Faculty/ During Week 10 to Week 14 25 LA3 Project Progress Course Faculty/ During Week 10 to Week 14 25 Lab ESE Project Progress Course Faculty/ During Week 15 to Week 18 25		LA1	Drojact Drograss	Course Faculty/			Dur	ing	Week	1 to	Wee	k 4	2	5			
LA2 Project Progress Course Faculty/ Industrial Guide During Week 5 to Week 8 25 LA3 Project Progress Course Faculty/ Industrial Guide During Week 10 to Week 14 25 LA3 Project Progress Course Faculty/ Industrial Guide During Week 10 to Week 14 25 Lab ESE Project Progress Course Faculty/ Lab est During Week 15 to Week 18 25		LAI	rioject riogiess	Industrial Guide			Sub	mis	sion at the e	end of	Week 5	5	2	.5			
LA3 Project Progress Course Faculty/ During Week 10 to Week 14 LA3 Project Progress Course Faculty/ During Week 10 to Week 14 Lab ESE Project Progress Course Faculty/ During Week 15 to Week 18		LA2	Project Progress	Co	urse	Fac	ulty	/	Dur	ing	Week	5 to	Wee	k 8	2	5	
LA3 Project Progress Course Faculty/ Industrial Guide During Week 10 Week 14 25 Lab ESE Project Progress Course Faculty/ During Week 15 to Week 18 25				Ind	Industrial Guide Submission at the e						end of	Week 9)				
Industrial Guide Submission at the end of Week 14 Lab ESE Project Progress Course Faculty/ During Week 15 to Week 18 25		LA3	Project Progress	Co	urse	Fac	ulty	/	Dur	ing	Week 1	0 to	Week	x 14	2	25	
Lab ESE Project Progress Course Faculty/ During Week 15 to Week 18 25		_	D	Ind	lustria	al C	buid	e	Sub	mis:	sion at the e	$\frac{1}{2}$	Week 1	4			
		Lab ESE	Project Progress	Co	urse	Fac	ulty	/	Dur	nng	Week 1	5 to	Week	x 18	2	.5	

Week 1 indicates starting week of Semester.

Project activities/Project performance shall include literature review, problem statement, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the industrial project.

Course Contents:

The industrial project work will start in semester II and should be an industrial problem with research potential and should involve scientific research review, design, generation/collection and analysis of data,

determining solution and must preferably bring out the individual contribution. Student should undergo industrial project in registered company/organization after consulting with faculty guide assigned by the department. Industrial project should be based preferably in the area in which the candidate is interested to undertake the dissertation work. The student has to be in regular contact with guide and the topic of industrial project must be mutually decided. The examination shall consist of the preparation of report consisting literature review, detailed problem statement, methodology, etc, according to type of work carried out. The work has to be presented in front of the examiners panel formed by DPGC for evaluation.

Professional Elective (Theory) Courses

Title of	the Course: PE 3									
Interna	Т	Р	Cr							
3 0 0 3										
Pre-Re	quisite Courses: Mathematics, Thermodynamics, Fluid Mechanics,	, Heat 🛛	Fransfe	r						
Textbo	oks:									
1.	J. B. Heywood I. C Engine Fundamentals", Tata McGraw Hill Pub.1 st	^t editior	1998.							
2.	2. V. Ganesan, 'Internal Combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.									
Refere	nces.									
1. F. O	bert, "Internal Combustion Engines and Air Pollution", In-text Education	ional P	ublishers	s, 1 st ec	lition					
1973										
2. P. M	. Heldt, "High Speed Combustion Engines", Chilton company 4th edition	ion 195	6.							
3. Colin	n Fergusson, Allan Kirkpatrick, "Internal Combustion Engines" Wiley	Publica	ation.							
<u> </u>										
Course	Objectives :									
At the e	nd of the course:									
1	To enable the students to analyze and solve I C Engine related prob	olems by	v annivii	ng prin	ciples of					
-	mathematics, science and engineering.		, appiji	-8 p						
2	2. To prepare students to use modern tools, techniques and skills to fu	lfill ind	ustrial n	eeds r	elated					
	I.C.Engine systems.									
3	5. To train students with effective communication skill to demonstrate	e I.C.Er	gine the	ories.						
2	. To develop skills in the analysis of I.C.Engine systems in research	or desig	ın.							
5. To develop a professional approach to lifelong learning in the I.C.Engine to include the awareness										
of social and environment issues associated with engineering practices										
Course	Learning Autcomes.									
	After the completion of the course the student should be able to Ploom's									
Correction of the course the student should be able to Correct										
			leve		scriptor					
CO1	Apply the knowledge of mathematics, science, and engineering for the	he need	S							
_	in I.C.Engine.			Ap	plying					
CO2	Analyse diffeAnalyse the IC engine systems and its design repor	rt	IV	An	alvzing					
	Evolution conformation of									
03	Evaluate performance of I C Engines under different conditions and interpret the reports		V	EVa	iuating					
	i.e. Engines under unterent conditions and interpret the reports.									

CO-PO Mapping :

CO1 2 CO2 2 3		PO1	PO2	PO3	PO4	PO5	PO6
CO2 2 3	CO1					2	
	CO2		2		3		
CO3 1 2 2	CO3	1		2			2

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50
ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.	

MSE: Assessment is based on 50% of course content (Normally first three modules) ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1	Hrs.
Introduction to Engine Design:	6
Engine selection, basic data for design like power torque, speed, mean effective pressure,	
air consumption, fuel consumption, stroke to bore ratio, heat distribution, exhaust temperature,	
power to weight ratio, rating and de-rating for four-stroke and two-stroke engines.	
Module 2	Hrs.
Design Considerations:	7
Combustion chamber design considerations for S.I. and C.I. engines. Thermal and Mechanical	
design of cylinder, piston, piston rings, cylinder head, valves, Mechanical design of connecting	
rod, crankshaft and crank case. Design considerations for fuel injection and governing systems;	
cooling and lubrication systems	
Module 3	Hrs.
Simulation of I.C. Engine Processes	6
Simulation, S.I. Engine simulation with air as working medium, simulation with adiabatic	
combustion. Definitions of progressive combustion model, gas exchange process model and heat	
transfer process model	
Module 4	Hrs.
Carburetion and Injection:	7
Carburetion Mixture characteristics ,distribution, Carburetor systems, Carburetor and stratified	
charge engines, S.I. Engine fuel injection system and type, Modern Carburetor designs and air	
Pollution control, altitude compensation.	
Stratified Charged Engine: General characteristics, methods of stratification, applications,	
advantage and disadvantages	
Injection Systems: Design, Bosch distribution pump, Cummins- P-T injection system, Spray	
characteristics ,quantity of fuel per cycle, types of nozzles, injection timing, fuel line hydraulics,	
determination of pressure time and velocity time functions, effect of elasticity of pipe and	
fuel	
Module 5	Hrs.
Lubrication System: Design, Lubrication principles, properties of lubrication oil, classification,	7
additives, lubrication system, types of pumps and filters, crank case ventilation.	

Cooling System: Design,Heat transfer in I.C. engines, piston and cylinder temperatures, heat rejected to coolant, comparison of air and water cooling, temperature distribution for air and water cooled engine across the cylinder wall, cooling system types and components, water treatment, antifreeze Additives.

Ignition System: Requirements, battery ignition, magneto ignition and electronic ignition systems,	
centrifugal and vacuum advance; spark plug types and selection, firing order and its importance.	
Intake and Exhaust System: Functions components, piping layouts, materials and sizing, exhaust	
purifiers.	
Governing System: Types, limiting speed, variable speed, hydraulic, pneumatic and electrical	
governors	
Module 6	
Other Engine Designs	
Wankel Engine: Working principle, engine geometry, engine scaling, lubrication, cooling,	Hrs
induction, ignition systems, combustion in rotary engine, performance, advantages and	6
applications	
Stirling Engine: Working principle of two piston engine, advantages and disadvantages	
· · ·	
Module wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
1. Summarize various engine design parameters.	
2. Interpret various design consideration and decide various parameters.	
3. Carry out the I.C Engine simulation.	
4. Identify and explain the carburetion and injection system used.	
5. Describe lubrication, intake and exhaust, cooling and governing system used in I. C. Engine.	
6 Explain other engine designs and their applications.	

Title o	f the Course: PE	3									
Desigr	of Heat Exchang	ers -4HP532				L	Т	Р	Cr		
								0	3		
Pre-Requisite Courses: Fundamentals of heat transfer and fluid mechanics											
Textbooks:											
1. Ramesh K. Shah and Dusan P. Sekulic, "Fundamentals of Heat Exchanger Design" John Wiley and sons Inc., 2003.											
References:											
1.	1. D.C. Kern, "Process Heat Transfer", McGraw Hill, 1950.										
2.	. SadikKakac and Hongton Liu, "Heat Exchangers: Selection, Rating and Thermal Design" CRC Press, 1998.										
3.	A .P. Frass and M	.N. Ozisik, "l	Heat Exchan	iger Design", I	McGraw Hill,	1984					
4.	Afgan N. and Sch	linder E.V. "I	Heat Exchan	iger Design an	nd Theory Sou	rce Boo	k".				
5.	T. Kuppan, "Hand Book of Heat Exchanger Design".										
6. 7	G Walkers "Indu	rd", New Yo	rk, 1999. Kohongora A	Pasia Guida'	' MaGrow Hi	1 1082					
<u>/.</u> Cours	e Objectives ·		XCHangers-A	Basic Guide	, wiedław III	1, 1962	•				
1	Enable the student	s to analyze :	and solve he	at exchanger i	problems by a	mlving	princir	oles of			
	mathematics, scien	nce and engir	leering.	ar enemanger j	proorenns o'y uj		prineir				
2.	Prepare students to	o use modern	tools, techn	iques and skil	ls to fulfill ind	ustrial	needs r	elated to	Э		
	design of heat exc	hanger.	,	1							
2.	Train students wit	h effective co	ommunicatio	on skill to dem	onstrate heat e	exchang	er theo	ries.			
3.	Develop skills in t	he analysis o	f heat excha	nger with mat	hematical mod	leling fo	or appli	ications	in		
	research or design										
4.	Develop a profess	ional approac	ch to lifelong	g learning in th	he heat exchan	gers to	include	e the			
C	awareness of socia	al and enviror	nment issues	s associated w	ith engineering	g practio	ces.				
Cours	e Learning Outcol	mes:	41 4 1	4 1 111	11 4	D1.	· · · · ·	• • . •			
CO	After the complet	ion of the cou	irse the stud	ent should be a	able to;	BIO	om's Co	ognitive			
						leve	level Descriptor				
CO1	Apply fundame	ental knowl	edge of	mathematics,	science, an	d III	Ap	plying			
	engineering for the	ne needs in h	eat exchange	er designing.							
CO2	Thermal and Hyc	lraulic desigi	nof different	types of heat ex	changers	IV	An	alyzing			
CO3	Mechanical Desi	gn of Heat Ex	kchangers			V	Eva	aluating			
CO-P	O Mapping :										
	PO1 PO2 PO3 PO4						05	PO)6		
	CO1	3									
CO2 3 2						2					
	CO3	3		2	2						
L			I	1	J	_1		1			
Assess	ments :										
Two c	Two components of In Semester Evaluation (ISE). One Mid Semester Examination (MSE) and one End										
Semes	ter Examination (E	SE) having 2	0%. 30% an	d 50% weight	age respective	lv.	,				

Assessment	Marks
ISE1	10
MSE	30
ISE2	10
ESE	50

ISE 1 and ISE 2 are based on assignment, oral, seminar, test (surprise/declared/quiz), and group discussion.[One assessment tool per ISE. The assessment tool used for ISE 1 shall not be used for ISE 2]

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:							
Module 1 : Types of heat exchanger	Hrs.						
Heat Exchangers - Classification according to transfer process, number of fluids, surface							
compactness, and construction features. Tubular heat exchanger, plate type heat exchangers,	(
extended surface heat exchangers, heat pipe, Regenerators. Classification according to flow							
arrangement: counter flow, parallel flow, cross flow exchanger.							
Module 2: Heat exchanger design methodology	Hrs.						
Assumption for heat transfer analysis, problem formulation, e-NTU method, P-NTU method,							
Mean temperature difference method, fouling of heat exchanger, effects of fouling, categories of	6						
fouling, fundamental processes of fouling.							
Module 3 : Compact and Double Pipe Heat Exchangers	Hrs.						
Thermal and Hydraulic design of compact heat exchanger.							
Thermal and Hydraulic design of inner tube, Thermal and hydraulic analysis of Annulus, Total	7						
pressure drop.							
Module 4 : Direct-contact heat exchanger, cooling towers	Hrs.						
Relation between the wet-bulb and dew point temperatures - The Lewis number -Classification							
of cooling towers cooling-tower internals and the role of fill – Heat exchange heat transfer by							
simultaneous diffusion and convection - Analysis of cooling towers measurements - Design of	(
cooling towers - Determination of the number of diffusion units - Calculation of cooling tower	0						
performance - The influence of process conditions upon design - The influence of operation							
tables.							
Module 5 :Shell and Tube heat exchangers	Hrs.						
Tinker's, kern's, and Bell Delaware's methods, for thermal and hydraulic design of Shell and	(
Tube heat exchangers	0						
Module 6:Mechanical Design of Heat Exchangers	Hrs.						
Design standards and codes, key terms in heat exchanger design, material selection, and thickness							
calculation for major components such as tube sheet, shell, tubes, flanges and nozzles.	7						
Introduction to simulation and optimization of heat exchangers, flow induced vibrations.							
Module wise Measurable Students Learning Outcomes :							
After the completion of the course the student should be able to:							
1. Applying the basics of heat Exchangers							
2. Formulation of design equations and its solution methodology							
3. Thermal and hydraulic analysis of compact and double pipe heat exchanger							
4. Design of direct-contact heat exchanger							
5. I nermal and Hydraulic design of shell and tube heat exchanger							

6. Mechanical **Design** of Heat Exchangers

Title of the Course: PE 3										
Industrial Refrigeration - 4HP533	L	Т	Р	Cr						
	3	0	0	3						
Pre-Requisite Courses: Thermodynamics, Fluid Mechanics, Heat Tra	ansfer									
Textbooks:										
 C. P. Arora, "<i>Refrigeration and Air conditioning</i>", Tata Mcgraw Hill Education Private Limited, third edition,2008. Wilbert F. Stoecker, <i>Industrial refrigeration handbook</i>, Mcgraw-hill Professional Publishing 1st edition., ,1998 										
References:										
1. Roy J. Dossat " <i>Principals of Refrigeration</i> ", Pearson, 4 th edition,	2007									
2. ASHRAE Hand Book: Refrigeration, 1998.										
Journal of Air conditioning and refrigeration- ISHRAE, ASH	RAE.									
Course Objectives :	1	1	1							
1. 1. 10 enable the students to analyze and solve refrigeration related	i problen	ns by app	plying pr	inciples						
2. To prepare students to use modern tools, techniques and skills to f	fulfill inc	lustrial n	eeds rela	ted to						
refrigeration systems.										
3. To train students with effective communication skill to demonstra	te refrige	eration/ t	heories.							
4. To develop skills in the analysis of refrigeration systems in resear	ch or des	sign.	1 (1							
5. To develop a professional approach to lifelong learning in the refr awareness of social and environment issues associated with engine	1geratior	1/ to inclu vactices	ide the							
Course Learning Outcomes:	cering pi	actices.								
CO After the completion of the course the student should be able to	Bloom's	Cognitive	5							
	level	_								
		Desen								
CO1 Apply knowledge of mathematics, science, and engineering for										
the needs in Refrigeration		A	olving							
	Ш		, 0							
CO2 Anchor liffing the file sector and their				_						
correctoristics	IV	Ana	lyzing							
CO2 Evaluate the performance of different refrigeration systems										
Evaluate the performance of different ferrigeration systems	V	V Evaluating								
PO1 PO2 PO3 PO	4	PO5	1	PO6						

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1			1		
CO2	2		2	2		
CO3			1	2		

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks					
ISE 1	10					
MSE	30					
ISE 2	10					
ESE	50					
SE 1 and ISE 2 are based on assignment/declared test,	/quiz/seminar etc.					
MSE: Assessment is based on 50% of course content (۱	Normally first three modules)					
ESE: Assessment is based on 100% course content with	n60-70% weightage for course content (norn	nally last				
modules) covered after MSE.						
Course Contents:						
Module 1		Hrs.				
Industrial refrigeration as distinguished from comf	fort air-conditioning, What is industrial					
refrigeration, Refrigerated storage of unfrozen foc	od, Frozen food, Refrigeration in food					
processing, freeze drying, Refrigeration in manufa	cturing plant, Refrigeration in	6				
construction, Refrigeration in chemical industry. Id	ow temperature applications like					
manufacture of ice cream,						
Module 2		Hrs.				
Carnot cycle ,conditions for high cop of Carnot	t cycle ,Steady flow energy equation,					
Analysis of Carnot cycle using refrigerant enthalpies, Dry vs wet compression, The						
standard vapor compression cycle, Variations ir	n standard vapor compression cycle,					
Usefulness of thermodynamic foundation.						
Module 3		Hrs.				
Reciprocating, scroll and screw compressor: Multistage industrial applications, cylinder						
arrangement, cooling methods - oil injection	and refrigeration injection, capacity	6				
regulations - Economizers.						
Module 4		Hrs.				
Types of Evaporators, Liquid circulation: Mech	hanical pumping and gas pumping -					
advantage and disadvantage of liquid re-circulation	- circulation ratio - top feed and bottom					
rised remigerant - Net Positive Suction Head (NPSH	Condensors array constant.	-				
Tisers – design - piping loses. Different industrial	condensers arrangement, Evaporators-	/				
Types and arrangement, inquid circulation, type	e of feed, reinigerant piping design,					
runcuonal aspects. Lubricating oil: types - physica	i properties, types of circulation and oil					
separator. Cic, noncic and natural reirigerants and	i its applications.	TT				
Mogale in industrial activity and in the line of the section of the line of the section of the line of the section of the sect	nooring flagh to the line it 1	Hrs.				
vessels in industrial retrigeration: High pressure i	receiver - Hash tank - Hquid and vapor					
separator - separation enhancers - low pressure receivers - surge drum - surge line						
accumulator thermosyphon receiver - oil pots		TT				
Module 6	<u> </u>	Hrs.				
Conservation and design considerations - source of	of losses - critical thickness - insulation					
cost and energy cost - vapor barriers - construction methods of refrigerated spaces. energy						
efficient components - heat reclaim - thermal s	torage: ice builder and ice harvester.					

Module wise Measurable Students Learning Outcomes :

Student will be able to

- 1. Summarize basics of refrigeration, thermal principles, and vapor compression systems.
- 2. Explain industrial refrigeration requirements, classification and applications.
- 3. Make decision regarding selection of compressors, and related operations.
- 4. Summarize components of system & interpret liquid circulation methods.
- 5. Explain vessels & receivers of refrigeration system.
- 6 Understand various design consideration of industrial refrigeration system.

Title of	f the Course: PE	4									
Cryogenics - 4HP534								Т	Р	Cr	
				3	0	0	3				
Pre-Re	equisite Courses: '	Thermodyna	mics, Fluid	Mechanics, I	Refriger	ation	and A	Air Cond	litioni	ng, Het	
Transf	Transfer. Mathematics										
Textbooks:											
1. Barron. R.F. Cryogenic Systems, McGraw-Hill, 2 nd edition 1985.											
References:											
 Thomas M. Flynn, "<i>Cryogenic Engineering</i>", Marcel Dekker. Inc New York illustrated edition 1997. Marshall Sittig, D. Van Nostrand Co. "<i>Cryogenics - Research and Applications</i>", Princeton N.J, Van Nostrand . 1963Scott, R. B, <i>Cryogenic Engineering</i>, Scott, R. B. D'Van-Nostrand, 1962. Vance, R. W., <i>Applied Cryogenic Engineering</i>, John Wiley and sons, 1st edition 1962. M. Sitting , "<i>Cryogenic</i>", D' Van-Nostrand company, 1st edition 1963. 											
 Course Objectives : To enable the students to analyze and solve cryogenics related problems by applying principles of mathematics, science and engineering. To prepare students to use modern tools, techniques and skills to fulfill industrial needs related to low temperature systems. To train students with effective communication skill to demonstrate cryogenics theories. To develop skills in the analysis of cryogenics systems in research or design. To develop a professional approach to lifelong learning in the refrigeration/air conditioning/cryogenics 											
Course	e Learning Outcom	mes:									
СО	After the complet	ion of the cou	rse the stude	nt should be al	ble to	Bloom	n's Co	gnitive			
						level	[Descriptor			
CO1	Apply knowledge	e of mathema	tics, science	, and engineer	ing for					-	
	the needs in Cryo	ogenic.				Ш		Applyi	ng		
CO2	Analyze differen	t Cryogenic s	ystems.			IV		Analyz	ing		
CO3	Evaluate and inte	erpret the anal	ysis reports	in the field of	f					-	
	Cryogenic	-	- •			V		Evaluat	ing		
CO-PC) Mapping :						1			4	
		PO1	PO2	PO3	PO	94		PO5	P	06	
	CO1						1				
	CO2 2 2 2 2										

Assessments :

Teacher Assessment:

CO3

2

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

1

Assessment	Marks						
ISE 1 10							
MSE							
ISE 2							
ESE							
ISE 1 and ISE 2 are based on assignment/declared test/	quiz/seminar etc.						
MSE: Assessment is based on 50% of course content (N	ormally first three modules)						
ESE: Assessment is based on 100% course content with	60-70% weightage for course content (norm	nally last thro	ee				
modules) covered after MSE.							
Course Contents:							
Module 1 Cryogenic fluids and applications		Hrs.					
Introduction, properties of cryogenic fluids, propert	ies of materials used in cryogenics at						
lower temperature, superconductive materials, appl	ications of cryogenics, cryogenic	6					
space technology, space simulation, cryogenics in b	biology & medicines.						
Module 2 Gas Liquefaction		Hrs.					
Gas liquefaction & refrigeration systems, Basics	of refrigeration & liquefaction, ideal						
thermodynamic cycle, Joule Thomson effect, adia	batic expansion, various liquefaction						
cycles, Liquefaction systems for air, Neon, H	ydrogen & Helium gas, Effect of	8					
components' efficiencies on system performance.							
Module 3 Gas Separation and Purification	Hrs.						
Gas separation and purification – principles, Gas sep	paration systems for air, hydrogen, and						
helium.		6					
Module 4 Cryocoolers		Hrs.					
Cryogenic refrigeration systems, Ideal and	practical systems, Joule-Thompson						
cryocoolers, Stirling Cycle Refrigerators, Gifford	-McMahon Cryocoolers, Pulse Tube	8					
Refrigerators, Regenerators used in Cryogenic Ref	rigerators, Dilution refrigerators.						
Module 5 Cryogenic fluid storage and transfer s	ystems	Hrs.					
, Cryogenic Dewar, Cryogenic Transfer Lines, T	wo phase flow in cryogenic transfer						
system, Insulations used in Cryogenic Systems		6					
Module 6 Instrumentation and safety		Hrs.					
Instrumentation in cryogenics to measure Flow, Le	evel and Temperature, Introduction to						
vacuum technology, safety in cryogenics	6						
Module wise Measurable Students Learning Outo	comes :						
1. Illustrate use of cryogenics in various field of	f engineering.						
2. Detail study of gas liquefaction process.							
3. Study of different gas separation and purifica	tion processes.						
4. Understanding and application of cryogenic e	equipment.						
 J. Transportation and storage of cryo fluids. Study of different instruments used in cryotec 	chnology						
5. Study of anterent instruments used in cryoted	-morogy.						

Title of the Courses DE 4									
Modelling of Internal Combustion Engines 4110525								р	Cr
Modeling of Internal Compusition Engines - 4117555							1	P	
3								0	3
Pre-Re	equisite Courses	s:Mathema	tics,Therm	odynamics,	Fluid Mech	nanics	, Hea	t Trans	fer
Textbo	ooks:	1 - 1						~	
1. J.B.I	Heywood, 'Intern	nal Combus	tion Engine	Fundamenta	als', McGrav	w Hill	Book	Co, 19	88.
2. V. G	anesan, 'Interna	l Combustic	on Engines'	, Tata McGr	aw Hill Boo	k Co,	Eight	h Repri	nt,
2005.									
Refere	ences:								
1. Hey	wood, "I.C. Engi	ines", McGr	aw Hill.						
2. Ram	ios J (1989), "Int	ernal Comb	ustion Engi	ine Modeling	g",Hemisph	ere Pu	blishi	ng Com	pany
3. C. D	. Rakopoulos an	d E. G. Gial	koumis, "Di	iesel Engine	Transient O	perati	on".		
4. Oper	ration Principles	of Operatio	n and Simu	lation Analy	sis", Spring	er, 200)9. 		
5. V. G	aneshan, "Interr	al Combust	ion Engines	s", Tata McC	Fraw Hill, N	ew De	elhi, l	996.	
6. P.A.	Lakshminaraya	nan and Y. \vee	V. Aghav, "	Modelling I	Diesel Comb	oustion	ı" Spr	ringer, 2	010
7. Berr	hard Challen and	RodicaBara	anescu, "Die	esel Engine l	Reference B	ook" l	Butter	worth-	
Heinen	nann, 1999.								
Course	e Objectives :								
At the	end of the course	e:							
1. Stud	lents will demon	strate a basio	c understan	ding of sever	ral types of e	engine	mode	els that	will
inclu	ide zero dimensi	onal thermo	dynamic m	odel, one di	mensional a	nd mu	lti-din	nension	al,
single	zone, two zone e	tc models.							
2. Stud	lents will develop	p models an	d simulate t	them for dies	sel engine pe	etrol e	ngine,	gas eng	gine.
3. Stud	lents will demon	strate the pe	rformance e	evaluation ar	nd emission	standa	rds fo	or such	
modell	ed engines								
Course	e Learning Out	comes:							
CO	After the com	pletion of th	e course the	e student sho	uld be able t	o E	Bloom'	's Cogni	tive
						1	evel	Descrip	otor
CO1	Apply knowled	lge of basic	I C Engine	to model SI	and CI Engi	ne	Ш	Applyi	ng
CO2	Analyze the dif	ferent Engin	ne processe	S			IV	Analyz	ing
CO3	Evaluate the Er	ngine cycle	parameters	for different	conditions		V	Evalua	te
CO-PO	O Mapping :								
		PO1	PO2	PO3	PO4		PO5	F	'O 6
	CO1	1				3			
	CO2		2		3				
	CO3		1			2		2	
L			1 1		l]
Assess	Assessments :								

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10

ESE	50
ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.	
MSE: Assessment is based on 50% of course content (Normally first three modules)	
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.	
Course Contents:	
Module 1	Hrs.
Fundamentals: Governing equations, Equilibrium charts of combustion chemistry,	7
chemical reaction rates, and approaches of modeling, model building and integration	
methods, gas exchange through valves, engine and porting geometry, exhaust gas	
recirculation, valve lift curves.	
Module 2	Hrs.
Thermodynamic Combustion Models of CI Engines:	7
Single zone models, premixed and diffusive combustion models, combustion heat	
release using wiebe function, wall heat transfer correlations, ignition delay, internal	
energy estimations, two zone model, application of heat release analysis.	
Module 3	Hrs.
Fuel spray behavior: Fuel injection, spray structure, fuel atomization, droplet	7
turbulence interactions, droplet impingement on walls.	
Module 4	Hrs.
Modeling of charging system: Constant pressure and pulse turbo charging, compressor	7
and turbine maps, charge air cooler.	
Module 5	Hrs.
Mathematical models of SI Engines: Simulation of Otto cycle at full throttle, part	6
throttle and supercharged conditions. Progressive combustion. Autoignitionmodeling.	
single zone models, mass burning rate estimation, SI Engine with stratified charge.	
Friction in pumping, piston assembly, bearings and valve train etc. friction estimation	
for warm and warm up engines.	
Module wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
1. Understand the fundamentals of Governing Equations relating to Engine Processe	s.
2. Demonstrate the thermodynamic combustion model of I C Engine.	
3. Understand the Fuel spray behavior and related parameters.	
4. Apply the models to different systems.	
5. Analyze the Engine cycles.	

Title of	the Course: PE	Ŧ	T	D	G					
Industi	ndustrial Air-Conditioning - 4HP536							P	Cr 2	
								0	3	
Pre-Requisite Courses: Thermodynamics, Fluid Mechanics, Heat Transfer, Refrigeration and Air-										
Condit	Conditioning.									
1 extbo	OKS: Johan Drasad "Dafi	rigoration &	Air Conditio	ning" Now A	a Dublishara					
$\frac{1}{2}$ Stor	ollai Flasau, Kell	on & Air Cor	All Colluluc ditioning"	McGraw Hill	1007					
$\frac{2}{3}$ Aro	ra C P "Refriger	ation & Air C	anditioning	" Tata McGra	w Hill 1985					
4 "Refi	5 AFORA U.P., "KEIFIGERATION & AIT CONDITIONING", 1 ata MCGraW Hill, 1985. 4 "Refrigeration and air-conditioning" ARI Prentice Hall New Delbi 1002									
Refere	nces:									
1 ASH	RAE Handbook.:	HVAC System	ms and Equi	ipment, 1996.						
2 Haine	er R.W., "Control S	Systems for H	leating, Ven	tilation and A	ir-Conditionin	g", Vai	1 Nost	rand		
3 Norn	nan C. Harris, "Mo	odern Air Cor	nditioning",	New York, M	cGraw-Hill,19	974.				
4 Jones	W.P., "Air Condi	tioning Engin	eering", Ed	ward Arnold H	Publishers Ltd.	, Londo	on,198	4.		
5 Carri	er Hand Book.									
6 Roy	J Dossat " Principl	es of Refrige	ration.							
Course	Objectives :	4 1	1 1		. 1 . 4	. 1			f	
1. To e	nable the students	to analyze an	d solve air c	conditioning re	elated problem	s by ap	plying	g principl	es of	
mat	nematics, science	and engineeri	ng. oola taabnii	and skills	to fulfill indu	strial n	ada ra	lated to	air	
2. 10 p	ditioning	use modern o	oors, technic	ques and skins		striai ne	eus re		alr-	
3 To 1	train students with	effective con	nmunication	skill to demo	nstrate air con	ditionir	na thea	ries		
3. TO	develop skills in th	e analysis of	air conditio	ning systems i	in research or o	design	ig thet	JIC5.		
5. To	develop a professi	onal approact	h to lifelong	learning in th	e air conditior	ing to	includ	le the		
awa	reness of social ar	d environme	nt issues ass	sociated with e	engineering pra	actices				
Course	Learning Outcom	mes:			0 01					
СО	After the comple	etion of the c	ourse the s	tudent should	l be able to	Blo	om's (Cognitive	e	
						low	1	Descript	or	
C01	Apply knowledge	e of mathema	tics science	and engineer	ing for the		III Applying		01 0	
COI	needs in air-cond	ditioning	ties, selence		ing for the	Apprying			5	
CO2	Analyze different	t Air-Conditie	oning syster	ns and their ch	aracteristics	IV		Analyzin	וס	
CO3	Evaluate the perf	ormance and	interpret the	e report in the	field of Air-	V		Evaluatiı	ng.	
	Conditioning		P-00 610	r sto in the					0.	
CO-PC	Mapping :					1	1			
		PO1	PO2	PO3	PO4	P	05	PC)6	
	CO1	1			3					
	CO2	2		2	2					
	CO3			1	1					
•										
Assessi	nents:									
Two co	monents of In Se	mester Evalu	ation (ISE)	One Mid Sem	nester Examina	ation (A	ASE) a	nd one F	Ind	
Semest	er Examination (E	SE) having 2	0% 30% an	d 50% weight	s respectively		10L) a		2114	
Assessment Marks										
ISE 1				10						
MSE				30						
ISE 2 10										
ESE				50						
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									· · · ·	

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content	with 70-80% weightage for course content (normally
last three modules) covered after MSE.	

Course Contents:	
Module 1	Hrs.
Psychrometery: moist air properties; mass transfer and evaporation of water into moist air; theory of psychrometer; correlation of w.b.t. with temperature of adiabatic saturation; Lewis number; construction of psychrometric chart.	6
Module 2	Hrs.
Heat and Mass Transfer: Direct contact transfer equipment; simple air washer and indirect evaporative cooling contact mixture principle; enthalpy potential; basic equation for direct contact transfer equipment; graphical and analytical methods for heat and mass transfer analysis of air washers with heated and chilled water sprays; cooling towers. Extended Surface Heat Transfer Apparatus: Cooling and Dehumidifying coils, Design of finned surfaces, Adsorption cooling systems	6
Module 3	Hrs.
Ventilation: Necessity; ventilation standards; natural and mechanical ventilation; forces for natural ventilation; general ventilation rules; advantages of mechanical ventilation; various methods; ejector systems; determining ventilation requirement; use of decay equation.	6
Module 4	Hrs.
Air Cleaning: Physical and chemical vitiation of air; permissible concentration of air contaminants; mechanical and electronic air cleaners; dry and wet filters; air sterilization; odour control. Steam Heating Systems: Elements of steam, water and warm-air heating systems; radiators and convectors. Design of a year-round air conditioning system.,	6
Module 5	Hrs.
Air handling Equipment: Fans & Duct System Characteristics, Fan Arrangement Variable Air Volume systems, Air Handling Units and Fan Coil units. air conditioning apparatus, unitary equipment, accessory equipment, Noise control.Piping and Ducts: Pressure drops in piping and fittings; design of water and refrigerant piping; Air conditioning duct design methods.	6
Module 6	Hrs.
Industrial Applications: Major uses of air conditioning for medium sized & large industrial buildings. Application of air conditioning in Pharmaceutical, textile, electronic, precision tool room and paper industry.	6
 Module wise Measurable Students Learning Outcomes : After the completion of the course 1. Student should understand psychrometric principles of Air-conditioning system. 2. Student should understand application of heat and mass transfer principles in air conditioning. 	

- 3. Student should understand upprediction of near and mass transfer principles in a 3. Student should understand ventilation requirements for various applications.
- 4. Student should analyze air cleaning method required for the specific application.

5. Students should apply the knowledge of air conditioning equipment in the design of air conditioning system for the given application.

6. Students should understand air conditioning requirement of the specific industry.

Professional Elective (Lab) Courses

Control and control Professional Elective Heat Power Engineering Lab.4 - 4HP573 L T P Cr Professional Elective Heat Power Engineering Lab.4 - 4HP573 L T P Cr O 0 4 2 Pre-Requisite Courses:Basics and some applications and fluid mechanics. Basic of numerical techniques. Texthooks: 1. From respective theory courses Efferences: 1. 7. To microduce the students about use of numerical techniques and commercial tools available for analysis of thermal system. 3. 7. To prepare the student to do experiment and calculate the various parameters in the field of Fluid Mechanics, Hear Transfer. 4. 4. To train the students to analyze the performance of various thermal systems systems. Course Objectives : CO1 After the completion of the course the student should be able to substances. Bloom's Cognitive level Descriptor CO2 Carry out the analysis of various thermal systems by through lab set IV Analyze ups CO3 Evaluate the performances of various thermal systems by conducting V Evaluate experiments. CO4 PO1 PO2 PO3 PO4 PO5 PO6 CO3 Evaluate the performances of various thermal systems by conducting V Evaluate	Ti	itle of	f the Co	urse:												
Index one of the role of any neering back. If the DSDDDDDDPre-Requisite Courses:Textbooks:1. From respective theory coursesReferences:1. From respective theory coursesCourse Objectives :1. To introduce the student about use of numerical techniques and commercial tools available for analysis of thermal system.3. To prepare the student about use of numerical techniques and commercial tools available for analysis of thermal system.Course Learning Outcomes:COAfter the completion of the course the student should be able toBloom's Cognitive level DescriptorCO1After the completion of the course the student should be able toBloom's Cognitive level DescriptorCO2Carry out the analysis of various thermal systems by conducting experiments.CO2CO13OPO4PO5PO6CO2Corry out the analysis of various thermal systems by conducting experiments.CO2PO1PO2PO3PO4PO5PO6 <td colspan<="" td=""><td>Pr</td><td>ofess</td><td>ional El</td><td>ective Hea</td><td>t Power Engir</td><td>peering Lah</td><td>4 - 4HP5</td><td>73</td><td></td><td></td><td>L</td><td>т</td><td>Р</td><td>Cr</td><td>•</td></td>	<td>Pr</td> <td>ofess</td> <td>ional El</td> <td>ective Hea</td> <td>t Power Engir</td> <td>peering Lah</td> <td>4 - 4HP5</td> <td>73</td> <td></td> <td></td> <td>L</td> <td>т</td> <td>Р</td> <td>Cr</td> <td>•</td>	Pr	ofess	ional El	ective Hea	t Power Engir	peering Lah	4 - 4HP5	73			L	т	Р	Cr	•
Pre-Requisite Courses:Basics and some applications and fluid mechanics. Basic of numerical techniques. Textbooks: 1. From respective theory courses References: 1. From respective theory courses Course Objectives : 1. To introduce the students about the techniques used to measure properties of various substances. 2. To educate the student about use of numerical techniques and commercial tools available for analysis of thermal system. 3. To prepare the student to do experiment and calculate the various parameters in the field of Fluid Mechanics, Heat Transfer. 4. To train the students to analyze the performance of various thermal systems systems. Course Learning Outcomes: CO After the completion of the course the student should be able to Bloom's Cognitive level Descriptor CO1 Perform the experiments to find thermal properties of given III Applying substances. CO2 Cary out the analysis of various thermal systems by conducting V Evaluate experiments. CO3 Evaluate the performances of various thermal systems by conducting V Evaluate experiments. CO4 PO1 PO2 PO3 PO4 PO5 PO6 CO2 2 2 1 1 1 1 1 Lob Assessment: There are four components of lab assessment, LA1	11	01035			t i ower Engli	Lab.	, , , , , , , , , , , , , , , , , , , ,	15			0	0	1	2	-	
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WAAV I Indicated starting week of Namester	N.	laolz 1	indicat	related do	ocumentation	aster	-	Sub	mission a	at the ei	nd of W	eek 18				

Lab activities/Lab performance shall include performing experiments, mini-project, presentations,

drawings, programming and other suitable activities, as per the nature and requirement of the lab course.

Course Contents: Experiments from PE 3 and PE 4 based on elective selected.

PE 3 - IC engine design	20 Hrs.
1. Study Constructional details of I.C. Engines by Dismantling and assembly of	
I.C .engine.	
2. Study of Various systems of I C Engine (air inlet, exhaust, cooling, lubrication,	
Fuel supply, Ignition, starting – SI and CI Engines)	
3. Study of fuel injection system of diesel engine.	
4. Trail on 1 cy diesel Engine. (non-computerized)	
5. Trail on 1 cy diesel engine (computerized)	
6. Trail on multi cylinder four stroke petrol engine.	
7. Assignment on Design of intake and exhaust manifold system	
8. Assignment on Thermal design of Piston, Connecting Rod,	
9. Assignment on Thermal design of Crankshaft, camshaft and cylinder head.	
10. Assignment on Design of Fuel injection system.	
Note: Instructor may take some trials or give assignments other than mentioned based	
on the course modules.	
PE 3 - Design of heat exchanger	20 Hrs
E 5 - Design of heat exchanger (any eight)	201115.
1. Study/trial on double ning best such an asr	
1. Study/trial on double pipe heat exchanger	
2. Study/ trial on shell and tube heat exchanger	
3. Study/trial on shell and screw heat exchanger	
4. Study/trial on barried neat exchanger	
5. Study/trial on compact neat exchanger	
6. I nermal analysis of calorimeter	
7. Study/trial on cooling tower	
8. Study/trial for performance comparison compact near exchanger	
9. Study/that on cross now near exchanger	
10. Study/that on the tube heat exchanger 11. Design, of heat exchanger using standards and code	
The Design of near exchanger using standards and code	20 Цла
2 3 - Industrial reirigeration ((any 10 experiments from given list)	20 Hrs.
1. Trial on refrigeration tutor.	
2. Trial on cascade system.	
3. Trial on ICE plant	
4. Irial on multi evaporator system.	
5. Irial on Fault simulator.	
 Design/Simulation of domestic retrigeration systems 	
7. Design and analysis commercial refrigeration systems	
8. Performance study of Cold room	
9. Visit to Cold Storage unit	
10. VISIT TO MILK processing and Storage unit	
11. VISILIO Commercial reingeration Equipment manufacturing unit.	
PE 4–Cryogenics	20 Hrs.
1. Study/Demonstration of behavior of material at cryogenic temperature	
2. Study/demonstration of applications of cryogenics	
3. Study/ demonstration of cryocooler	
4. Study/trial on pulse tube cryocooler	
4. Study/trial on pulse tube cryocooler5. Study/demonstration of cryogenic storage system	
 4. Study/trial on pulse tube cryocooler 5. Study/demonstration of cryogenic storage system 6. Study/demonstration of cryogenic insulators 	

8. Sin 9. Sti	mulation of cryocooler udv/demonstration of measurement.		
PE 4 - M	odeling of IC engines	20 Hrs	
PE 4 - Mo 1. St 2. M 3. Si 4. Si 5. Si 6. Sl 7. Si 8. Si 9. Si	odeling of IC engines audy of different Modeling techniques. Iodeling of Internal Combustion Engine processes SI and CI Engines imulation of Otto Cycle with Air as working medium imulation of Otto Cycle with Adiabatic combustion imulation of Otto Cycle with Progressive combustion I Engine simulation with Gas exchange processes imulation of Diesel Cycle with Air as working medium imulation of Diesel Cycle with Adiabatic combustion imulation of Diesel Cycle with Adiabatic combustion	20 Hrs.	
10. C	I Engine simulation with Gas exchange processes		
10. 0	Eligine siniciation with Sus exchange processes		
PE 4 - Inc	dustrial air conditioning (any 10 experiments from given list)	20 Hrs.	
1. Ti	rial on Air Conditioning Tutor.		
2. Ti	rial on Central AC plant.		
3. V (S	isit to Central air conditioning plant for a Mall . Study of Design, installation and Performance of the system)		
4. V (S	isit to Central air conditioning plant for Theatre. Study of Design, installation and Performance of the system)		
5. V	isit to automobile air conditioning service station.		
6. A	nalysis of air distribution in air conditioned room.		
7. C	lean rooms and its applications.		
8. Se	election of air conditioning systems for different applications.		
9. A	ir conditioning applications of heat Pumps.		
10. Ei	nergy analysis for air conditioning system –Case study		
11. D	etermination of pressure loss and heat loss through ducting system		

Mandatory Life Skill Courses

Title of	f the Course: Constitution of India 4IC601								
			L	Т	Р	Cr			
			02	-	-	-			
Pre-Re	equisite Courses: -								
Textbo	oks:								
1.	1. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.								
2.	2. M. P. Jain, Indian Constitution Law, 7 th Edn., Lexis Nexis, 2014.								
3.	3. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.								
Refere	nces:								
1. T	The Constitution of India, 1950 (Bare Act), Government Publicatio	n							
Course	e Objectives :								
The obj	jectives of the course are:								
1.	To review and create awareness on various provisions in the const	itution	of In	dia.					
Course	e Learning Outcomes:								
CO	After the completion of the course the student should be able	Bloon	n's Co	ognitive					
	to	level	D	escripto	r				
001				1 /	1'				
COI	Explain the premises informing the twin themes of liberty and	2	U	ndersta	nding				
	freedom from a civil rights perspective.								
CO2	Address the growth of Indian opinion regarding modern Indian	2	U	ndersta	nding				
	intellectuals' constitutional role and entitlement to civil and								
	economic rights as well as the emergence of nationhood in the								
	early years of Indian nationalism.								
CO3	Address the role of socialism in India after the commencement	2	U	ndersta	nding				
	of the Bolshevik Revolution in 1917 and its impact on the initial								
	drafting of the Indian Constitution.								
CO-PC) Mapping :								
	1 2 3 4 5 6								
	CO1								
	CO2								
	CO3								
Assess	ments :								
Teache	er Assessment:								
	Assessment	Ma	arks						
	ISE 1	1	0						
	MSE	3	30						
	ISE 2	1	0						
	ESE	5	50						

Course Contents:	
Module 1	4 Hrs.
History of Making of the Indian Constitution	
Drafting Committee, (Composition & Working)	
Module 2 Philosophy of the Indian Constitution	4 Hrs.
Preamble, Salient Features	
Module 3 Contours of Constitutional Rights & Duties	5 Hrs.
Fundamental Rights; Right to Equality; Right to Freedom; Right against Exploitation;	
Right to Freedom of Religion; Cultural and Educational Rights; Right to Constitutional	
Remedies; Directive Principles of State Policy; Fundamental Duties.	
Module 4 Organs of Governance	5 Hrs.
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions,	
Executive, President, Governor, Council of Ministers	
Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions	
Module 5 Local Administration	5 Hrs.
District's Administration head: Role and Importance,	
Municipalities: Introduction, Mayor and role of Elected Representative,	
CEO of Municipal Corporation.	
Pachayati raj: Introduction, PRI: ZilaPachayat.	
Elected officials and their roles, CEO ZilaPachayat: Position and role.	
Block level: Organizational Hierarchy (Different departments),	
Village level: Role of Elected and Appointed officials,	
Importance of grass root democracy	
Module 6 Election Commission	5 Hrs.
Election Commission: Role and Functioning.	
Chief Election Commissioner and Election Commissioners.	
State Election Commission: Role and Functioning.	

Title of	the Course: Pedagogy Studies 4IC602								
		L	Т	Р	Cr				
		02	-	-	-				
Pre-Re	quisite Courses: -								
Textbo	oks:								
1. Agra	1. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum								
Studies	Studies, 36 (3): 361-379.								
2. Akye	ampong K (2003) Teacher training in Ghana - does it count? Multi-site	e teache	r educa	tion rese	earch				
project	(MUSTER) country report 1. London: DFID.								
3. Akye	ampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching	g and lea	arning	of basic	maths				
and read	ling in Africa: Does teacher preparation count? International Journal E	ducation	nal Dev	elopme	nt, 33				
(3): 272	-282.								
4. Chav	an M (2003) Read India: A mass scale, rapid, 'learning to read' campa	ign.							
5. www	.pratham.org/images/resource%20working%20paper%202.pdf.								
Referen	nces: 1. Alexander RJ, 2001, Culture and pedagogy: International comp	parisons	in prin	nary					
education	on, Oxford and Boston: Blackwell.								
2. Acke	rs J, Hardman F (2001) Classroom interaction in Kenyan primary scho	ols, Cor	npare,	31 (2):					
245-26	l								
Course	Objectives :								
The obj	ectives of the course are:								
1. To di	scuss pedagogical practices being used by teachers in formal and inform	mal clas	srooms	in deve	loping				
countrie	28.								
2. To pi	ovide the evidence on the effectiveness of these pedagogical practices,	, in what	t condi	tions, an	d with				
what po	pulation of learners.								
3. To e	explain teacher education (curriculum and practicum) and the scho	ol curri	culum	and gu	idance				
materia	Is best support effective pedagogy.								
Course	Learning Outcomes:	51	. ~						
CO	After the completion of the course the student should be able to	Bloom	's Cogi	nıtıve					
		level	Des	criptor					
CO1	Outline pedagogical practices, and existing evidence on the review	2	Ur	derstan	ding				
	topic to inform programme design and policy making undertaken.								
CO2	Explain critical evidence gaps to guide the development	2	Uno	lerstand	ing				

CO-PO Mapping :

	1	2	3	4	5	6
CO1						
CO2						
CO3						

leacher Assessment:			
Assessment	Marks		
ISF 1	10		
MSE 20			
ISE 2	10		
ESE 50			
Lot	50		
Module 1 Introduction and Methodology		5Hrs	
Aims and rationale Policy background Conceptual	framework and Terminology Theories	5111 5.	
of learning Curriculum Teacher education Concen	tual framework Research questions		
Overview of methodology and Searching	tuar frame work, Research questions,		
Module 2		5 Hrs.	
Thematic overview: Pedagogical practices are being	used by teachersin formal and informal		
classrooms in developing countries.	2		
Curriculum, Teacher education.			
Module 3		5 Hrs.	
Evidence on the effectiveness of pedagogical practic	es, Methodology for the in depth stage:		
Evidence on the effectiveness of pedagogical practic quality assessment of includedstudies.	es, Methodology for the in depth stage:		
Evidence on the effectiveness of pedagogical practic quality assessment of includedstudies.How can teacher education (curriculum and practiculum)	m) and the schoolcurriculum and		
Evidence on the effectiveness of pedagogical practic quality assessment of includedstudies. How can teacher education (curriculum and practicu guidance materials best support effective pedagogy?	ees, Methodology for the in depth stage: m) and the schoolcurriculum and Theory of change.		
Evidence on the effectiveness of pedagogical practic quality assessment of includedstudies. How can teacher education (curriculum and practicu guidance materials best support effective pedagogy? Strength and nature of the body of evidence for effective	es, Methodology for the in depth stage: m) and the schoolcurriculum and Theory of change. ctive pedagogicalpractices.		
Evidence on the effectiveness of pedagogical practic quality assessment of includedstudies. How can teacher education (curriculum and practicu guidance materials best support effective pedagogy? Strength and nature of the body of evidence for effect Pedagogic theory and pedagogical approaches, Teac	ees, Methodology for the in depth stage: m) and the schoolcurriculum and Theory of change. ctive pedagogicalpractices. chers' attitudes and beliefs and		
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 Evidence on the effectiveness of pedagogical practic quality assessment of includedstudies. How can teacher education (curriculum and practicu guidance materials best support effective pedagogy? Strength and nature of the body of evidence for effective pedagogic theory and pedagogical approaches, Teac Pedagogic strategies. Module 4 	ees, Methodology for the in depth stage: m) and the schoolcurriculum and Theory of change. ctive pedagogicalpractices. chers' attitudes and beliefs and	5 Hrs.	
Evidence on the effectiveness of pedagogical practic quality assessment of includedstudies. How can teacher education (curriculum and practicu guidance materials best support effective pedagogy? Strength and nature of the body of evidence for effect Pedagogic theory and pedagogical approaches, Teac Pedagogic strategies. Module 4 Professional development: alignment with classroom	ees, Methodology for the in depth stage: m) and the schoolcurriculum and Theory of change. ctive pedagogicalpractices. chers' attitudes and beliefs and m practices andfollow-up support	5 Hrs.	
 Evidence on the effectiveness of pedagogical practice quality assessment of includedstudies. How can teacher education (curriculum and practicul guidance materials best support effective pedagogy? Strength and nature of the body of evidence for effective pedagogic theory and pedagogical approaches, Teace Pedagogic strategies. Module 4 Professional development: alignment with classroom Peer support, Support from the head teacher and the pedagogic strategies. 	ees, Methodology for the in depth stage: m) and the schoolcurriculum and Theory of change. ctive pedagogicalpractices. chers' attitudes and beliefs and m practices andfollow-up support e community, Curriculum and	5 Hrs.	
 Evidence on the effectiveness of pedagogical practice quality assessment of includedstudies. How can teacher education (curriculum and practicul guidance materials best support effective pedagogy? Strength and nature of the body of evidence for effect Pedagogic theory and pedagogical approaches, Teac Pedagogic strategies. Module 4 Professional development: alignment with classroom Peer support, Support from the head teacher and the assessment, Barriers to learning: limited resources and pedagogical processional development. 	ees, Methodology for the in depth stage: m) and the schoolcurriculum and Theory of change. ctive pedagogicalpractices. chers' attitudes and beliefs and m practices andfollow-up support e community, Curriculum and and large class sizes	5 Hrs.	
 Evidence on the effectiveness of pedagogical practice quality assessment of includedstudies. How can teacher education (curriculum and practicul guidance materials best support effective pedagogy? Strength and nature of the body of evidence for effective pedagogic theory and pedagogical approaches, Teace Pedagogic strategies. Module 4 Professional development: alignment with classroom Peer support, Support from the head teacher and the assessment, Barriers to learning: limited resources a Module 5 	ees, Methodology for the in depth stage: m) and the schoolcurriculum and Theory of change. ctive pedagogicalpractices. chers' attitudes and beliefs and m practices andfollow-up support e community, Curriculum and and large class sizes	5 Hrs.	
Evidence on the effectiveness of pedagogical practice quality assessment of includedstudies. How can teacher education (curriculum and practicul guidance materials best support effective pedagogy? Strength and nature of the body of evidence for effect Pedagogic theory and pedagogical approaches, Teac Pedagogic strategies. Module 4 Professional development: alignment with classroom Peer support, Support from the head teacher and the assessment, Barriers to learning: limited resources a Module 5 Research gaps and future directions	ees, Methodology for the in depth stage: m) and the schoolcurriculum and Theory of change. ctive pedagogicalpractices. chers' attitudes and beliefs and m practices andfollow-up support e community, Curriculum and and large class sizes	5 Hrs. 5 Hrs.	
 Evidence on the effectiveness of pedagogical practice quality assessment of includedstudies. How can teacher education (curriculum and practicul guidance materials best support effective pedagogy? Strength and nature of the body of evidence for effective pedagogic theory and pedagogical approaches, Teacher Pedagogic strategies. Module 4 Professional development: alignment with classroom Peer support, Support from the head teacher and the assessment, Barriers to learning: limited resources a Module 5 Research gaps and future directions Research design, Contexts, Pedagogy, Teacher education 	ees, Methodology for the in depth stage: m) and the schoolcurriculum and Theory of change. ctive pedagogicalpractices. chers' attitudes and beliefs and m practices andfollow-up support e community, Curriculum and and large class sizes	5 Hrs.	

Title o	f the Course: Disaster Management 4IC603						
		L	Т	Р	Cr		
		02	-	-	-		
Pre-Re	equisite Courses: -						
Textbo	ooks: R. Nishith, Singh AK, "Disaster Management in India: Perspectives, is:	sues and	l strates	vies "'N	ew		
	Royal book Company.			5			
2.	2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.						
3.	Goel S. L., Disaster Administration And Management Text And Case S	studies"	,Deep&	Deep			
Course	e Objectives :						
1 ne ob	Jecuves of the course are: To impart knowledge for critical understanding of key concepts in disa	ster risk	reducti	ion and			
1.	humanitarian response, and disaster management approaches	5001 115K	reduct				
2.	Critically evaluate disaster risk reduction and humanitarian response po- multiple perspectives	olicy and	l practi	ce from			
3.	Develop an understanding of standards of humanitarian response and pa	ractical	relevan	ce in sp	ecific		
4	types of disasters and conflict situations.	aromm	ing in d	lifforant			
4.	countries, particularly their home country or the countries they work in	gramm	ing in c	interent			
Course	e Learning Outcomes:						
CO	After the completion of the course the student should be able to	Bloom	ı's Cog	nitive			
		level	Des	scriptor			
CO1	Explain disaster risk reduction and humanitarian response policy and practice from multiple perspectives	2	U	nderstan	ding		
CO2	Summarize standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.	2	Un	derstand	ling		
CO3	Outline the strengths and weaknesses of disaster management	2	Un	derstand	ling		
	approaches, planning and programming in different countries.				U		
CO-P(O Mapping :		I				
	CO1 CO1						
	CO2						
	CO3						
Assoss	ments .						
Teach	er Assessment:						
	Assessment M	arks					
	ISE 1	10					
	MSE	30					
	ISE 2	10					

ESE	50			
Module 1 Introduction		4 Hrs.		
Disaster: Definition, Factors and Significance; Differ	rence Between Hazard and Disaster; Natural			
and Manmade Disasters: Difference, Nature, Types and Magnitude.				
Module 2 Repercussions Of Disasters And Hazards				
Economic Damage, Loss Of Human And Animal	Life, Destruction Of Ecosystem. Natural			
Disasters: Earthquakes, Volcanisms, Cyclones, Ta	sunamis, Floods, Droughts And Famines,			
Landslides And Avalanches, Man-made disaster	:: Nuclear Reactor Meltdown, Industrial			
Accidents, Oil Slicks And Spills, Outbreaks Of Disea	ase And Epidemics, War And Conflicts.			
Module 3 Disaster Prone Areas In India		4 Hrs.		
Study Of Seismic Zones; Areas Prone To Floods	and Droughts, Landslides and Avalanches;			
Areas Prone To Cyclonic And Coastal Hazards V	Vith Special Reference To Tsunami; Post-			
Disaster Diseases And Epidemics				
Module 4 Disaster Preparedness And Manageme	nt	4 Hrs.		
Preparedness: Monitoring Of Phenomena Triggering	A Disaster Or Hazard; Evaluation Of Risk:			
Application Of Remote Sensing, Data From Meteoro	ological and Other Agencies, Media Reports:			
Governmental and Community Preparedness.				
Module 5 Risk Assessment		4 Hrs.		
Disaster Risk: Concept and Elements, Disaster Ris	k Reduction, Global and National Disaster			
Risk Situation. Techniques Of Risk Assessment, Gl	obal Co-Operation In Risk Assessment and			
Warning, People's Participation In Risk Assessment	. Strategies for Survival.			
Module 6 Disaster Mitigation		4 Hrs.		
Meaning, Concept and Strategies Of Disaster M	itigation, Emerging Trends In Mitigation.			
Structural Mitigation And Non-Structural Mitigation	h, Programs Of Disaster Mitigation In India.			

Title of the Course: Value Education 4IC604						
		L	Т	Р	Cr	
		02	-	-	-	
Pre-Requisite Courses: -						
Textbooks:						
1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University						
Press, New Delhi						
Course Objectives ·						
The objectives of the course are:						
1 To impart knowledge on value of education and self- development						
2 To implify and values in students						
3 To highlight importance of character						
Course Learning Outcomes:						
CO After the completion of the course the student should be able to			Bloom's Cognitive			
		level	Des	Descriptor		
CO1 Explain value of education and self- development.		2	Uı	Understanding		
CO2 Summarize importance of good character and Behavior 2 Understandi			ling			
development.						
CO-PO Mapping :						
CO1	CO1					
CO2	CO2					
CO3						
Assessments :						
Teacher Assessment:						
Assessment	Marks					
	10					
MSE 30						
	10					

Module 1	6Hrs.	
1. Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.		
2. Moral and non- moral valuation. Standards and principles.		
3. Value judgments		
Module 2		6 Hrs.
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1.	Importance of cultivation of values	
2.	Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness,	
	Cleanliness.	
3.	Honesty, Humanity. Power of faith, National Unity.	
4.	Patriotism. Love for nature, Discipline	
Module 3		7 Hrs.
1.	Personality and Behavior Development - Soul and Scientific attitude. Positive	
	Thinking. Integrity and discipline.	
2.	Punctuality, Love and Kindness.	
3.	Avoid fault Thinking.	
4.	Free from anger, Dignity of labour.	
5.	Universal brotherhood and religious tolerance.	
6.	True friendship.	
7.	Happiness Vs suffering, love for truth.	
8.	Aware of self-destructive habits.	
9.	Association and Cooperation.	
10	. Doing best for saving nature	
Module 4		7 Hrs.
1.	Character and Competence – Holy books vs Blind faith.	
2.	Self-management and Good health.	
3.	Science of reincarnation.	
4.	Equality, Nonviolence, Humility, Role of Women.	
5.	All religions and same message.	
6.	Mind your Mind, Self-control.	
7.	Honesty, Studying effectively	