Pimpri Chinchwad Education Trust's

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

SECTOR NO. 26, PRADHIKARAN, NIGDI, PUNE 411044

An Autonomous Institute Approved by AICTE and Affiliated to SPPU, Pune

DEPARTMENT OF MECHANICAL ENGINEERING



Curriculum Structure and Syllabus

of

TY B Tech Mechanical Engineering

(Course 2020)



Effective from Academic Year 2022-23

Institute Vision

To Serve the Society, Industry and all the Stakeholders through the Value-Added Quality Education.

Institute Mission

To serve the needs of society at large by establishing State-of-the-Art Engineering, Management and Research Institute and impart attitude, knowledge and skills with quality education to develop individuals and teams with ability to think and analyze right values and self-reliance.

Quality Policy

We at PCCOE are committed to impart Value Added Quality Education to satisfy the applicable requirements, needs and expectations of the Students and Stakeholders. We shall strive for academic excellence, professional competence and social commitment in fine blend with innovation and research. We shall achieve this by establishing and strengthening state-ofthe-art Engineering and Management Institute through continual improvement in effective implementation of Quality Management System.



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LIST OF ABBREVIATIONS IN CURRICULUM STRUCTURE

Sr. No.	Abbreviation	Type of Course					
1.	BSC	Basic Science Course					
2.	ECC	Engineering Core/ Science Course					
3.	HSMC	Humanities, Social Sciences and Management Course					
4.	PCC	Programme / Professional Core Course					
5.	PEC	Programme / Professional Elective Course					
6.	OEC	Open Elective Course					
7.	PROJ	Project					
8.	INTR	Internship					
9.	AC	Audit Course					
10.	MC	Mandatory Course					
11.	LS	Life Skill					
12.	PFC	Proficiency Course					
13.	МО	MOOC Course					
14.	L	Lecture					
15.	Р	Practical					
16.	Т	Tutorial					
17.	Н	Hours					
18.	CR	Credits					
19.	IE	Internal Evaluation					
20.	MTE	Mid Term Evaluation					
21.	ETE	End Term Evaluation					
22.	TW	Term Work					
23.	OR	Oral					
24.	PR	Practical					

CURRICULUM FRAMEWORK (2020-2021; 2021-2022; 2022-2023; 2023-2024)

The Course and Credit Distribution

Sr. No.	Type of Courses	No of Courses	Total Credits No
1.	Basic Science Course (BSC)	8	23
2.	Engineering Core/ Science Course (ECC)	13	22
3.	Humanities, Social Sciences And Management Course (HSMC)	6	13
4.	Professional Core Course (PCC)	17	48
5.	Professional Elective Course (PEC)	6	18
6.	Open Elective Course (OEC)	6	18
7.	Project (PROJ) "Knowledge Brings	Freedo ₂ n"	16
8.	Internship (INTR)	ididates 1	3
9.	Audit Course (Audit)	3	-
10.	Mandatory Course (MC)	2	-
11.	Life Skill (LS)	4	-
12.	Proficiency Course (PFC) "Knowledge Brin	gs Freedom"	-
13.	Massive Open Online Course (MOOC)	Confidents	-
	Total	73	161

	COURSE DISTRIBUTION : SEMESTER WISE												
Sr.	Type of Course		No of Courses/ Semester										
No.	Type of Course	1	2	3	4	5	6	7	8	Totai			
1.	Basic Science Course (BSC)	3	3	2	-	-	-	-	-	8			
2.	Engineering Core Course (ECC)	6	5	1	1	-	-	-	-	13			
3.	Humanities, Social Sciences And Management Course (HSMC)	1	1	1	1	1	1	-	-	6			
4.	Professional Core Course (PCC)	-	-	5	4	3	3	2	-	17			
5.	Professional Elective Course (PEC)	-	-	-	1	2	2	2	-	6			
6.	Open Elective Course (OEC)	-	-	<u>, -</u>	1	1	2	2	-	6			
7.	Project (PROJ)	- 1	1	4		-	60	-	1	2			
8.	Internship (INTR)	-		-	-	-	-	-	1	1			
9.	Audit Course (Audit) "Knowled	ge B	rings	Fre	edlon) ^{**} 1	1	-	-	3			
10.	Mandatory Course (MC)	redit	ilitz C	sud-de	864	1	1	-	-	2			
11.	Life Skill (LS)	1	1	1	1	-	-	-	-	4			
12.	Proficiency Course (PFC)	lin <u>e</u> se	-	1	1	1	1	-	-	4			
13.	MOOCs								1	1			
	Total	11	11	11	10	10	11	6	3	73			

	CREDIT DISTRIBUTION : SEMESTER WISE											
	1 Lecture hour = 1 Credit 2 Lab Hours = 1 Credit 1 Tutorial Hour = 1 Credit											
Sr.	Sr. Type of Courses		No of Credits /Semester									
No.			2	3	4	5	6	7	8	Total		
1.	Basic Science Course (BSC)	9	9	5	-	I	-	-	-	23		
2.	Engineering Core Course (ECC)	9	7	3	3	5	-	-	-	22		
3.	Humanities, Social Sciences And Management Course (HSMC)	2	2	3	2	2	2	-	-	13		
4.	Professional Core Course (PCC)		-	11	12	9	8	8	-	48		
5.	Professional Elective Course (PEC)	J.	1	-	-	6	6	6	-	18		
6.	Open Elective Course (OEC)	-		1	3	3	6	6	-	18		
7.	Project (PROJ)	_	2	-		-	-	-	14	16		
8.	Internship (INTR)	g <u>e</u> B	ring	s F <u>r</u> ee	don	1 T	-	-	3	3		
9.	Audit Course (Audit)	-	-		<u> </u>	Χ-	-	-	-	-		
10.	Mandatory Course (MC)	-	-	-	7-	-	-	-	-	-		
11.	Life Skill (LS)	44 <u>1</u> 5 1	<u> </u>	-	-	-	-	-	-	-		
12.	Proficiency Course (PFC)	-	-	-	-	-	-	-	-	-		
13.	MOOCs	-	-	-	-	-	-	-	-	-		
	Total	20	20	22	20	20	22	20	17	161		

Curriculum structure TY B Tech Mechanical Engineering

CURRICULUM STRUCTURE FOR 3rd YEAR B. TECH. MECHANICAL ENGINEERING

Course Code	Course	Course Name	Teaching Scheme				Evaluation Scheme					e				
couc	турс		т	р	т	н		CR	1	IF	MTF	FTF	тw	DD	OP	Total
			L	1			TH	PR	Total	112		LIL	1 **	IN	OK	10141
BME5410	PCC	Heat Transfer	3	-	-	3	3	-	3	20	30	50	-	-	-	100
BME5411	PCC	Machine Design	3	-	-	3	3	-	3	20	30	50	-	-	-	100
BME5412	PCC	Fluid Mechanics & Machinery Lab	- \	2	-	2	-	1	1	-	-	-	25	-	25	50
BME5413	PCC	Heat Transfer Lab	(P)	2	-	2		1	1	-	-	-	25	50	-	75
BME5414	PCC	Machine Design Lab		2		2	-	1	1	2	-	-	25	-	50	75
BME5501	PEC	Professional Elective Course- I (Thermal)	3	00	-	3	3	13	3	20	30	50	-	-	-	100
BME5502	PEC	Professional Elective Course - II	3	-	1	3	3		3	20	30	50	-	-	-	100
	OEC	Open Elective - II	3	-	-	3	3	-	3	20	30	50	-	-	-	100
BHM5113	HSMC	HSMC-V	2	1-		2	2	1	2	30	CUD S	20	-	-	-	50
BME5913	PFC	CAE Analysis	-	2	-	2	-	-								
BHM5917	МС	Professional Development Kno Training-I	31	edg	e E	31 ³ 11	gs	Fre	edo	n"		G	RAD	E		
BHM9961	AUDIT	Environmental Science	1	-	-	1	ла Лан		-							
		Total	21	8	-	29	17	3	20	130	150	270	75	50	75	750

SEMESTER – V

Abbreviations are: L-Lecture, P-Practical, T-Tutorial, H- Hours, IE- Internal Evaluation, MTE- Mid Term Evaluation, ETE- End Term Evaluation, TW – Termwork, OR - Oral

Semester - V

List of courses – Professional Elective Course – I

Course Code	Course Name	
BME5501A	Design of Fan, Blower and Compressor	
BME5501B	Incompressible Flow Machines	Chasses
BME5501C	Steam and Gas Turbine	Choose any one
BME5501D	Internal Combustion Engines	

List of courses – Professional Elective Course – II

Course Code		
BME5502A	Product Design and Development	
BME5502B	Smart Manufacturing	
BME5502C Advanced Materials & Manufacturing		Choose any one
BME5502D	Design Thinking	
BME5502E	Design for Reliability	

List of courses – Open Elective Course – II

Course Code	Department	Course Name	
BAS5607	AS&H	Statistical Data Analysis Using R	
BCI5602A	CIVII	Total Quality Management	
BCI5602B	CIVIL	Intelligent Transport System	
BCE5601	COMPLITER	Data Structures Using Python	Choose any one
BCE5602	COMPUTER	Programming with C++	Choose any one
BET5601	E & TC	Smart City: An Electronic Perspectives	
BET5602	Earc	Modeling and Simulation	
BIT5601	IT	Object Oriented Programming	

List of courses – Humanities, Social Sciences and Management Course – V

Course Code	Course Name
BHM5113	Principles Management

List of courses – Proficiency Course – III

Course Code	Course Name
BME5913	CAE Analysis

List of courses – Audit Courses – II

Course Code	Course Name
BHM9961	Environmental Science

CURRICULUM STRUCTURE FOR 3rd YEAR B. TECH. MECHANICAL ENGINEERING SEMESTER –VI

Course Course Course Name				1	Tea	ching	g Sch	eme			Evaluation Scheme					
Code	Туре	Course Maine	т	P	Т	н		CR		IF	MTE	FTF	тw	PR	OR	Total
			L	-	C ¹ C	- 11	TH	PR	Total	IL		EIL	1 **	IK	UK	Total
BME6413	PCC	Numerical Methods & optimization	2		-	2	2	- /	2	20	30	50	-	-	-	100
BME6414	PCC	Mechatronics	3	-	-	3	3	-	3	20	30	50	-	-	-	100
BME6415	PCC	Design Engineering lab	-	2	1	2	-	1	1	-	-	-	25	-	25	50
BME6416	PCC	Numerical Methods & optimization Lab	10	2	2 - NS	2	-	1	1	3	-	-	-	25	-	25
BME6417	PCC	Mechatronics Lab	1	2	-	2		1	1		60	-	-	-	25	25
BME6503	PEC	Professional Elective- III	3	-	-	3	3	-	3	20	30	50	-	-	-	100
BME6504	PEC	Professional Elective- IV (Design)	3			3	3		3	20	30	50	-	-	-	100
	OEC	Open Elective - III	3	wle	da	3 8 B	3 ring	IS FI	3 reeda	20	30	50	-	-	-	100
	OEC	Open Elective - IV	3	1	-	3	3	Yay	3	20	30	50	-	-	-	100
BHM6114 To BHM6116	HSMC	HSMC-VI	2	5-7	- 1	2	2	lenca R	2	30	-	20	-	-	-	50
BME6914	PFC	Computational Fluid Dynamics	-	2	-	2	-	-	-							
BHM6918	MC	Professional Development Training-II	3	-	-	3	-	-	-			(GRAI	DE		
BHM9962	AUDIT	Constitution of India	1	-	-	1	-	-	-							
		Total	23	8	0	31	19	3	22	150	180	320	25	25	50	750

Abbreviations are: L-Lecture, PR-Practical, T-Tutorial, H- Hours, IE- Internal Evaluation, MTE- Mid Term Evaluation, ETE- End Term Evaluation, TW – Termwork, OR - Oral

Semester - VI

List of courses – Professional Elective Course – III

Course Code		
BME6503A	Non - Conventional Energy Systems	
BME6503B	Biomechanics and Biomedical Engineering.	
BME6503C	Hydraulics & Pneumatics	Chaosa any ana
BME6503D	Industrial Engineering	Choose any one
BME6503E	Design of Transmission systems	
BME6503F	Alternative Energy Sources for I. C. Engines	

List of courses – Professional Elective Course – IV

Course Code	Course Name
BME6504	Mechanical System Design (Design Module)

List of courses – Open Elective Course - III

Course Code	Department	Course Name	
BAS6608	AS&H	Multivariate Data Analysis Using R	
BCI6603A	CIVII	Remote Sensing and GIS	
BCI6603B	CIVIL	Building Services and Maintenance	
BCE6603	COMDUTED	Information Security	Chaosa any ana
BCE6604	COMPUTER	Principles of Software Engineering	Choose any one
BET6601	$\mathbf{F} \boldsymbol{k} \mathbf{T} \mathbf{C}$	Designing with Raspberry Pi	
BET6602	Lait	Basics of Automotive Electronics	
BIT6601	IT	Web Technology	

List of courses – Open Elective Course - IV

Course Code	Department	Course Name	
BCI6604A	CIVII Smart Cities & Building Automations		
BCI6604B	CIVIL	Mechanical Electrical Plumbing (MEP) Systems	
BCE6605	COMDUTED	Fundamentals of Machine Learning	
BCE6606	COMPUTER	JAVA Programming	Choose any one
BET6603	E & TC	Designing with Arduino platform	
BET6604	Earc	Communication Protocols for e-Vehicle	
BIT6602	IT	Mobile Application Development	

List of courses – Humanities, Social Sciences and Management Course - VI

Course Code	Course Name	
BHM6114	Project Management	
BHM6115	Financial Management	Choose any one
BHM6116	Entrepreneurship Development	

List of courses – Proficiency Course – IV

Course Code	Course Name
BME6914	Computational Fluid Dynamics

List of courses – Audit Courses - III

Course Code	Course Name					
BHM9962	Constitution of India					

Course Syllabus TY B Tech Semester-V

Progr	gram: B. Tech. (Mechanical) Semester : V									
Cours	e:	Heat Tran	sfer (PCC)					Code : BME541	10	
		Te	aching Sche	me			1	Evaluation Sch	neme	1
Lectu	ure	Practical	Tutorial	Credit		MTE	TW	PR 50	ETE	Total
J Prior	know	<u>ل</u> بامامه مf۰	-	4	20	30	25	50	50	1/5
a.	Mat	nematics: Inf	tegration and	derivatives						
b.	Stea	dy flow ener	gy equation		, ,					
с.	Con	cept of boun	dary layer ar	e essential						
Cours	se Ob	jectives:			_				_	
1.	To un	derstand the	application	of conducti	on equation	n to various g	eometries	s with and without	t heat genera	tion
2.	To ge	t conversant	with method	nt analysis Is of detern	of fumped s	systems. transfer coeff	ficient in	natural and forced	l convection	heat transfer
4.	To lea	arn estimatio	n radiation h	eat transfer	between o	biects with si	mple geo	metries	Convection	ficat transfer
5.	To ge	t conversant	with method	ls of design	and analys	is of heat exc	changer.			
Cours	se Ou	tcomes:			•					
After	learni	ng the cours	e, students sł	ould be ab	le to					
1.	Analy	ze the basic	heat conduc	tion equation	on for stead	ly, one dimen	isional the	ermal systems wit	h and withou	it internal
2	energ Com	y generation	on thickness	and avalue	to boot our	montation by	, fin onnli	ication		
2.	Analy	vze transient	one dimensi	onal therm	al system b	v using gover	ning equ	ations and charts		
4.	Analy	ze the heat	transfer phen	omenon in	natural and	forced conv	ection.	ations and charts.		
5.	Evalı	ate heat trai	nsfer by radia	ation betwe	en objects	with simple g	eometries	S		
6.	Desig	n and evalu	ate the perfo	rmance of j	parallel/ co	unter/ cross fl	low heat e	exchangers.		
					Detaile	d Syllabus:				D
Unit					Descr	iption				Duration (H)
	Мо	des of Heat	Transfer an	d General	Heat Cond	luction Equa	ation:			(11)
	Mod	les and Lav	vs of heat tr	ansfer, the	rmal condu	ctivity, therr	nal diffu	sivity. Boundary	and initial	
1	Con	ditions, Solu	ution of Stea	ady one di	mensional	heat conduct	ion Prob	lems by applying	, boundary	6
	con	litions. One	dimensional	steady sta	te heat con	duction with	and with	out heat generation	on in plane	
	wall	, solid cylin	der & sphere	, with diffe	rent bounda	ary condition	s.			
	Con Elec	trical analog	erials and E	xtended St	iriaces:	mal resistance	a natwork	Application to	multi	
	lave	red (Compos	site) plane wa	all. hollow	cvlinder an	d hollow sphe	ere. critic	al thickness of ins	sulation for	
2	cylir	der and sph	ere, economi	cal and cos	t considera	tion.				6
	Heat	transfer from	m finned sur	faces, Type	s of fins, G	overning Equ	uation for	constant cross se	ctional	
	area	fin, Solution	n for infinitel	y long fin,	negligible ł	neat loss from	n fin tip, s	hort fins (correcte	ed length),	
	Fin e	efficiency &	effectivenes	8.						
	Tra Vel	nsient heat	conduction:	ad anatam	onalizzia T	list and Four	nian mumb	an Transiant and	lucia maina	
3	v an	ally and cri	analysis Tin	bed system	analysis, E	nse of therm	ner nume	er, Transient ana Transient heat an	alveis with	6
	spec	cial effects b	v using Heisl	er and Gro	ber charts.		seoupie,	Transfert fieur an	arysis with	
	Con	vective Hea	t Transfer:							
	Fun	damentals o	f convection	: Mechanis	sm of natur	al and force	d convect	tion; local and av	erage heat	
	tran	sfer coefficie	ent, concept	of velocity	& thermal	ooundary laye	ers,		-	
	Exte	ernal Forced	Convection:	Dimensio	nless numb	ers and their	physical	significance; Flo	w over flat	6
4	plate For	es, cylinders	s, spheres, e	mpirical c	orrelations	for both la	uminar ar	id turbulent flow	s; Internal	0
	tem	perature con	ditions Emr	i incinar a	elations for	both laminar	and turbi	ilent flows in tube		
	Nati	aral convect	ion: Introduc	tion, dime	nsionless n	umbers and t	their physic	sical significance,	Empirical	
	corr	elations for a	natural conve	ection over	surfaces.		1 2	e ,	1	
	The	rmal Radia	tion:							
	Fun	damental co	ncepts of ra	diation, Di	fferent law	s of radiatio	n, Radiat	tion shape factor,	Radiation	
5	neat Rad	istion Shield	etween blac.	k surfaces.	, Radiation	neat transi	er betwe	en Diffuse Gray	surfaces,	6
5	Boil	ing and con	densation:							
	Poo	l boiling cur	ve, different	regimes o	f boiling he	eat transfer, c	critical he	at flux, Film and	drop wise	
	cone	lensation			-					

6	Heat Exchanger: Classification, applications, concept of overall heat transfer coefficient, fouling factor, Heat exchanger analysis using LMTD for parallel flow and counter flow heat exchange, LMTD correction factor for multi-pass and cross flow heat exchangers by using charts, Effectiveness– NTU method for	6
	parallel flow heat exchanger and counter flow heat exchanger, use of charts for multi-pass and cross flow heat exchangers selection of heat exchangers	
	Total	36
Text	Books:	
1.	Y.A. Cengel and A. J. Ghajar, Heat and Mass Transfer - Fundamentals and Applications, Tata Mc	Graw Hill
	Education Private Limited, 2019	
2.	F.P. Incropera, D.P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley, 2009.	
Refer	ence Books:	
1.	J. P. Holman, Heat Transfer, McGraw – Hill publication, 2002.	
2.	P. K. Nag, Heat and Mass Transfer, McGraw Hill Education Private Limited, 2011	
3.	R.C. Sachdeva, Fundamentals of Engineering Heat and Mass Transfer, New Age Science, 2009.	
4.	C.P. Kothandaraman, S.V.Subramanyam, Heat and Mass Transfer Data Book, New Academic, 2008.	
LIST	OF EXPERIMENTS	
Any e	ight experiments (1-11) and two assignments (12-14) from the following list	
1.	Determination of Thermal Conductivity of metal rod	
2.	Determination of Thermal Conductivity of insulating powder	
3.	Determination of Thermal Conductivity of Composite wall	
4.	Determination of Thermal Contact Resistance	
5.	Determination of heat transfer coefficient in Natural Convection	
6.	Determination of heat transfer coefficient in Forced Convection	
/.	Determination of temperature distribution, fin efficiency in Natural / Forced Convection	
8.	Determination of Emissivity of a Test surface	
9.	Determination of Steran Boltzmann Constant	
10.	Determination of effectiveness of heat exchanger	
11.	Assignment on 1 D transient heat transfer are says using finite difference wethed	
12.	Assignment to solve transient heat transfer program using limite difference methods.	
13.	Assignment to solve transferit field transfer problem using fielder and Orober Charls.	
14.	Assignment on multi-pass / cross-now neat exchanger using enectiveness charts.	

Progra	ram: B. Tech. (Mechanical) Semester : V										
Course	rse : Machine Design (PCC) Code : BME5411										
	Teaching Scheme Evaluation Scheme										
Lectu	ire Pra	actical	Tutorial	Credit	IE	MTE	ETE	TW	PR	OR	Total
3		2	-	4	20	30	50	25		50	175
Prior l	knowledge	of									
a.	Engineer	ing Mec	hanics,								
b.	Elements	of Mecl	hanical Engi	ineering							
с.	Strength	of Mater	rials								
d.	Engineer	ing Mate	erials and m	etallurgy							
e.	Kinemati	cs and T	heory of M	achines							
I.	Manufac	turing Sc	cience are es	ssential							
Course	e Objectiv	es:	h 1:								
1 his	A noluzo	is at ena	bling the stu	dents to:	the dome	in of moching	design and	m ovido o	ltornot	a colut	iona
1.	Choose	and den	tion by aval	untion of alterna	ta solutio		e design, and j	provide a	nernat	e solut	lons.
2. 3	Drosont f	ha soluti	on graphica	lly using moder	n tools for	ns modeling wi	th roprosontat	ion of G	ר&ר		
J.	o Outcome		on graphica	iny using moder		modening wi	in representat		Jai.		
Δfter 1	e Outcome	COURSE	the students	will be able to							
1		STAND	the design	considerations a	nd IDEN	TIFV the apr	licable consid	lerations	for giv	ien ani	lication
1.	DESIGN	I the ma	chine comp	onents subjected	to static	loading based	on strength a	nd rigidi	tor gr	/en apj	Jiication.
2.	DESIGN	the ma	chine eleme	nts subjected to	fluctuatin	o stresses	i on strength a	ina mgran	.y.		
3. 4	DESIGN	the not	ver screws a	and bolted conne	ctions for	the industria	lapplications				
5	SELEC	Γa rollir	ng contact he	earing for the give	ven applic	ation	r upprications				
<i>5</i> . 6.	DESIGN	the spu	r gears for t	he industrial apr	olications	, autom					
		· ···· ····	8		etailed S	vllabus:		96			
U nit				De	scription	<u>, 11410 487</u>	4.3	0	A.	D	uration
Omt				De	seription				<u>.</u>		(H)
	Fundam	ientals o	f design- D	esign, types of o	design, de	sign cycle, de	esign consider	ations, D	esign	1	
1.	for manu	ifacture,	design for	assembly, prefer	rred numb	per and series	, use of stand	lards and	code	$5 \times$	6
	in design	i, Aestne	tic and ergo	nomic considera	ations in c	lesign, Mater	al selection n				
2	Design C	of machi	ine element	s subjected to s	tatic load	ang based of	Strength an	a Kigiai	y norta	8	
Δ.	besign C	of machine	ne compone	shefts balical a	omprossi	, Axially all	d on strongth	y loaded		1	6
	Dased off	f Mash	i. Design of	shafts, hencal c		on spring base	ed on strength	and rigit	шу		-
	S N Die	or Mach	Ine element	s subjected to I	atronath	g stresses	omnonanta fo	r infinito	and		
3.	S N Dia finita lif	igraiii, E	avalia load	ing Design of a	strength,	infinite and t	Sinita life und	r minnte	oting	I	6
	strassas 1	e under	Sodorborg	Goodman diagr	ame and (Corbor parabo		er nuctu	aung		
	Design of	f Dowor	Sorows on	d boltod connor	ations		na.		5.77		
	Design o	crews_	Suitable thr	ead forms Tor	aue requi	red in overco	ming thread	friction	while		
4	lifting au	nd lower	ing the loa	d efficiency and	d self-loc	king/ overha	ling conditio	ns com	ound		6
т.	and differential screws						U				
	Bolted connections. Design of eccentrically loaded bolted connections										
	Rolling	Contact	Bearings	or cocontrolling	104404 0						
_	Classific	ation. se	lection of b	earing type for g	viven appl	ication. Statio	c and dynamic	c load car	rving		
5.	5. capacity, selection of deep groove and taper roller bearings, Design for varying load and speeds, Bearings with life other than rated life., Bearing mounting and preloading of bearings.								6		
	Design o	of Spur (Gears		,	0 0	C	,	U		
(Design of	of spur g	gears- Select	tion of appropri	ate gear o	drive for give	n application	, Fundan	nental		(
0.	geometri	c relatio	ons, Gear to	oth failures, De	sign base	d on reverse	d bending stre	ess fluctu	ating		0
	contact s	tresses,	Gear lubrica	tion.	-		-		-		
									Total		36
Text B	Books:										
1.	V B Bha	ndari, D	esign of Ma	chine Elements,	Tata Mc	Graw Hill Puł	olication, 4 th E	Edition 20)17		
2.	J K Gupt	a, R S K	Churmi, A te	st Book of Macl	nine Desig	gn, S Chand F	Publication, 20	005.			
3.	Kamlesh	Purohit	, K. C. Shar	ma, Design of M	Iachine E	lements - Pres	ntice Hall Ind	ia Public	ation, 2	2002.	
1 1	N C Do	ndua C	N Shah M	Jaching Design	Charatar	Publishing 2	006				

N. C. Pandya, C. N. Shah, Machine Design, Charotar Publishing, 2006.
 P C Gope, Machine Design Fundamentals and Applications, PHI, EEE, 2012.

Reference Books:

- 1. Robert L Norton, Machine Design: An Integrated Approach, Pearson Education, 2000
- 2. George E. Dieter, George Ellwood Dieter, Linda C. Schmidt, Engineering Design, McGraw-Hill Education, 2008
- 3. Richard Gordon Budynas, J. Keith Nisbett, Shigley's Mechanical Engineering Design, McGraw Hill, 2015.
- 4. V B Bhandari, Machine Design Data Book, , TMH Publication, 2019.
- 5. Paul H. Black, O. Eugene Adams, Paul H. Black, O. Eugene Adams, Machine Design by, McGraw Hill, 1981
- 6. Merhyle Franklin Spotts, Terry E. Shoup, Lee Emrey Hornberger, Design of Machine Elements Vol 1 and 2, 2004

e-sources:

NPTEL Course lectures links:

https://www.youtube.com/watch?v=ofmbhbVCUqI&list=PL3D4EECEFAA99D9BE&index=3
https://www.youtube.com/watch?v=py5xbKHGA
https://www.youtube.com/watch?v=SL21aDqgs8Q
https://youtu.be/PEKfS2Q1WqM
https://www.youtube.com/watch?v=PEKfS2Q1WqM&list=PL3D4EECEFAA99D9BE&index=19
https://www.youtube.com/watch?v=TPURJnlekeo
https://www.youtube.com/watch?v=WRoPQGE0WdI
https://www.youtube.com/watch?v=WRoPQGE0WdI
https://www.youtube.com/watch?v=WRoPQGE0WdI
https://www.youtube.com/watch?v=py5xbKHGA
https://www.youtube.com/watch?v=YZYcMtkZiDY
https://www.youtube.com/watch?v=py5xbKHGA
https://www.youtube.com/watch?v=py5xbKHGA
https://www.youtube.com/watch?v=YZYcMtkZiDY
https://www.youtube.com/watch?v=tTBnW5gAieM
https://www.youtube.com/watch?v=46quOD7V-cQ
https://youtu.be/T4IgtIkBnOo

Term work

Term work shall consists of the following

A. Design Project: Any ONE topic based on real life application

- i. Design of manually operated or motorized application of Power screw in real life application.
- ii. Design of single stage gearbox for industrial applications..
- iii. Design of automotive valve operating mechanism.
- Design data book shall be used wherever necessary to achieve selection of standard components leading to minimum cost of the product being developed.
- The detailed design report containing, problem selection, problem analysis, problem definition, Solution based on all applicable design considerations, exclusive summary reflecting final dimensions of parts, Leaflet comprising the final specifications of the product designed, cost, Instructions to the users shall be submitted.
- 2D Part drawing in two views (preferably one sectional view exploring internal features of the parts) with representation of geometric, dimensional tolerances, surface roughness symbols, other instructions such as the surface coating, heat treatments to be submitted.
- 2D assembly drawing in two views (preferably one sectional view exploring internal features of the assembly), with representation of overall dimensions, centre distances, dimensions ensuring alignment of parts in assembled condition, locations at which a particular fit is to be achieved, bill of materials representing clearly the OEM parts and parts to be manufactured in-house with correct representation of materials quantity, costing, Warrantee applicable to OEM parts.

OR

Design Project to develop and apply the knowledge of Machine Design and drafting software for any mechanical system on the basis of: (1) Idea generation, (2) Creativity, Reliability and safety, (3) Design parts of the system (4) Ergonomic Considerations (5) Use of International standards.

B. Assignment: Any TWO topics from the following list

- a. Case study on design of springs used in automotive application (Minimum 2different springs).
- b. Study of bolted connections in two wheeler containing purpose, type of loading, design approaches for the bolts.
- c. Identification of components of a bicycle subjected to static and fluctuating loads and suggesting design approaches for each.
- d. Case study on selection of bearing for any two the real life applications

A report (4-5 pages)/ poster and Power Point Presentation on these topics in a group of 4-5 students to be submitted while presenting the assignment.

Note: A group of 4-5 students shall work together for the design project and assignment.

Program:	B. Tech.	B. Tech. (Mechanical) Semester : V									
Course :	Fluid Me	chanics & M	achinery La	b (PCC)			Code : BN	ME5412			
	Teachin	g Scheme	<u> </u>			Evaluatio	on Scheme				
Lecture	Practical	Tutorial	Credit	IE	MTE	TW	OR	ЕТЕ	Total		
	2	-	1			25	25		50		
Prior know	wledge:				•				•		
a. Fur	ndamental co	oncepts and la	ws/governin	g equations of	of Fluid Mech	anics.					
b. Fur	ndamental co	oncepts and la	ws/governin	g equations of	of physics and	Mathemati	cs.				
are	essential										
Course O	bjectives:										
1. To	learn to use	various instru	ments relate	d to measure	ment of Press	ure, Temper	rature, Velo	city, Flow rat	e etc.		
2. To	2. To experimentally verify the principles of Fluid Mechanics										
3. To learn to conduct trials of various equipment like turbine, pumps, compressors											
4. To	learn to eval	luate and anal	yze the perfo	ormance of e	quipment like	turbine, pu	mps, compre	essors			
Course O	utcomes:										
After learn	ing the cour	se, students sl	nould be able	e to							
1. Do	measuremen	nts of flow pro	operties like	Pressure, Te	mperature, Ve	elocity, Flow	v rate etc				
2. To	. To identify the types of flows										
3. To	To experimentally verify the impulse momentum principle										
4. To	To use and calibrate various flow measurement devices										
5. To	conduct trial	ls on impulse	and reaction	turbines and	l analyze the p	performance	•				
6. To	conduct trial	ls on centrifug	gal Pump and	l Compresso	r and analyze	the perform	ance.				
				Detailed	Syllabus:						
LIST OF	EXPERIMI	ENTS									
Any four	experiments	out of 1 to 7	and any fou	rout of 8 to	• 14 are to be	e conducted					
1. Det	ermination of	of viscosity of	liquids and	its variation	with temperat	ture.					
2. Det	ermination of	of Laminar an	d Turbulent	flow by Rey	nolds's appara	atus.					
3. Vei	rification of	modified Beri	noulli's equa	tion.							
4. Cal	ibration of C	Drifice meter/	Venturimete	r.							
5. Det	ermination of	of hydraulic c	oefficients of	f orifice/ V-1	notch						
6. Det	ermination of	of Major and 1	minor losses	through pipe	es.						
7. Me	asurement o	f static pressu	re distributio	on, lift and d	rag around an	aerofoil usi	ng wind tun	nel apparatus	•		
8. Vei	rification of	Impulse Mom	entum Princ	iple							
9. Des	sign of Pump	ping system u	sing industri	al manuals.							
10. Per	formance an	alysis of Imp	ulse Turbine	under differ	ent conditions						
11. Per	formance an	alysis of Read	ction Turbine	e under diffe	rent condition	s.					
12. Per	formance an	alysis of Cent	trifugal Pum	p under diffe	rent condition	1S.					
13. Per	formance an	alysis of Cent	trifugal Com	pressor unde	er different con	nditions.					
14. Cas	se study on '	Use of fans/bl	owers/comp	ressor/pump	s in Process Ir	idustry. (Stu	ident has to	visit process	industry		
usii	ng any of the	e listed turbo i	nachines and	l prepare cas	e study report	on the same	e.)				
Text Book	S:		1. 51.11		137 11	a. 1 17		N DIII	2017		
1. Mo	di P N & Se	th S N, Hydra	ulics, Fluid	Mechanics a	nd Machinery	, Standard E	Sook House,	New Delhi,	2017		
2. Ma	nish Dubey,	BVSSS Prasa	id, Archana	Nema, I urbo	o-Machinery,	, McGraw F	111,2018				
3. Cho	$\frac{\partial W}{\partial W}$, V.I. and	i iviaidment, F	iyarology fo	r Engineers,	McGraw-Hill	i inc., Ltd,20	J14				
Keierence	DOOKS:	. Eunderse	als of Tl	maahirraa	ohn Wilco 0	Sama 2007					
1. W1	mam w. Per	g, rundament	als of Turbo	machinery, J	Creary LU11 10	SONS,2007					
2. 5.N	1. Tanya , Iu	amaghing N	Hessors & Fa	uis, 1 ata-MC	Graw Hill, 19	200					
3. B. U	0. Pai, 1 urb	b Gülich Cor	ney mana,20	2007_{000}							

4. Johann Friedrich Gülich ,Centrifugal Pump ,2007cae

Program	n: B. Tech. (Me	chanical)	S	Semester : V			
Course	Design of Fa	ns, Blowers and	d Compressor	rs (PEC-I)	0	Code : BME5501A	
	Teaching	Scheme			Evaluatio	on Scheme	
Lect	ure Practical	Hours	Credit	IE	MTE	ЕТЕ	Total
3		3	3	20	30	50	100
Prior kn	owledge:		· · ·				
a.	Fundamental concep	ts and laws/gov	erning equation	ons of Fluid Me	chanics.		
b.	Fundamental concep	ts and laws/gov	erning equation	ons of Engineeri	ing Thermodynar	mics.	
с. а	re essential	unematics.					
Course	Objectives:						
This cou	rse aims at enabling	the students to					
1.	To make the student	s conversant wi	th the basic pr	inciples, govern	ning equations an	d applications of Fa	ns, Blowers
_	and Compressors in	real life and ind	lustrial domair	1.	_		
2.	To understand the co	onstruction, wor	king principle	and evaluate th	e performance cl	haracteristics of Fan	s, Blowers
2	To develop the comp	atanay to ident	ify and analyz	a the losses and	flow instabilitio	in Fong Plowers	nd
5.	Compressors.	petency to ident	ify and analyz	e the losses and	now instabilities	s III Falls, Diowers a	liu
4.	To create awareness	about present e	nergy scenario	and energy co	nservation in con	npressible flow mac	hines through
	the design modificat	ions.	25	2.		1	U
5.	To create awareness	about the recen	t innovations i	in compressible	flow machines		
Course	Outcomes:						
After lea	rning the course, the	students will be	e able to:				
1.	Apply the impulse n	nomentum princ	ciple to different	nt plate profile	es and recognize	use of turbo machine	es for
2	Design Centrifugal (Compressors un	der different fl	luid flow condit	tions		
3	Analyze the perform	ance of Axial f	low Compress	ors under differ	ent fluid flow co	nditions	
4.	Analyze the perform	ance of Fans an	d blowers und	ler different flui	d flow condition	S.	
5.	Identify the opportu	nities of energy	conservation i	n the applicatio	ons of compresse	d air	
6.	Identify and appreci	ate the recent de	evelopments in	fans, blowers a	and compressor t	echnology and impr	ovement in
	their performance						
			Detai	led Syllabus:			
Unit			Desc	ription			Duration
	Fundamentals of	Turbomochino		•			(H)
	Classification of	Turbomachines.	. Basic equati	ion of energy	transfer between	n fluid and rotor.	
1	Navier Strokes Eq	uation, Impulse	Momentum j	principle and its	s applications, fo	orce exerted by jet	6
1	of water on flat	plate(Fixed, Me	oving),curved	plate at its ce	enter or one of	the tip(Fixed and	
	Moving), Series of	plates(Flat an	d Curved), Po	erformance ana	lysis of above	cases in terms of	
	Centrifugal Com	ressor					
	Classification of ro	todvnamic com	pressors, blow	vers and fans.			6
2	Centrifugal compr	essor: Construct	tion and worki	ing, flow proces	ss on T-S Diagram	m, velocity diagram	Ŭ
	and Euler's work,	slip factor and i	ts effect on we	ork input, actua	l work input, din	nension parameters,	
	pre-whirl losses, p	erformance cha	racteristics, su	irging, choking,	, and stalling cha	racteristics.	
	Axial Flow Comp Construction and	working stage	velocity tria	noles and its a	nalvsis flow r	process on T-S	
3	Diagram, dimens	ionless parame	ters, flow thro	ough the blade	rows, pressure	rise across the	6
	stage, stage losses	and efficiencies	, performance	characteristics.	· •		
	Fans and Blowers	6					
4	Classification of I	Fans and blowe	ers, Basics of	stationary and	moving air, Eu	lers characteristics,	6
	velocity triangles	and operating p	ressure condit	tions, governing	g equations for b	lowers, Losses and	v
	nyuraune emcienc	y, surge and sta	an, Application	ns of blowers al	iu talis.		

5	Energy Conservation in Compressed air systemPresent energy scenario, Applications of compressed air in industry, Compressed air network, Leakdetection in compressed air network, Methods to improve the performance.	6
	Recent innovations in compressible flow machines	4
6	performance metrics and functionality.	0
	Total	36
Text B	poks:	
1	Manish Dubey, BVSSS Prasad, Archana Nema ,Turbo-Machinery,McGraw Hill,2018	
2	S.M. Yahya, Turbines, Compressors & Fans,, Tata-McGraw Hill, 2005.	
3	R. K. Rajput, Thermal Engineering, 2009.	
Referen	ce Books :	
1	William W. Perg, Fundamentals of Turbomachinery, John Wiley &Sons,2007.	
2	L.C.Witte, P.S.Schmidt, D.R.Brown ,Industrial Energy Management and Utilisation, Hemisphere Publication Washington, 1988.	1
3	W.C.Turner, Energy Management Handbook, Wiley, New York, 1982.	

Progra	am:	B. Tech. (Me	chanical)			Semester : V				
Cours	e :	Incompressi	ble Flow Mac	hines (PEC-I)			Code : BME5501	3		
		Teaching	g Scheme			E	valuation Scheme			
Lect	ure	Tutorial	Hours	Credits	IE	MTE	ETE		Total	
3	3		3	3	20	30	50		100	
Prior	knowled	ge:		1 1		1				
a. b. c.	Fundam Fundam Fundam are esse	nental concept nental concept nentals of Mat ential	s and laws/gov s and laws/gov hematics.	verning equation verning equation	s of Fluid Mee s of Engineeri	chanics. ing Thermo	odynamics.			
Cours	e Object	ives:	T 7							
To make the students conversant with the basic principles, governing equations and applications of Hydraulic										
1. To make the students conversant with the basic principles, governing equations and applications of Hydrautic										
2. To understand the construction, working principle and evaluate the performance characteristics of Hydraulic										
	Turbines and rotary pumps.									
3.	3. To develop the competency to identify and analyze the losses and flow instabilities in Hydraulic Turbines and rotary									
	pumps.									
4.	4. To create awareness about present energy scenario and hydro potential.									
5.	To ma	ke the student	s conversant v	vith the various i	ndustrial pum	ps.				
Cours	e Outcoi	mes:								
I ne St	A noluci	the impulse m	omontum prin	ainla to different	nlata profile	a and race	aniza usa of Turbor	achina	for anobling	
1.	a sustainable society									
2.	2. Estimate load factor, utilization factor, capacity factor of Hydropower plants									
3.	 Design Impulse water Hydraulic Turbines and Analyze the performance of under different fluid flow conditions. 									
4.	Design	Reaction wat	er Hydraulic T	Turbines and Ana	alyze the perfo	ormance of	under different fluid	flow c	onditions.	
5.	Design	rotary pumps	and Analyze	the performance	under differen	nt fluid flo	w conditions.			
6.	Select	pumps for var	ious industrial	applications						
				Detaile	ed Syllabus:				Duration	
Unit				Descri	ption				(H)	
1	Funda Classif Strokes flat pla plates(1	mentals of Tu ication of Tu s Equation, In ate(fixed, mov flat and curved	urbomachinen bomachines, l npulse Momen ving),curved p d), Performanc	cy: Basic equation o tum principle an late at its center analysis of abo	f energy trans d its applicati r or one of th ove cases in te	sfer betwee ons, force ne tip(Fixe erms of effi	en fluid and rotor, N exerted by jet of wat d and Moving),Seri ciency and work dor	avier er on es of ne.	6	
2	Basics Classif factor, classifi	of Hydropow ication of Hy estimation of cation.	v er Plants: dropower plan f hydropower	nts, Definition o potential. hydro	of terms – loa opower develo	nd factor, u opment in	utilization factor, Ca India, Hydropower	pacity plants	6	
3	Impuls Classif Pelton specific	se Water Tur ication of Hy Wheel, design c speed, Selec	bine: draulic Turbin gn aspects ,P tion of Turbin	nes, Working pr erformance para es	rinciple, constant	truction, v	elocity diagram, Mu curves, Unit Quan	ıltijet tities,	6	
4	Reactien Classif of rea Cavitat	on Water Tu ication of Rea ction, Perfor tion, Governin	rbine: action water tu mance param ag of water Tu	rbines, Working eters, character rbines	principle, co istics curves,	nstruction, , Draft T	velocity diagram, d ube-types and ana	egree lysis,	6	
5	Rotary Classif triangle priming operati	y Pumps: ication of roto es and their an g of pumps, sp on of pumps,	odynamic pum alysis, effect o pecific speed, j system resista	ps, components of of outlet blade an performance cha nce curve, select	of centrifugal gle, cavitation racteristics of ion of pumps.	pump, type n, NPSH, T centrifugal	es of heads, velocity Thoma''s cavitation fa I pump, series and pa	actor, arallel	6	

6	Industrial Pumps: Turbine Pumps, API Process Pumps, Canned Motor Pumps, Circulator Pumps, Drum Pumps, Submersible Pumps, End Suction Pumps, Grinder Pumps, Chopper Pumps, Booster Pumps, Syringe Pumps.	6
	Total	36
Text E	Books:	
1.	Manish Dubey, BVSSS Prasad, Archana Nema , Turbo-Machinery, McGraw Hill, 2018.	
2.	Chow, V.T. and Maidment, "Hydrology for Engineers", McGraw-Hill Inc., Ltd, 1987.	
3.	P N Modi &Seth ,Fluid Mechanics and Hydraulic Machines , Standard book house,2006.	
Refere	nce books:	
1 2	 Subramanya, K., "Engineering Hydrology", Tata McGraw-Hill Publishing Co., Ltd, 1994. Johann Friedrich Gülich, Centrifugal Pump, 2007. 	

Program	B. Tech. (Mechanical) Semester : V										
Course:	Steam & Gas Tu	rbines (PEC-l	()	r		Code:	BME550	1C			
	Teaching S	cheme	Г]	Evaluatio	on Schem	e			
Lecture	Practical	Hours	Credits	IE	MTE	TW	OR	ETE	Total		
3	-	3	3	20	30			50	100		
Prior Kn	owledge of										
a. Fu	indamental concepts ai	nd laws/govern	ing equations	s of Fluid N	lechanics.						
b. Fu	indamental concepts and amountal soft Mathematical	nd laws/govern	ing equations	s of Engine	ering Therm	odynamic	es.				
C. FU	re essential	natics.									
Course ()hiectives:										
This cours	se aims at enabling the	students to									
1. T	1. To make the students conversant with the basic principles, governing equations and applications of Steam and Gas										
Т	Turbine.										
2. T	o understand the const	truction, working	ng principle a	and evaluate	e the perform	nance cha	racteristic	s of Stear	n and Gas		
1 2 T	urbine.	out the present	anaray soona	rio and the	recent inner	votions in	Stoom on	d Goo Tur	hina		
Course O	utcomes.	out the present	energy scena				Steam an	u Gas Tui	one.		
After learn	ning the course, studen	ts should be ab	ole to								
1. Ap	poly the impulse mome	entum principle	to different	plate profi	les and reco	gnize use	of turbor	nachines f	or enabling a		
sus	stainable society.	I I I		I I .		0			0		
2. An	alyze the energy trans	fer through the	steam nozzle	es.							
3. An	alyze the performance	of Steam Turb	ine under van	rious condi	tions.						
4. An	alyze the performance	of Gas turbine	under variou	is condition	IS.	·	ef Cterre		Truching for		
5. Ap	ply the principle of or obling a sustainable so	energy convers	sion, design	parameters	and recogn	iize use o	of Steam	and Gas	Turbine for		
6. Ide	entify and appreciate the	he recent innov	ations in des	ign and per	formance of	steam ar	nd gas turl	oines and	improvement		
in	their performance.			-Bit und per		steam a	ia gas tar				
			Detaile	d Syllabus	•						
Unit			Desc	ription					Duration (H)		
	Fundamentals of T	urbomachiner	y:								
	Classification of	Furbomachines	, Basic equa	tion of en	ergy transfe	r between	n fluid ar	nd rotor,			
1	Navier Strokes Eq	uation, Impulse	Momentum	principle a	nd its applic	cations, fo	orce exerte	ed by jet	6		
	of water on flat p	plate(fixed, mo	oving), curved	plate at 1	ts center or	one of	the tip(Fi	xed and			
	efficiency and wor	k done	u curveu), r	errormance	analysis o	above o	cases in t	erms or			
	Steam Nozzle:	k done.									
	Stagnation Proper	ties- Function	of nozzle -	Applicatio	ns and Typ	es- Flow	through	nozzles-			
2	Thermodynamic an	nalysis – Assun	nptions -Velo	ocity of noz	zle at exit-Ic	leal and a	ctual expa	unsion in	6		
4	nozzle- Velocity c	oefficient- Con	dition for ma	aximum dis	scharge, Crit	ical press	sure ratio-	Criteria	U		
	to decide nozzle sl	hape- Super sat	turated flow,	its effects,	Degree of s	uper satu	ration and	l Degree			
	of under cooling -	wilson line.									
3	Construction and	working of	Impulse ar	nd Reactio	n steam t	urbine. v	velocity (liagram.	6		
č	characteristics curv	ves, governing	of steam turb	ines, losses	in steam tur	bine.	, ero ero y		Ū		
	Multistage Steam	Furbine									
4	Need, significance	e and types of	f multistagin	ng of stea	am turbine,	Velocity	Triangle	s ,Stage	6		
-	Efficiency, The St	age Inlet Flow	Profiles, Se	electing the	Blade Row	Geomet	ry, Dimer	sionless	Ū		
	Performance Paran	neters, Airtoil (Jeometry, Se	election of t	blade geomet	try					
	General layout of	GTPD compo	ments of CT	PP onen	losed know	i_ closed	evela ac	turbino			
5	plant. Bravton cycle analysis for thermal efficiency, work ratio, maximum & optimum pressure 6										
	ratio, inter-cooling; reheating & regeneration cycle gas and steam turbine combined cycle plant.										
	environmental imp	acts of GTPP.	<u> </u>					· '			

6	Recent developments in steam and gas turbine technology Recent innovations in design and other aspects to improve the performance metrics of steam and gas turbine.	6
	Total	36
Text Bo	oks:	
1.	R. Yadav, Steam and Gas Turbines and Power Plant Engineering, VII edition, Central Publ. House, 2021.	
2.	R. K. Rajput, Thermal Engineering ,2009.	
Referen	ce Books:	
1.	Manish Dubey, BVSSS Prasad, Archana Nema ,Turbo-Machinery,McGraw Hill,2018	
2.	A.S. Leyzerovich ,Steam Turbines for Modern Fossil-Fuel Power Plants ,2006.	
3.	Claire Soares, Gas Turbines, A Handbook of Air, Land and Sea Applications ,2014.	

Progra	ogram: B. Tech. (Mechanical) Semester : V									
Cours	e :	Internal Combu	stion Engines (PEC-I)			Code: BN	AE5501D)		
		Teac	ching Scheme			Evalı	ation Sc	heme		
Lectu	ire	Practical	Hours	Credit	IE	MTE	ETE		Total	
3		-	3	3	20	30	50		100	
Prior a. b.	know Fur Air are e	ledge of idamental concept standard cycles fo essential	s of Thermodynamics or I. C. Engines							
Cours 1 2 3 4 5	1 To get familiar with the construction and working various engine systems 2 To understand the methods of theoretical analysis of I. C. engines 3 To learn the theory of combustion of S. I. and C. I. engines 4 To have understanding of various engine performance parameters and methods of measurement 5 To get familiar with the alternative fuels , pollution form I.C. engine and methods of controlling it									
Cours	e Out	comes:	students will be able to							
1 2 3 4 5 6	 After learning the course, the students will be able to Compare various Engine sub systems based on their advantages, drawbacks and applications. Analyze Fuel-Air cycles and actual cycles of I. C. Engines based on various parameters. Analyze the P-theta diagram of S.I. Engine for stages of combustion, rate of pressure rise, abnormal combustion etc. Analyze the P-theta diagram of C.I. Engine for stages of combustion, rate of pressure rise, abnormal combustion etc. Calculate the performance parameters of I. C. Engines and analyze the performance characteristics curves. Compare various alternative fuels based on the desirable properties for their utilization in LC. Engines 									
	Detailed Syllabus:									
Unit	Description									
1.	Engine systems : Heat Engine, IC and EC engines, Engine classification ,I.C. Engine construction - components and materials, Engine nomenclature, Comparison of S.I. & C.I., 4-s and 2-s Engines, Applications. Valve operating system, Valve timing diagram (Theoretical & Actual), Cooling System, Lubrication System Ignition System Coverning system Starting System								6	
2.	Eng Fuel spec Fuel	ine Cycles: air cycle analysi ific heat, dissociat Air cycle, Air S meters on losses i	is and its importance, A tion, Effect of A/F ratio Standard cycle and Act	Assumptions and b, Comparison w ual cycle, vario	d considera ith air stan us losses i	ations, Effec dard cycle, (n actual cyc	et of vari Comparis eles, Effe	ables on of ct of	6	
	SI E	ngines:	n actuar e yere.							
3.	St Engines: Fuel supply system of S. I. Engine : Air Fuel mixture requirements, Simple carburetor, systems of carburetor, Electronic fuel injection system T.B.I, M.P.F.I., G.D.I. System, sensors, actuators and ECU. Combustion in spark Ignition engines, stages of combustion, factors affecting combustion, rate of pressure rise, abnormal combustion: Detonation, Preignition. Combustion chambers of S.I. Engine Bating of fuels in SL engines. Additives								7	
	CIE	Engines:	-							
4.	Fuel size com knoc Add and	supply system of of nozzle, Electr pression ignition of king in CI engin itives, Comparison their limitations	C.I. engine, Mechanica onic Diesel Injection s engines, stages of comb e. Types of combustion n of knocking in SI & C	I Fuel Injection ystem, sensors, ustion, factors a chambers, rati I engines, Super	system, Qu actuators ffecting co ng of fuels charging an	antity of fuo and ECU. (mbustion, P s in CI engi ad turbo-cha	el injected Combustion henomeno nes, Dop rging me	d and on in on of es & thods	6	
5.	Eng Engi Engi	ine Performance ne performance ne performance cl	& Testing: parameters, Methods of haracteristic curves, heat	f determination balance sheet.	of various	performance	ce param	eters,	5	

6.	Fuels and Emissions Control: Important qualities of S.I. & C.I. Engine fuels, Possible alternative fuels: Alcohols, C.N.G., L.P.G., Biodiesel, Hydrogen etc. Air pollution due to IC engine and its effect, Emissions Norms, Sources of emissions, Components of emission from S.I. & C.I. Engines and their causes, Measurement of emission, Emission control methods for SI and CI engines.	6				
	Total	36				
Text Books:						
1	M.L. Mathur and R.P. Sharma, A course in Internal combustion engines, Dhanpat Rai Publication, Ne Delhi,2016	W				
2	V. Ganesan: Internal Combustion Engines, Tata McGraw-Hill,2012					
3	S. Shrinivasan, Automotive Engines, Tata McGraw-Hill,2019					
Refere	ence Books:					
1	John B. Heywood, Internal Combustion Engine Fundamentals, Tata McGraw-Hill, 1988					
2	R. Yadav, Internal Combustion Engine, Central Book Depot, Ahmedabad, 2003					
3	H.N. Gupta, Fundamentals of Internal Combustion Engines, PHI Learning Pvt. Ltd., 2011					

Program: B. Tech. (Mechanical) Semester: V												
Course	e: Product De	esign and Dev	elopment (PE	C-II)		Code: BME	25502A					
	Teachir	ng Scheme	•			Evaluation S	Scheme					
Lectu	re Practical	Tutorial	Credit	IE	MTE	ЕТЕ	PR	Total				
3	-		3	20	30	50	-	100				
Prior k	nowledge of											
a.	Basic Engineerii	ng Science										
D.	Engineering Me	tallurgy										
d.	Manufacturing	processes.										
	are essential	F										
Course	e Objectives:											
To explain student's significance of												
1.	1. Product design and Product development process											
2.	Concept design a	and detailed detailed $detailed$	Sign related as	pects.								
3.	Human factors in	n design and ir	nportance of p	atents in PD	D process							
Course	• Outcomes:	ii debigii dila ii	inportance or p		D process.							
On com	pletion of the cou	rse, students w	vill be able to -	-								
1.	Understand ess	ential factors f	or product des	ign								
2.	Interpret the co	ncept design a	nd detailed des	sign during p	product deve	elopment.						
3.	Understand me	thods and proc	esses of Forwa	ard and Reve	erse enginee	ring						
4.	. Apply values design processes as DFA, DFMEA, design for remaining. Integrate the Rapid Prototyping knowledge with available system for better product development											
<i>5</i> .	6. Understand the importance of IPR and Patents.											
Detailed Syllabus:												
Unit	Description Duration,											
Unit								(H)				
	Introduction to	the Product I	Design Proces	s and its spe	cifications	ufluonoo of do	ion on cost	and				
1.	auality product	t life-cycle P	roblem staten	nent custon	anarysis, n er needs	product design	n specificatio	and 6				
	Quality Function	n Deployment.	Toblem staten	ient, custon	ier needs,	product desig.	ii specificatio	115,				
	Conceptual Des	sign										
	Establishing pro	duct functions	; functional de	composition	, morpholog	gical analysis;	concept creati	on,				
2.	concept selection	n.						6				
-	Detail Design	d design (CA	D) modeling	design si	mulation	monufo otunin o	doormontoti					
	engineering dray	u uesigii (CF vings	(D) modernig	, design si	mutation,	manuracturing	uocumentati	011,				
	Reverse Engine	ering										
	Product Teardo	wn Process,	Tear Down	Methods, F	orce Flow	Diagrams, M	easurement a	and				
3	Experimentation	n, Application	s of Product	Teardown,	Benchmar	king Approac	h and Detai	led 6				
	Procedure, Too	ls Used in B	enchmarking	Indented A	ssembly C	ost Analysis,	Function -Fo	orm				
	Diagrams, Tren	d Analysis, Se	etting Product	Specificatio	ons, Introdu	ction to Produ	ict Portfolio a	and				
	Architecture.											
	Factors influence	ing process se	lection: fabric	ation guidel	ines: design	n for manufact	uring, design	for				
4.	assembly. Desig	n for Reliabilit	y	anon guiari				6				
	Failure modes an	nd effects anal	ysis (FMEA).									
	Additive manuf	facturing and	tooling									
5.	Need of Addi	tive manufac	turing, Class	ification of	AM pro	cesses-Benefits	s- Applicatio	ons. 6				
	Stereolithograph	y Apparatus	(SLA), Fuse	d depositio	n Modelin	g (FDM), La	iminated Obj	ect				
	Human Factor	LUNI), Selecti	ve Laser Sinte	ing (SLS), I	xapiù 100li	ng.						
6	Principles of use	er-friendly desi	gns: human fa	ctors engine	ering. Valid	ation plan Dig	ital Vs Actual					
0.	Design for Susta	ainability. Gree	en design: desi	ign for zero	waste; desi	gn for disassen	nbly, Intellect	ual 6				
	property, Intelle	ctual property	and patents	-			•					
							Total	36				

Textbook:

- 1. A. K. Chitale and R.C. Gupta, Product Design and Manufacturing, PHI Learning Pvt. Ltd., 2013
- 2. George Dieter, Engineering Design, McGraw Hill Pub. Company, 2012.

References:

- 1. Kevin Otto and Kristin Wood, Product Design: Techniques in Reverse Engineering and New Product Development, Pearson Education, 2001
- 2. Michael Grieves, Product Lifecycle Management, TATA McGraw Hill Publication, 2006
- 3. James Bralla, Handbook of Product Design for Manufacturing, McGraw Hill, 1996
- 4. Karl Ulrich, product design and development, TATA McGraw Hill Publication, 2020
- 5. Rochelle Cooper Dreyfuss and Jane C. Ginsburg, Intellectual Property at the Edge: The Contested Contours of IP2, Cambridge University Press., 2014

E-Sources:

NPTEL Course lectures links:

https://nptel.ac.in/courses/112107217 (Product Design and Development-IIT Roorkee) https://onlinecourses.nptel.ac.in/noc21_me83/preview(Product Design and Development-IIT Roorkee)

https://onlinecourses.nptel.ac.in/noc22_hs59/preview (Intellectual Property By Prof. Feroz Ali | IIT Madras)

Program	ame B Tash (Mashanisal)										
Course:	Smart Manu	facturing (PF	C - II)			Code: BME5502	2B				
course.	Teachin	ng Scheme			Evaluat	ion Scheme					
Lecture	Practical	Hours	Credit	IE	MTE	ЕТЕ	Total				
3		3	3	20	30	50	100				
Prior know	vledge of:										
a. Math	ematical skills										
b. Basic	programming s	kills									
c. Tradi	tional manufact	uring processes									
Course Ob	iectives.										
1. To intr	1. To introduce the concept of smart factories, especially the various technologies involved within the smart										
manufacturing.											
2. To cov	er the technolog	gical developme	ent and its impa	ct in 4 th revolut	ion of industry.						
3. To intr	oduce the applie	cations and sco	pe for technolog	gy involved in I	ndustry 4.0.						
After learni	tcomes:	the students wi	l ba abla ta:								
1 Reco	ng uns course,	the students wi	if be able to.	d to Industry	40 and its in	nplementation in r	nanufacturing				
indus	ries.	n manaraetarn	ig trends relate	to mausify	no und no m	ipienientation in i	landraetaring				
2. Corre	late the advance	ed technologies	and their integr	ation for the in	telligent manuf	acturing.					
3. Adap	the changes in	existing manuf	acturing practic	es and relate th	e role of indust	rial robotics and ser	nsors.				
4. Identi	4. Identify the role of IoT and IIOT for smart factories, challenges and scope.										
5. Apply	5. Apply different simulation techniques for smart manufacturing.										
o. Identify applications of AK and VK in smart manufacturing. Detailed Syllabus:											
Detailed Synabus. Duration											
Unit			Desci	ription			(H)				
I	Introduction to Industry 4.0:										
1.	echnological ir	moustry 4.0	, Smart facto ry 4.0 Framew	ork for Industry	gical pillars	on of Industry 4.0,	6				
i i	1 smart manufa	cturing. Sustain	able developme	ent in industry 4	, 4.0, Applicati	on of moustry 4.0					
S	mart Manufac	turing in Indu	stry 4.0:								
2. (Overview of big	, data, data driv	en smart manuf	facturing, data	lifecycle, introd	luction to big data	6				
a	analytics, different tools used for analytics, its application and limitations										
	loud computin	ng and Cybers	ecurity in Indu	stry 4.0:	1. 1 6.						
3.	ntroduction to c	computing and	its types, cloud	computing and	l its benefits, c	loud computing in	6				
	vbersecurity tec	chnology	cybersecurity,	security princi	ipies, fisk and	opportunities in					
I	ndustrial Robo	otics and Senso	ors:								
Ι	ntroduction, Re	cent Technolo	gical Compone	nts of Robots-	Advanced Ser	sor Technologies,					
4. I	nternet of Rob	otic Things, C	oud Robotics,	and Cognitive	Architecture f	or Cyber-Physical	6				
F	Robotics, Indust	trial Robotic a	nd sensors,0-	Applications, N	Manufacturing,	Maintenance and					
A	Assembly	A utificial Tuta									
5 1	ntroduction to (Aruncial Inte	ingence in indi	usiry 4.0:	of simulation f	or smart industry	6				
J. 1	nteractive simul	lation. software	for advance sin	nulations and it	s limitations	or smart moustry,	0				
V	virtual and Au	gmented Reali	ty in Industry 4	4.0:							
6. I	ntroduction, Di	ifference in A	R and VR, H	ardware and S	Software Tech	nology, Industrial	6				
A	Applications of A	Augmented real	ity and Virtual	reality							
						Total	36				
Text Book	Text Books:										
I. Smid	P., CNC Progra	mming Handbo	OOK, Industrial H	Tess, 2005	hars 2020						
2. Leong	rist A., Industry	4.0: The Indus	trial Internet of	Things, Apress	. 2017						
e. onen		ino mado			, ,						

Reference Books:

- 1. Alp Ustundag and Emre Cevikcan, Industry 4.0: Managing the Digital Transformation, Springer, 2018.
- 2. Bartodziej, Christoph Jan, The Concept Industry 4.0: An Empirical Analysis of Technologies and Applications in Production Logistics, Springer, 2016
- Klaus Schwab, The Fourth Industrial Revolution, World Economic Forum, 2017 3.
- Christian Schröder, "The Challenges of Industry 4.0 for Small and Medium-sized Enterprises, Friedrich-Ebert-4. Stiftung, 2016
- 5. Chua C K, Leong K F, Lim C S, Rapid Prototyping, World Scientific, 2012

E-sources: www.nptel.ac.in/courses/108105003

Progra	ram: B. Tech. (Mechanical) Semester : V									
Cours	e: Adva	anced I	Materials & Ma	anufacturing	(PEC-II)		Code : B	ME5502C		
	Г	eachir	ig Scheme	-		- 1	Evaluation S	cheme		
Lectu	ire Prac	ctical	Tutorial	Credit	IE	MTE	ETE	PR	Total	
3	<u> </u>	-		3	20	30	50		100	
Prior	knowledge	of:								
a. b	Materials	Engine	ering							
0.	are essent	unng 5 ial	cience							
Cours	e Objective	s:								
1.	To introd	uce adv	anced and exot	ic materials.						
2.	To establi	ish the	significance of	material selec	tion in engin	neering desig	n.			
3.	To explor	e new	design opportur	nities.						
4.	To select	and an	alyze special for	rming process	ses for the p	roduct under	consideration.			
5.	5. I o select and analyze advanced joining processes for the product under consideration.									
6.	1 o unders	stand ai	id analyze the b	basic mechani	sms of hybr	id non-conve	ntional machin	ing techniques.		
After	e Outcomes		a the students i	will be able to						
1	Analyze	differe	of materials in a	dvanced engi	neering ann	lications				
2.	Relate st	ructure	and properties	of new materi	als in engin	eering applic	ations.			
3.	Evaluate	and se	elect materials f	or advanced e	engineering	applications.				
4.	Classify	and an	alyze special fo	orming proces	ses.					
5.	Analyze	and id	entify the applic	cability of adv	anced joini	ng processes.				
6.	Understa	and and	1 analyze the ba	asic mechanis	ms of hybri	d non-conver	tional machin	ing techniques.		
				D	etailed Syll	abus:			Derestian	
Unit	Description							(H)		
1	Advanced	and e	xotic materials:	: Biomaterial	s, Nanomat	terials, Aerog	gels, Supercor	ductors, Carbon	6	
2	Smart Mat	erials.	Piezoelectricity.	. Magnetostrio	ction. Smart	Polymers, SI	nape Memory	Allovs.	6	
3	Introductio	on to]	Nano, Nano-bi	omimicry, S	ynthesis of	nanomateria	lls by physica	al and chemical	6	
	methods, S	Synthes .	is of nanomater	ials by biolog	ical method	s, Characteriz	zation of nanoi	materials.	-	
	Special F	orming	Processes: P	Forming pro	chines, pro	Decess variab	les, process	capabilities and \mathbf{UVE} Explosive		
4	Forming N	IS OF FI Magnet	ic Pulse Formin	g Electro-Hy	draulic For	ming Petro-F	Forge Forming (Micro Forming	6	
	Micro Ben	ding/L	aser Bending.	ig, Electro II	diddic 1 of	lilling, i etto i	orge i orning	, where i orning,		
	Advanced	Joining	g Techniques: I	Principle, pro	cess variabl	les, process d	capabilities and	d applications of		
5	Friction St	ir Wel	ling, Electron F	Beam Weldin	g, Laser Bea	am Welding,	Explosive Join	ning, Cold Metal	6	
	Transfer W	/elding	, Ultrasonic We	elding, Cryoge	enic Weldin	g, Thermal S	pray Coatings.			
	Advanced	Machi	ning Technique	es: Diamond	Turn Machi	ining, Ultraso	onic Microma	chining, Focused		
(Ion Beam	Machir	ing, Photochem	nical Machini	ng, Introduc	tion to hybrid	l processes, M	agnetic Abrasive		
0	Finishing, Machining	Electro	chemical Grind	n process dre	naped Tube	Electrolytic	Machining (SI	EM), Electro-jet	0	
	Electroche	mical I), Electrolytic II Discharge Mach	ining (FCDM	SSIIIg (ELF)	face treatment	ts	wi, Kotary EDWi,		
	Electroche	inicui i	Zisenarge Waen		i), Euser sur	idee deather		Total	36	
Text B	Books:									
1.	W.D. Ca	llister, l	Material Scienc	e and Enginee	ering: An In	troduction, W	iley publicatio	on, 2014.		
2.	V. K. Jai	n, Adva	anced Machinin	g Processes",	Allied Publ	lishers Pvt. L	td., 2009			
3.	3. M. P Groover., Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, Wiley 2015.									
4.	A. Ghosh	1, A. K.	Mallik, Manuf	acturing Scien	nce, Affiliat	ed East-West	Press Pvt. Ltd	., New Delhi, 201	.0.	
1 Kerere	Keterence Books:									
2.	L.F. Pease	R.M. R	ose and L Wulf	ff. Electronic	Properties (Volume IV [.] S	Structure and P	roperties of Mate	rials).	
	Pearson, 20	15.		,	r•100 (1 / · k	inter and I	r	,,	
3.	ASM: Meta	l Hand	book, Volume 6	5, "Welding, I	Brazing and	Soldering", N	Metal Park, Oh	io, ASM Internat	ional, 2011.	
4	ASM: Meta	1 Hand	book. Volume 1	indust4 "For	ming" Met	al Park Ohio	ASM Interna	tional 2011		

- R. Balasubramaniam, RamaGopal V. Sarepaka, Sathyan Subbiah, Diamond Turn Machining: Theory and Practice,
- CRC Press, 2017.
- 6. V. K. Jain, Micromanufacturing Processes, CRC Press, 2018.

Program	n: B. Tech. (Mecl	B. Tech. (Mechanical) Semester: V								
Course:	Design Thinki	Design Thinking (PEC-II)				Code: BME5502D				
Teaching Scheme/week Evaluation Scheme										
Lectu	re Tutorial	Hours	Credit	IE	MTE	ЕТЕ Т	W	Total		
3		3	3	20	30	50		100		
Prior knowledge of								1		
	Problem solving and Analytical skill is essential									
	Objectives:	stones of this lin	a and anastivity	and immant	the shills needed	l for onhonoine dos	i an th	intrin a		
1.	To highlight the import To introduce the conc	ent of design thi	g and creativity	and impart	design process	1 for enhancing des	ign tr	iinking		
Course (Dutcomes:	ept of design un		istanding of	design process					
The stude	ents will be able to,									
1.	Develop a user centric	e mindset while o	lesigning, innov	vating and c	reative problem-	solving.				
2.	Understand challenges	s and benefits of	design Thinkin	lg.						
3.	Investigate design pro	blems and gener	ate ideas by cre	ative thinking	ng.					
4.	Practice design Think	ing for defining	Detailed	Sullahua						
			Detailed	Synabus:				Duration		
Unit	Description							(H)		
	Design Thinking tools							()		
1	Concept of Design Thinking and Its Role within NPD and Innovation, Framework of Design									
1.	Thinking, Principles and the "Mindset" of Design Thinking, Identifying Customer Needs, Product									
	Specifications									
2.	Phases of Design Thinking - Empathize, Define							6		
3	Applied Creativity	7						6		
5.	Creativity, brainstorming, and concept generation process in designing.									
4.	Phases of Design Thinking - Ideate, Design Heuristics – Opposite, Concept, User needs,							6		
5.	Phases of Design T	hinking - Proto	type and Test					6		
6.	Apply Agile method to developing software, Design an App using the principles of Design							6		
	Thinking, Develop	an App for And	old			Ta	al	26		
Toxt Books:						ai	30			
1 Design Thinking M.G. Luchs, K.C. Swan, Wiley-Blackwell 2015										
Reference books:										
1. Design Thinking Methodology, Emrah Yayici, Publisher Emrah Yayici, 2016										
2. Designing for Growth: A design thinking toolkit for Managers, Tim Ogilvie ,Columbia Business School Publishing							ublishing			
3.	3. Integrated Design Engineering - Interdisciplinary and Holistic Product Development, Sándor Vajna, S							Springer		
International Publishing, Springer (2020)										
Assignm	1 Use of Idea Generation software									
2.	Case Study - Analyzir	ng existing produ	ict for improve	ment.						

2. Case Study - Analyzing existing product for improvement.

Program	am: B. Tech. (Mechanical) Semester: V									
Course:	se: Design for Reliability (PEC – II) Cod					Code: BM	Code: BME5502E			
Teaching Scheme/week				Evaluation Scheme						
Lecture	re Tutorial Hours Credit			IE	MTE	ЕТЕ	TW	Total		
3	-	3	3	20	30	50	-	100		
Prior knowledge of										
a. P	a. Probability and statistics									
b. N	b. Numerical methods									
Course (biectives:									
1. T	o impart a basic	understandi	ng of probabili	ty and statis	tical technique	es used in reli	ability engine	ering.		
2. T	o make the lear	ner aware of	applications of	f probability	distributions i	n modeling a	nd analyzing	failure data.		
3. T	o be familiar wi	th the technic	ques used in sy	stem reliabi	lity modeling	and analyze	warranty data.			
4. T	o provide a basi	c understand	ing of the use	of probabilis	stic approaches	s to design co	omponents and	l predict reliability		
5. I 6 T	o explain the co	concept of refit	eliability testir	on nσ						
Course (o introduce the	concepts of f	endonity testi	15.						
The stude	ents will be able	to,								
1. U	se the basics of	reliability an	d its measures	for analyzir	ng components	and systems				
2. A	pply probability	distribution	s to estimate re	eliability fun	ctions such as	reliability, C	DF, PDF, haz	ard rate, etc.		
3. L	evelop system i	eliability mo	dels to solve s	ystem reliab	ility problems	and analyze	warranty data			
5. U	se reliability all	ocation meth	ods to allocate	e reliability r	equirements at	t product desi	ign stage.			
6. S	elect a suitable	reliability tes	ting method.	, 10 11401110 <u>j</u> 1	- -	Produce des	.5			
				Detailed Syl	labus:			-		
Unit			Ι	Description				Duration		
	Introduction of	nd Rasie Rol	iability Math	matics				(H)		
	Reliability Eng	ineering in 2	21 st Century,	Concept of	failure, reliab	oility, mainta	inability and			
1	availability, Rel	iability objec	tives, How to	meet reliabil	ity objectives.	5,	2	6		
1	Basic reliability	y mathemati	cs: Universe,	Population, S	Sample, PDF,	Reliability fu	inction, CDF,	U		
	Moments of tir	ne to failure	- MTTF, M	FBF, the me	edian time to	failure, mod	le, skewness,			
	Probability Dis	tributions a	nd Their Ann	lications in	Product Desig	an cui ve				
	Discrete probability distribution - Binomial distribution. Poisson distribution.									
2	Continuous Probability Distributions – Weibull, exponential, normal (Gaussian), lognormal,									
	estimation of rel	liability metri	ic such as life	of the compo	onent, warrant	y period, reli	able life, etc.			
	Concept of conf	idence interv	al							
	System Reliabi Failura Modes	lity Modelin and Effects	g and Warrai	nty Analysis FA) Fault 7	ree Analysis	(FTA) Reli	ability Block			
	Diagrams (RBDs) Root cause analysis (FMEA), Fault Tree Analysis (FTA), Keliability Block									
3	Warranty Ana	lysis	j					6		
	Product warranties, warranty return information, warranty policies, warranty and reliability,									
,	warranty cost a	nalysis, war	ranty and relia	ability mana	agement, Use	of software	for warranty			
	analysis Probabilistic D	osign for Do	liability and f	octor of cof	aty Design f	or roliability	Design of a			
-	tension element. Reliability models for probabilistic design. Relationship between reliability									
	the factor of safety and variability, Functions of random variables, Steps for probabilistic									
4	design.	•	0							
	Reliability Predictions from Stress-Strength Models - Physics of failure, Reliability from									
	stress-strength distributions, Reliability from similar stress-strength distributions									
	Kenability Allocation Definition, Reliability allocation methods – equal allocation weighting factor and optimal									
	reliability allocation.									
5	Weighting factor methods – ARINC, AGREE, Feasibility of objectives, Aggarwal's method,									
	Integrated factor.									
	Optimal reliability allocation methods: Redundancy allocation, Cost minimization problem									
formulation.										

6	Reliability Testing Introduction to reliability testing, Stress strength interaction, Introduction to Markov model Testing for Reliability and Durability- Accelerated Life Testing and Highly Accelerated Life Testing (HALT), highly accelerated stress Screening (HASS). Reliability in manufacturing- Production FRACAS.	6						
	Total	36						
Text Bo	Text Books:							
1.	1. An Introduction to Reliability and Maintainability Engineering by C. E. Ebeling, Waveland Press inc., 2019.							
2.	Reliability Engineering by K. C. Kapur, and M. Pecht, Wiley, 2014.							
3.	3. Design Reliability: Fundamentals and Application by B. S. Dhillon, CRC Press, 1999.							
4.	. Reliability Engineering and Life Testing by V. N. A. Naikan, PHI Learning, 2008.							
Reference books:								
1.	1. Reliability Engineering by E. Balagurusamy, Tata McGraw Hill, 2017.							
2.	2. Reliability Engineering and Risk Analysis – A practical Guide by M. Modarres, K. Kaminsky, and V. Krivstov,							
	CRC Press, Taylor and Francis Group, 2017.							
3.	3. Practical Reliability Engineering by P. D. T. O'Conner, John Wiley and Sons, 2012.							
4.	4. Life cycle reliability engineering by G. Yang, John Wiley and Sons, 2007.							
5.	5. Engineering Maintainability by B. S. Dhillon, Prentice Hall of India, 1999.							

Progra	m B. Te	B. Tech. (AS&H)					Semester : V			
Course	e: Statis	Statistical Data Analysis Using R (OEC – II)				Code : BAS5607				
Teaching Scheme					Evaluation Scheme					
Lectu	ure Prac	tical	Tutorial	Credit	IE	MTE	ETE	Total		
3	-		-	3	20	30*	50*	100		
Prior I	Knowledge of	:								
1.	Descriptive	Statisti	cs							
2.	2. Inferential Statistics									
3.	Probability									
C	are essential	•								
Course	e Objectives:	ot onch	ling the stude	nts to loorn	data collection view	ulization and n	ranroaccing tachni	anas for		
data	science	at enab	ing the stude		lata conection, visu	ializatioli, allu p	reprocessing techni	ques ioi		
Course	Outcomos:									
Δfter le	e outcomes:	irse th	e students wil	he able to:						
Alter K	1 Implem	nent R	nackages relat	r de able to: red to data sci	ence					
	2. Apply (lifferen	t data visualiz	ation techniq	ues to understand th	ne data.				
	3. Apply of	lata pre	eprocessing m	ethods and ge	enerate quality data	for analysis.				
	4. Analyz	e the da	ata using analy	tical method	s for regression in re	eal life Problems	using the R.			
	5. Develo	p a mod	lel for Predict	ion and Decis	sion Making for a da	ata set.	C			
	6. Frame	the hyp	othesis for the	e data and tes	t it for data set in R.					
				Det	ailed Syllabus:					
								Duration		
Unit				De	escription			(H)		
	Introduction	n to da	ta analysis ar	nd R Softwar	e fundamentals: U	nderstanding the	e Data, R Packages			
1.	for Data Scie	ence, Ir	nporting and I	Exporting Dat	ta in R Software, Ge	etting Started: A	nalyzing Data in R	6		
	Software, Ad	ccessin	g Databases w	ith R Softwar	re.	C				
	Data Wrang	gling: F	Pre-processing	Data in R So	oftware, Dealing wit	h Missing Value	es in R Software,			
2.	Data Format	ting in	R Software, D	ata Normaliz	ation in R Software	, Binning in R S	oftware, Turning	6		
	categorical v	ariable	s into quantita	tive variables	s in R Software.					
3	Data Visual	ization	in R Softwa	re: Histogram	n, Bar/ Line Chart, E	Box Plot (includi	ng group-by	6		
5.	option), Scat	ter Plo	t (including 31	D and other fe	eatures), Mosaic Plo	ot, Heat Map, Co	rrelogram (GUIs)	U		
4	Statistical D	ata Ar	nalysis: Proba	bility, Sampli	ing & Sampling Dis	tributions		(
4.	Exploratory	Data	Analysis: Cer	tral & Descri	iptive Statistics, Hyp	pothesis Testing		0		
-	Model Deve	Provelopment: Linear regression and multiple linear regression, model evaluation using								
5.	visualization	, predio	ction and decis	sion making				0		
	Data Analy	sis Usi	ing R: use a	dataset from	kaggle (Link is gi	iven below). Ide	entify the problem			
	statement for	or the	given data ar	id by applyin	ng data analysis te	chniques analyz	ze the data. Draw			
	inferences fr	om the	data.							
6.	https://www	<u>kaggle</u>	.com/code/cva	aisnor/heart-2	<u>2020/data</u>			6		
	https://www.	<u>kaggle</u>	.com/code/kai	lash068/crop	-recommendation/d	<u>ata</u>				
	nttps://www.kaggle.com/datasets/debajyotipodder/co2-emission-by-vehicles									
	https://www	.kaggie		csarnt2/mgn	er-education-studen	ts-periormance-		26		
							Total	36		
Reference Books:										
1. Montgomery and Runger, "Applied Statistics and Probability for Engineers", Wiley, India, 6 Edition, ISBN:										
9/8812656294/. 2 D. Johnson "Drobability and Statistics for Engineers" Droutics India Ltd. 9 Edition ISDN 12:079										
2. K. Johnson, Probability and Statistics for Engineers", Prentice India Ltd, 8 Edition, ISBN 13:978-										
3 SP Gunta "Statistical Methods" Pannerhook publication 43 edition ISBN: 9788180549892 8180540805										
4. Victor A. Bloomfield. "Using R for Numerical Analysis in Science and Engineering" CRC Press First										
	Edition, ISBN: 9781315360492									
e-sources:

NPTEL Course lectures links:

https://www.youtube.com/watch?v=VVYLpmKRfQ8&list=PL6C92B335BD4238AB (Probability) https://nptel.ac.in/courses/111104100 (Introduction to R software)

https://www.youtube.com/watch?v=WbKiJe5OkUU&list=PLFW6lRTa1g83jjpIOte7RuEYCwOJa-6Gz (Descriptive statistics using R software)

*Instead of the conventional mode of examination for MTE and ETE; Examination will be conducted using **R** software in the laboratory through proper invigilation.

Progra	m: B. Tech. (Civil) Semester : V									
Course	e: '	02A								
		Teaching	g Scheme			Evaluatio	n Scheme			
Lect	ure	Tutorial	Credit	н	IE	MTE	ETE	Total		
3		-	3	3	20	30	50	100		
Course	e Objec	tives: After Co	ompleting this c	ourse, student	will have adequa	ate background :				
	1. '	To understand	the importance	of Quality	-	-				
	2.	To understand	the need of To	tal Quality Mar	agement & it's t	cools				
Course	3. Outeo	To understand	role of ISO in o	quality manage	ment					
Course	1.	Describe Oual	ity and Ouality	concepts	will be able to.					
	2. Apply different Quality control tools									
	3. Use cost of quality and ISO concepts and principles for quality assurance									
	4. Apply various techniques of TQM									
	Detailed Syllabus:									
Unit	it Description Duration (H)									
	Conc	ept of Quality	1.6	1	T	1.	·			
1	a) Qua	anty – various	allenges Eactor	a interpretation	ity Reasons for	quality on a pro	measures	6		
1.	to ove	rcome, Contril	bution of variou	is Quality Guru	s(Juran, Deming	g, Crossby, Ishik	(awa).	0		
	b) Evo	olution of TQN	1- QC, TQC, Q	A, QMS, TQM	•	, - · · · · , , ·				
	TQM	[& Six Sigma								
2.	a) TQ	M – Necessity	, advantages , Q	Quality Function	n Deployment(Q	(FD).		6		
	b) S1x	sigma – Impo	rtance, levels.							
	a) Cat	of Quanty and egories of cost	of Quality							
3.	b) Stu	dy of ISO 90	01 principles.,	Quality manua	l – Importance,	contents, docu	mentation,	6		
	Correc	ctive and Preve	entive actions, 0	Conformity and	NC reports	,	,			
	Tech	niques in TQI	M Implementa	tion						
4.	a) Ber	chmarking in	TQM, Kaizen i	n TQM,				6		
	b) '5-	S' techniques,	Zero Defects.							
-	Appli	lity Circle Co	anty Control 1	cols through (Lase study	Formation		6		
5.	b) Imp	olementation o	f 7 OC tools the	ough case stud	V	rormation		0		
	Feiler	o Modo Effor	t Analysia	0	5					
6	a) FM	EA problems	NPV					6		
0.	b) Dec	cision Tree pro	blems					0		
	,	1					Total	36		
Text B	ooks:									
1.	Total	Quality Manag	gement Dr. G	unmala Suri an	d Dr. Puja Chha	bra Sharma—Bi	iztantra.			
2.	Quali	ty Control and	Total Quality I	Management by	P.L.Jain- Tata	McGraw Hill Pu	ıbl.			
3.	Total Total	Quality Manag	gement - Dr. S.	Rajaram and D	r. M. Sivakumar	—Biztantra.				
4. Rofore	rotal	Engineering Q	uanty wanage	nent – Sumi Si	iai ma – iviacimil	ian mula Ltu.				
1	Iuran ³	JKS: 's Quality Han	dbook – Juran I	Publication (20	16 Edition)					
2.	 Management – Principal, process and practices by Bhat – Oxford University Press. (2008) 									
3.	Finan	cial manageme	ent by Shrivasta	wa- Oxford Un	iversity Press (6	th Edition 2022)	. /			
4.	Total	Project Manag	gement – The Ir	dian Context -	P.K.Joy Macmi	llan India Ltd. (1993, with la	test Edition)		

4. Total Project Management – The Indian Context - P.K.Joy Macmillan India Ltd. (1993, with latest Edition)

Progr	am:	B. Tech. (Civi	l)			Semester : V					
Cours	ogram:B. Tech. (Civil)Semester : Vurse :Intelligent Transport System (OEC-II)Code: BCI5602B										
		Teachin	g Scheme	1		Evaluatio	n Scheme				
Lect	ectureTutorialCreditHIEMTEETETotal3-33203050100										
3	3	-	3	3	20	30	50	100			
Prior	Know	ledge of:									
a.	Fun	damentals of Tra	ansportation and	l Traffic enginee	ering						
D.	$\frac{1}{20}$	nsportation Plan	and Design	ing ourse student w	ill have adequat	a background .					
1	To 1	learn all the aspe	ects related to int	telligent transpo	rtation system a	nd its application	n				
2.	To	use the fundament	ntal concepts of	transportation s	ystem managen	ient.					
3.	Tot	train the students	s to develop thei	r career in trans	portation indust	ry					
Cours	Course Outcomes: After learning the course, the students will be able to: 1. Describe the fundamentals and principles of ITS and its background										
1.	 Describe the fundamentals and principles of ITS and its background Demonstrate the knowledge of telecommunication practices in ITS 										
2.	 Demonstrate the knowledge of telecommunication practices in ITS Distinguish the physical architecture and hardware composition in the implementation of ITS 										
5. 4	 Distinguish the physical architecture and hardware composition in the implementation of ITS Implement the ITS concept in various domains 										
5	Exp	lain the user nee	ds and services	in the context of	fimplementing	effective ITS					
6.	Ider	ntify and evalua	te the practical	constraints in	the implementa	tion of the tech	nology and the				
	gras	ss root level.									
	1			Detailed	Syllabus:						
Unit				Descript	ion			Duration			
	Intro	duction						(H)			
	Intro	duction to Intelli	igent Transport:	ation Systems ()	TS) – Definitio	on of ITS and L	dentification of				
1.	ITS	Objectives, His	torical Backgro	und, Benefits	of ITS - ITS	Data collection	techniques –	6			
	Detec	ctors, Automati	c Vehicle Lo	cation (AVL),	Automatic V	/ehicle Identif	ication (AVI),				
	Geog	raphic Informati	on Systems (GI	S), video data co	ollection						
	Telec	communications	in ITS:	6 . 1	. ,						
2.	I elec Mono	ommunications	in IIS – Impor	tance of telecon	mmunications 1	n the IIS syste	m, Information	6			
	Positi	oning System	Management C	entres (TMC).	venicie – Road	side communica	ation – venicie				
	ITS a	architecture and	d Hardware:								
3.	Arch	itecture – ITS A	rchitecture Fran	nework – Hardw	vare Sensors – V	vehicle Detectio	n – Techniques	6			
	– Dyi	namic Message S	Sign – GPRS – (GPS – Toll Coll	ection						
	ITS I	Functional Area	1:								
4	Adva Com	nced Traffic Ma	nagement Syste	ms (ATMS), Advanced	Ivanced Travele	r Information S	ystems (ATIS),	(
4.	Publi	c Transportation	Systems (APT)	(O), Advanced R	venicle Contro	ion Systems (AV	(S), Advanced	0			
	1 uon	c mansportation	Systems (AI IS	5), Auvalieeu Ri		ion Systems (Al	(15).				
	ITS	User Needs and	Services:								
5	Trave	el and Traffic	management,	Public Transp	ortation Mana	gement, Electro	onic Payment,	6			
5.	Com	mercial Vehicle	Operations, E	mergency Man	agement, Adva	nced Vehicle s	safety systems,	U			
	Infor	mation Managen	nent.								
	Case	Studies:	Sustana Vahi	las in Distoons	Integration of	Automated His	hway Systams				
6.	ITS I	Programs in the	World – Over	view of ITS im	plementations i	n developed co	untries ITS in	6			
	devel	oping countries			promontations	n acteropea ee	undreb, 115 m				
	Total 36										
Refer	ence B	ooks:						1			
1	1. Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US, 2001.										
2	2. Henry F.Korth, and Abraham Siberschatz, Data Base System Concepts, McGraw Hill, 1992.										
3	3. Tu	rban E.,"Decisio	on Support and I	Export Systems	Management Su	pport Systems"	, Maxwell Macn	nillan, 1998.			
4	4. Sit	ausu S. Mittra, "	Decision Suppo	ort Systems – To	ols and Technic	ues", John Wile	ey, New York, 1	986.			
4	5. Cy	cle W.Halsapple	e and Andrew E	B.Winston, "Dec	ision Support S	Systems – Theo	ry and Applicati	ion", Springer			

TY B Tech (Mechanical Engineering), PCCoE Pune

Verlog, New York, 1987

6. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.

Progra	am: B. Tech. (Computer)			Semester: V	٢			
Cours	e: Data Stru	ctures Using	Python (OEC-	(I)	Code: BCE	5601			
	Teachir	ng Scheme			Evaluation	Scheme			
Lectur	e Practical	Tutorial	Credit	IE	MTE	ЕТЕ	Total		
03	-	-	03	20	30	50	100		
Prior k	nowledge of								
	Python Program	ming is essen	tial.						
Cours	e Objectives:								
1.	To understand P	ython Specifi	c Data Structure	s.					
2.	To illustrate and	demonstrate	Stacks, Queues.	reformed in Duthen					
5. 4	To understand h	ow linear and	non-linear data	structures work					
-+. 5	To learn the fund	damentals of y	writing Python s	cripts					
6.	To learn the ope	rations on tree	e and graph data	structure.					
Cours	e Outcomes:		8F						
After le	earning the course	e, students wi	ll be able to:						
1.	Differentiate the	type of data s	structure.						
2.	Create, run and i	manipulate Py	thon Programs	using core data struct	tures like Lists				
3.	Comprehend the	searching &	sorting algorithi	ns.					
4.	Apply suitable d	ata structures	to solve the pro	gramming problems.					
5.	Use effective and	d efficient dat	a structures in s	olving various Comp	outer Engineeri	ng domain probl	ems.		
6.	Comprehend nor	nlinear data st	ructures such as	tree and graph.					
			Det	ailed Syllabus:					
Unit			Des	scription			Duration		
	Introduction to	Data Struct	ures. Introduction	n to Python program	nmina		(П)		
	Data Structures	– Definition	Linear Data Stri	ictures on-Linear Da	ata Structures				
1.	Python Specific	Data Structur	es - List. Tuples	S. Set. Dictionaries. C	Comprehension	s and its Types.	6		
	Strings, slicing.		, 1	,,	I I I I I I I I I I I I I I I I I I I	51			
	Arrays - Overvie	ew, Types of .	Arrays, Operatio	ons on Arrays, Arrays	s vs. List.				
2	Searching and	Sorting Tech	niques: Searchi	ng - Linear Search a	nd Binary Sear	ch	6		
4.	Sorting - Bubble	e Sort, Selecti	on Sort, Insertio	n Sort, Merge Sort a	nd Quick Sort.		U		
3.	Linked List: Int	troduction, In	plementation of	Singly Linked Lists	, Doubly Linke	ed Lists,	6		
	Circular Linked	Lists		T 1	N. 1 A 1 .				
4	Stack & Queue	: Stacks - Ove	erview of Stack,	Implementation of S	Stack, Applicat	ions of Stack,	6		
4.	Queues- Overv	lew of Queu	e, implementat	ion of Queue, App	lications of Q	ueues, Priority	0		
	Tree Trees - O	verview of Tr	ees Tree Termi	nology					
5.	Binary Trees - I	ntroduction. I	mplementation.	Tree Traversals.			6		
	Binary Search T	rees - Introdu	ction	,			-		
	Graph: Introduc	ction, directed	l vs. Undirected	Graphs, Weighted va	s. Unweighted	Graphs,			
6.	Representations	- Adjacency	Matrix, Adjacen	cy list,	-	-	6		
	Graph Traversal	s - Breadth Fi	irst Search, Dept	th First Search.					
						Total	36		
Text Bo	oks:								
1.	Data structures	and algorith	ms in python b	by Michael T. Good	drich, ISBN-1	3: 978-1118290	279, ISBN-10:		
2	11182902/5, Pu	Diisner: Wile	ey; 1st edition (N	1arch 18, 2013).	on hy Des di	N Millon and D	widt Dame		
2.	ISBN 12. 079 1	g with Algorit	INDERING AND ALL S	tructures Using Pyth	Erant-lin Page	IN MILLER and Da	ivia L. Kanum.		
ISBN-15: $9/8$ -15902825/1, ISBN-10: 15902825/4, Publisher: Franklin, Beedle & Associates; 2nd edition (August 22, 2011)									
Referen	Crugust 22, 201	1).							
1.	Hands-On Data	Structures an	nd Algorithms	with Python: Write	complex and	powerful code i	using the latest		
	features of Pytho	on 3.7, 2nd Ec	lition by Dr. Bas	sant Agarwal, Benjar	nin Baka. ISBI	N: 97817889919	33, 2018.		

 Core Python Programming -R. Nageswara Rao, ISBN-10: 9789351199427, ISBN-13: 978-9351199427, Willy; 1st edition (January 1, 2016).

Program	: B. Tech. (C	omputer)			Se	mester: V						
Course:	Programmi	B. Tech. (Computer) Semester: V Programming with C++ (OEC-II) Code: BCE5602										
	Teaching Scheme Evaluation Scheme											
Lecture	Practical	Tutorial	Credit	IE	MTE	ETE	Total					
03	-	-	03	20	30	50	100					
Prior kn	owledge of											
Course	Python Programmi Objectives:	ng is essential.										
1. 2. 3. 4. 5. Course After le. 1. 2. 3. 4.	 To explore the principles of Object-Oriented Programming (OOP). To use the concept of inheritance and polymorphism. To understand the use of exception handling in C++ programs. To provide a foundation for advanced programming using File handling and STL. To provide lifelong learning attitude towards problem solving. rse Outcomes: r learning the course, students will be able to: Compare the strengths of object-oriented programming with respect to procedural programming. Demonstrate working with primitive data types. Understand and demonstrate dynamic memory management techniques. Analyze and apply the concept of function overloading & operator overloading for real time problem solving. 											
5.	Classify inheritance programming.	assify inheritance with the understanding of early and late binding, usage of exception handling, generic ogramming.										
0.			Detail	ed Syllabus:	hs with the help	or programs.						
Unit			Desc	ription			Duration					
1.	Introduction of C Overview of pro- declaration, Class Case Study: Writ	DOPs Concept cedural progra es and objects, te a program in	ts mming and ol Member funct c++ to create	bject-oriented prices of the p	rogramming, Sy nanagement. ss with appropr	ntax of variables	6					
2.	Inheritance Introduction, ben hybrid and hierard Case Study:Write syntax.	efits, Access chical. e a program in	specifiers, Typ c++ to derive	class bicycle from	ce - single, mu	iltiple, multilevel, e with appropriate	6					
3.	Polymorphism Introduction, Typ functions, Virtual Case study: Write	bes of polymo base class, Ov a program in	rphism: function erloading and c++ to overload	on and operator overriding. d '+' and '-' ope	r, Virtual funct erator.	ions, Pure virtual	6					
4.	Exception Handl Introduction to end defined exception Case Study: Wr telephone number	ting xception, Ben s in c++, Re-th ite a program as parameters	efits of except nrow. in c++ to cre . Program shou	ion handling, tr ate a class stud Ild throw an exc	ry, throw and c ent with name, eption if telepho	catch blocks, pre- age, roll no and one_number>10.	6					
5.	File Handling Classes for file manipulation, Fii organization, Dire Case Study: Wri file handling.	stream operations le operations ect access files te a program i	ntion, Opening on binary fi n c++ to creat	g and closing les – variables e a database for	a file, File p s, class object airline reserva	ointers and their s, sequential file tion system using	6					
6.	Templates Introduction, Fund Introduction to Iterators. CaseStudy:Write	ction templates STL: Introd	s, Class templar uction of STI	te with multiple components,	parameters. Sequential con	tainer,Algorithms,	6					
		program m		ucu		Total	36					

TY B Tech (Mechanical Engineering), PCCoE Pune

Text Books:

- 1. E. Balagurusamy, "Object -Oriented Programming with C++", McGraw Hill Education, Eighth Edition, Sept. 2020, ISBN-13: 978-9389949186.
- 2. Ivor Horton, Peter Van Weert, "Beginning C++20", Novice Professional, Sixth Edition, 2020, ISBN-13: 978-1484258835 (ISBN-10: 1484258835)
- 3. Robert Lafore, "OOP in C++", Pearson Publishing, 4th Edition, 2001, ISBN:0672323087 (ISBN 13: 9780672323089).

Reference Books:

- 1. Bjarne Stroustrup, The C++ Programming language, Third edition, 2008, Pearson Education. ISBN 9780201889543.
- 2. Deitel, C++ How to Program, 4 th Edition, Pearson Education, 2002, ISBN:81-297-0276-2.
- 3. Herbert Schildt, C++ the complete reference, Eighth Edition, McGraw Hill Professional, 2011, ISBN:978-00-72226805.

MOOC Courses:

1. An Introduction to Programming Through C++, NPTEL, 12 weeks

Program	n: B. Tech. (E&T	'C)			Semester: V							
Course	Smart City:An	B. Tech. (E&TC) Semester: V Smart City:An Electronic Perspective (OEC-II) Code: BET5601										
	Teaching	Scheme	T		Evaluation Scheme							
Lectur	e Tutorial	Credit	Hours	IE MTE ETE Total 20 30 50 100								
3	-	3	3	20	30	50	100					
Prior k	nowledge of											
a. 1	Basic Electronics		_									
D. D.	Objectives.	mmunications	S.									
1	To explore need and l	hasics of smar	t city and fun	damental co	ncents of IoT							
2	To elucidate the roles	of sensors and	d protocols in	n IoT								
3	To explain different I	oT frameworl	k and networ	king protoco	ls							
Course	Outcomes:	or frame won	k and networ	king protoco	15.							
	After learning the cou	irse, the studer	nts will be ab	le to:								
1.	realize the need of sm	art city and its	s implementa	tion challeng	ges.							
2.	Comprehend the various concepts, terminologies and architecture of IoT systems.											
3.	Use sensors and actuators for design of IoT system for smart city.											
4.	Apply various wireless protocols for design of IoT systems.											
5.	Apply various wireless protocols for design of 101 systems. Identify the impact of distributed Intelligence and Central Planning on city.											
6.	Design IoT framework based applications used in smart city.											
	Design for framework based applications used in smart effy. Detailed Syllabus:											
Unit			Des	cription			Duration					
	Noossity of SMA	DT CITY. 7	The Smort C	Vity Dhiloson	hu Davalanman	t of Asian Citias	(H)					
	Megacities of India	• Current Ch	allenges Th	e India Story	of Smart Cities	Conceptual Basis						
1.	of a Smart City, Gl	obal Smart Ci	ty Programs,	Recommend	ations for Smart	City Framework.	6					
						-						
	Fundamentals of	IOT: History	of IoT, Intr	oduction, de	finition and char	acteristics of IoT,						
2.	architecture of Io	T, Physical a	& logical de	esign of Io	Γ, Enabling tecl	nnologies in IoT,	6					
	Sonsor Notworks	Definition to	cation verses	$\frac{5101}{0}$	tors axamplas	k working PEID						
3.	Principles and con	nponents. Wi-	Fi. Bluetoot	h. etc. ireles	s sensor networ	k: History, sensor	6					
	node, networking n	odes, WSN ve	ersus IoT.	,		,,	0					
	Wireless Protocol	s for Smart C	ities: IPv6ov	verLow-Powe	er Wireless Perso	nal Area Network:						
4.	Features, Address	ing, Packet	fragmentation	n, Operatior	, Security. Zig	Bee: Architecture	6					
	Objectives, Wirele	ss Networking	Basics, Wir	eless Networ	king Assumption	ns, Bluetooth Low	U U					
	Distributed Intelli	$\frac{1}{1}$	1 Protocol.	COAP Protoc	col, AMQP Proto	col.						
_	On the Interplay	between Hum	ans and Si	mg. mart Device:	s. Theoretical To	ools. Intelligence-	-					
5.	artificial Intelligend	ce (Machine I	ntelligence),	Information	Dynamics, Syner	getic, Information	6					
	Dynamics and Algo	ometry in Sma	rt Cities.									
	Applications of Io	T in smart cit	y: TheRoleo	of ICTs,								
6.	Applications in sm	art city & thei	r distinctive a	advantages -	smart environment	it, smart street light	6					
	scopeofIOT inprese	a waste ma	nagement. A	Industrial IoT	y voltation and no	ospitanty, Koleanu						
				industriar 101	•	Total	36					
Toyt Po	oke.					10141	50					
1 - 1.	Surieet Dalal Vivek	Jaglan "Greer	Internet of	Things for Sr	nart Cities: Conc	epts. Implications	nd					
	Challenges", CRC P	ress; 1st editio	n.			-r,r, e						
2.	Sudip Misra, Ananda	arup Mukherje	e, Arijit Roy	, "Introduction	on to IoT" Camb	ridge University Pro	ess.					
3.	HakimaChaouchi,"T	heInternetofT	hingsConnec	tingObjectsto	otheWeb"ISBN:9	78-1-84821-140-7,	Wiley					
1	Publications OlivierHersent David	Bogwarthiak	andOmarEll	umi "TheIn	ernetofThingsV	evAmplications and	Protocols"					
	Wiley Publications.	aboswartinek,		Juin, Them	emetor i inings. K	cy approacions and	110100015 ,					

Reference Books:

- 1. Vincenzo Piuri, Rabindra Nath Shaw, "AI and IoT for Smart City Applications", Springer; 1st ed. 2022 edition.
- 2. Alfredo Barton, Raymond Manning, "Smart Cities: Technologies, Challenges and Future Prospects" Nova Science Pub Inc
- 3. Ibrahim El Dimeery, Moustafa Baraka, Syed M. Ahmed, "Design and Construction of Smart Cities" Amin Akhnoukh, Springer; 1st ed. 2021 edition
- 4. Ricardo Armentano, Robin Singh Bhadoria ,Parag Chatterjee , "The Internet of Things: Foundation for Smart Cities", eHealth, and Ubiquitous Computing" Chapman and Hall/CRC; 1st edition
- 5. DanielMinoli, "BuildingtheInternetofThingswithIPv6andMIPv6:TheEvolvingWorldofM2MCommunications", JSBN:978-1-118-47347-4, WillyPublications
- 6. Pethuru Rajand Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRCPreduction Content of Conte

ss Online Link/Courses:

- 1. <u>http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html</u>
- 2. <u>https://onlinecourses.nptel.ac.in/noc17_cs22/course</u>

Program	B. Tech. (E&T	C)				Semest	ter: V					
Course:	Modeling and	Simulation (C	DEC-II)	Semester: V I) Code: BET5602								
	Teaching	Scheme	1	Evaluation Scheme								
Lectur	e Tutorial	Credit	Hours	IE	M	ГЕ	ETE	Total				
3	-	3	3	20	3	0	50	100				
Prior kn	owledge of											
a. E	ngineering Mathema	tics										
b. B	asics of OOPs is esse	ential										
	o explain basic mode	ling technique	es and tools									
2. T	o demonstrate role of	f Model in cor	tinuous and o	discrete syste	ems.							
3. T	o explore with neural	l networks and	l its modeling	g.								
4. T	o illustrate with fuzz	y set and its m	odeling.									
Course (Outcomes:											
After lean	ming the course, the	students shoul	d be able to:									
1. U	nderstand the basic	requirements of	of Modeling	and tools us	ed in sim	ulation.						
2. A	nalyze the physical	models and the	eir criteria as	per knowled	lge of the	system.						
3. C	ompare different typ	es of determin	1stic models a	and their app	vizations	•						
4. U	se optimization met	work based m	odels using a	noronriate se	nization. oftware to	ools						
6. D	esign and simulate the	ne Fuzzy contr	ollers to solv	e engineerin	g probler	ns.						
0. 2	esign une sinterare t		Deta	iled Svllabu	<u>s:</u>							
T1*4			D					Duration				
Unit			Descr	ription				(H)				
	Introduction: Prog	gramming env	ironment, inp	put and output	ut variabl	es, State	variables, basic					
1	syntax; Determinis	stic linear mo	del, Array	mathematics	in Matl	ab, Plot	ting, Static and	6				
	Dynamic systems;	Hierarchy of k	nowledge ab	out a system	and Mo	leling St	rategy.	v				
	Physical Modelin	g: Dimension	s analysis, I	Dimensionles	ss group	ng of 11	nput and output					
2	models Stochastic	modeling Re	view of cons	ary criteria	and then the	applica	ing equation for	6				
	heat mass and mor	nentum transfe	er		is and the	e govern	ing equation for	U				
	Modeling of Syste	em with Know	wn Structur	e: Determini	stic mod	el: distri	buted parameter					
2	models in terms of	partial identif	ication and th	neir solutions	and lum	ped para	meter models in	(
3	terms of differentia	al and differen	nce equations	s, state space	e model,	transfer	functions block	0				
	diagram and sub sy	stems, stabilit	y of transfer	functions, m	odeling f	or contro	ol.					
	Optimizations an	d Design of	f Systems:	Summary of	of gradie	ent base	ed techniques :					
4	Nontraditional Opt	imizations tec	hniques, gen	etic Algorith	$\lim_{n \to \infty} (GA)$	- coding,	GA operations,	6				
	elitism, Applicatio	on using MA	ILAB: Simi	ulated Anne	aling, In	troductio	on to GUI,GUI	_				
	Introduction to N	oural Notwo	·k Modeling	· Basics of I	Noural N	otwork	Neural Network					
	Modeling of Syste	ems only with	Input-outpu	it Database.	Neuron	archite	ecture of neural					
5	networks, knowled	ge representat	tion, learning	algorithm.	Multilay	er feed f	forward network	6				
	and its back propag	gation learning	algorithm,	0	5							
	Modeling Based	on Expert	Knowledge:	Fuzzy sets	, Membe	ership f	unctions, Fuzzy					
6	Inference systems,	Expert Know	vledge and H	Fuzzy Mode	ls, Desig	n of Fu	zzy Controllers,	6				
Ŭ	Simulation of Engi	neering System	ms: Monte-C	arlo simulati	ion, Simu	lation of	f continuous and	Ŭ				
	discrete processes	with suitable e	xamples from	n engineering	g problen	ns.	Tatal	26				
Toyt Boo	dze•						Total					
$1 7\epsilon$	vigler R P Praehofer	H and Kim I	G "Theory of	of modeling	and simu	lation"	2 nd Edition Aca	lemic press 2000				
2. Jai	ng J.S.R. sun C.T and	1 Mizutani E	"Neuro-Fuzz	v and soft C	omputing	$\frac{1}{2}$ ". 3 rd e	edition. Prentice	hall of India 2002				
Reference	e Books:	,		<u>,</u>	r	, ,	,					
1. Ste	even I Gordon. Brian	Guilfoos."Int	roduction to 1	modeling and	d simulat	ion using	g MATLAB & P	thon" CRC press.				
2. Dr	.Shailendra Jain." M	odeling and sin	mulation usir	ng MATLAB	-Simulin	k ",2 nd	Edition, Wiley					
3. Sh	annon, R. E., "Syster	n Simulation:	the Art and S	Science", Pre	ntice Hal	1 Inc. 19	90					
4. Pra	atab.R " Getting start	ed with MAT	LAB" Oxford	university F	$\frac{200}{5}$	9	1					
Online c	ourse link: https://in	.mathworks.co	om/learn/trair	nng/simulinl	c-tundam	entals.ht	ml					

Program	: B. Tech. (IT)				Semester : V				
Course :	Object Oriented	l Programming	(OEC-II)	•	Code : BIT560	1			
	See: Object Oriented Programming (OEC-II) Code : BIT5601 Teaching Scheme Evaluation Scheme								
Lecture	e Practical	Tutorial	Credit	CE	MTE	ETE	Total		
3	-	-	3	20	30	50	100		
Prior Kn	owledge of:								
a.	C Programming is ess	ential.							
Course O	Dbjectives:								
1. 1	To learn the fundamen	tals of object-ori	ented concept	s and programmi	ng.				
2.	To develop problem-so	olving skills usin	g object orient	ed programming	g concepts.				
5. 1 4 7	To apply the concepts	ing skills using o	biect oriented	programming co	ncent				
Course O	Jutcomes:	ing skins using o	ojeet onemed	programming co	incept.				
After lear	ming the course, the st	udents will be ab	ole to:						
1. I	Demonstrate the key o	bject oriented co	ncepts.						
2. 4	 Apply functions for given real life data Apply operator overloading to develop programs 								
3. Apply operator overloading to develop programs									
4. I	Design hierarchy of cla	asses using inher	itance.	1 . 11.0	1.1				
5. I 6 I	Make use of polymorp	hism using virtu	al functions fo	r solving real life	e problems.				
0. 1	Develop application w	men nanules un	Detailed S						
			Detailed Sy	mabus:			Duration		
Unit			Descript	ion			(H)		
	FUNDAMENTALS	OF OBJECT OR	IENTED PRC	GRAMMING			(11)		
	Object Oriented Para	digm, Features of	f Object-Orien	ted Programmin	g: Objects and Cla	asses, Data			
1.	Abstraction and Er	ncapsulation, In	heritance, Po	lymorphism, D	ynamic Binding,	Message	6		
	Abstraction and Encapsulation, Inheritance, Polymorphism, Dynamic Binding, Message Communication. Visibility/Access Control, Constructors and Destructors, Operators, Static data								
	members and membe	r functions, Arra	ys and referen	ce variables.					
	FUNCTIONS								
2.	Function prototypes,	Default and Con	ist arguments,	Object as a func	tion argument and	d returning	6		
	overloading Friend f	unction	nce, Returnin	g a reference,	mine functions,	Function			
	OPERATOR OVERI								
3.	Rules of operator over	erloading, overlo	bading the una	ry and binary or	perators using m	ember and	6		
	friend function, overl	oading relational	and assignme	nt operator.	E E		-		
	INHERITANCE								
4	Need of inheritan	ce, base and	derived cl	asses, member	accessibility,	types of	6		
	inheritance, derived	class constructor	r, constructors	in multiple inhe	eritance, overridir	ng member	Ū		
┝───┼	functions, virtual base	e class.							
5	VIKIUAL FUNCTION	JINO objects 'this' m	ointer Pointer	s to derived class	ses virtual funct	ions Pure	6		
5.	virtual functions, abst	tract class, virtua	l destructors.		ses, virtual funct	ions, i uic	0		
	EXCEPTION HAND	DLING							
6.	Introduction, Except	ion handling n	nechanism: tr	y, catch and th	nrow, Multiple H	Exceptions,	6		
	Exceptions with argu-	ments							
						Total	36		
Text Boo	ks:								
1. I	E. Balaguruswamy, "C	Object-oriented P	rogramming w	vith C++", Tata N	McGraw Hill, 7 th e	edition.			
2. I	Kobert Lafore, "Objec	t-Oriented Progr	amming in C+	+", SAMS Tech	media				
Keferenc	eference Books:								
1.1	 Herbert Schlidt, C++: The Complete Reference, McGraw-Hill. Kogent "Object-Oriented Programming Methodology" Wiley ISBN-9789351191841 								
Online R	eferences:		<u>_</u>	<i>,</i> , , , , , , , , , , , , , , , , , ,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				
1. (Coursera Course on	C++ Basics:S	election and	iteration offere	ed by C- Codi	o, available	e online at		
ł	https://www.coursera.co	org/learn/codio-c	pp-basics		•	-			
2. 1	NPTEL Course Lectu	ire Links on "I	Programming	in C++" offered	d by IIT, Karag	our, availabl	e online at		
	"https://nptel.ac.in/cou	rses/106105151	"						

TY B Tech (Mechanical Engineering), PCCoE Pune

Progra	m: B. Tech. (All p	B. Tech. (All programmes) Semester: V										
Course	se : Principles of Management (HSMC-V) Code: BHM5113											
	Teaching Scheme Evaluation Scheme											
Lectu	turePracticalTutorialCreditIEMTEETETe2220-30											
2	-	_	2	20		30	50					
Prior k	nowledge of : None											
Course This con 1. 2. 3.	Objectives: urse aims at enabling st To expose students to To apply basic princip To understand basic s	udents primary function ples of managen tructure of econ	ons of management nent in various perso omy and banking so	and common fram onal and professio	neworks used in nal activities	business envir	onments.					
Course After le 1. 2. 3. 4.	 We Outcomes: learning the course, the students will be able to Understand managerial functions and have same basic knowledge on role of management Use principles of planning and organizing for accomplishment of a task Develop understanding of organization ecology and planning Apply necessary skills to direct, lead and think effectively 											
Detaile	d Syllabus:											
Unit			Description	1			Duration (H)					
1.	Introduction to Maa Thought: Major In Administrative Mana Management as Art Challenges	nagement: Defi fluences, Man gement, Introdu and Science, L	nition of Managem agement Thinkers iction to Manageme evels of Managem	ent; Science or A Introduction t nt Concepts: Man ent and Correspo	rt Evolution of o Scientific M agerial Function nding Skills, C	Management Management, as and Roles, ontemporary	6					
2.	Organizational Ecol its Characteristics, S Dynamics	logy: Types of I WOT and PES	Business Organizati ΓLE Analysis, Iner	ons, Organization ia and Change in	al Culture, Orga 1 Environment,	anization and Competitive	6					
3.	Organizational Dec Contemporary Orga Organizational Devel Tactical Plans, Introo Leader and Manager,	sign and Plan nizational Desi opment, Assess luction to Strate Types of Leade	nning : Concept gns, Structure and ing Success in Orga egic Management an ership.	of Organization I Process of an inization and Man ad Process, Visio	Design, Tra Organization, aging Change, n and Mission,	ditional and Process of Strategic and Leadership-	6					
4.	Design Thinking: C need, Synthesis, Idea	Concept, Stages sation and Proto	of Design Thinking typing Strategies.	g, Innovation, Cre	eativity & Inve	ntion and its	6					
						Total	24					
Text Bo	Books:											
l.	George R. Terry, Steph	ien G. Franklin;	Principles of Mana	gement, A.I.T.B.S	5. Publishers							
1. 2. 3.	nce Books: Stephen Robbins, Organizational Behavior, New Delhi: Prentice- Hall, 2005 Veerabhadrappa and Havinal; Management and Entrepreneurship, New Age International Publishers, 2011 Chaudhary Omvir, Singh Prakash; Principles of Management, New Age International Publishers, 2011											
e-sourc	es:											
1.	https://nptel.ac.in/cou	rses/122106031	-1									
2.	nttps://www.coursera	.org/learn/princi	pies-of-managemer	t								

a rogram.	B. Tech. (M	Iechanical)			Semester :	V				
Course:	B. Tech. (Mechanical) Semester : V CAE Analysis (PFC–III) Code : BME5913									
	Teachi	CAE Analysis (PFC-III)Code : BME5913Teaching SchemeEvaluation Scheme								
Lecture	Practical	Hours	Credit	IE	MTE	ETE	Total			
	2	2								
Prior know	wledge of:									
a. Sol	lid Mechanics,									
b. Nu	merical and Sta	tistical Metho	ods							
c. En	gineering Mech	anics,								
d. Ma	nufacturing Sci	ence,								
are	essential									
Course O	bjectives:									
The ob	jective of Cours	e is to,								
1. 1	o provide the in	formation on	various types of	CAE analysis a	nd various com	mercial software	available in the			
т 2 т	arket for CAE.	otical knowla	dga of the finite	alamant mathor	le and the skills	required to apply	za anginaaring			
2. I	coblems with co	mmercially a	vailable FFA sof	tware's	is and the skins	required to analy	ze engineering			
		innerenany a		tware 5.						
After learn	ing the course of	the students y	will be able to							
1. D	EFINE the use	e of CAE t	ools and DESC	RIBE the sign	ificance of sha	pe functions in	finite element			
fc	ormulations.					F				
2. A	PPLY the vario	us meshing to	echniques for bet	ter evaluation of	approximate re	sults.				
3. A	PPLY material	properties an	d boundary cond	ition to SOLVE	1-D and 2-D ele	ement stiffness ma	atrices to			
ol	otain nodal or el	emental solu	tion.							
4. A	NALYZE stead	y state therm	al problems.							
5. E	VALUATE and	SOLVE dyn	namic analysis pro	oblems						
6. G	ENERATE the	results in the	form of contour	plot by the USE	of CAE tools.					
	r		Detail	ed Syllabus:						
Practical			Detail Des	ed Syllabus: cription			Duration			
Practical	Part I		Detail	ed Syllabus: cription			Duration (H)			
Practical	Part I	uction to Com	Detail Des	ed Syllabus: cription			Duration (H)			
Practical	Part I Introdu Use of	iction to Com	Detail Dese	ed Syllabus: cription ineering (CAE) and its applicati	ons to engineeri	ng problems	Duration (H)			
Practical	Part I Introdu Use of Discret	iction to Com CAE in Prod ization metho	Detail Desc nputer Aided Eng uct development od commonly use	ed Syllabus: cription ineering (CAE) and its applicati d (FEM) for CA	ons to engineeri E.	ng problems	Duration (H)			
Practical	Part I Introdu Use of Discret Use of	iction to Com CAE in Prod ization metho application so	Detail Desc nputer Aided Eng uct development od commonly use oftware and diffe	ed Syllabus: cription ineering (CAE) and its applicati d (FEM) for CA rent available so	ons to engineeri E. ftware	ng problems	Duration (H) 4			
Practical	Part I Introdu Use of Discret Use of CAE To	ction to Com CAE in Prod ization metho application so ools- Pre-pro	Detail Desc nputer Aided Eng uct development od commonly use oftware and diffe cessor, Solver an	ed Syllabus: cription ineering (CAE) and its applicati d (FEM) for CA rent available so d Post-Processo	ons to engineeri E. ftware r.	ng problems	Duration (H) 4			
Practical	Part I Introdu Use of Discret Use of CAE To Nodal u	action to Com CAE in Prod ization metho application so ools- Pre-pro unknowns and	Detail Desc nputer Aided Eng uct development od commonly use oftware and diffe cessor, Solver an d shape function	ed Syllabus: cription ineering (CAE) and its applicati d (FEM) for CA rent available so d Post-Processo (Quadratic func	ons to engineeri E. ftware r. ion)	ng problems	Duration (H) 4			
Practical 1	Part I Introdu Use of Discret Use of CAE To Nodal u Part II	action to Com CAE in Prod ization metho application so ools- Pre-pro inknowns and	Detail Desc nputer Aided Eng uct development od commonly use oftware and diffe icessor, Solver an d shape function	ed Syllabus: cription ineering (CAE) and its applicati d (FEM) for CA rent available so d Post-Processo (Quadratic func	ons to engineeri E. ftware r. ion)	ng problems	Duration (H) 4			
Practical 1	Part I Introdu Use of Discret Use of CAE To Nodal u Part II Fundam	action to Com CAE in Prod ization metho application so ools- Pre-pro inknowns and mentals of fin	Detail Desc puter Aided Eng uct development od commonly use oftware and diffe icessor, Solver an d shape function ite elements, app	ed Syllabus: cription ineering (CAE) and its applicati d (FEM) for CA rent available so d Post-Processo (Quadratic func	ons to engineeri E. ftware r. ion) mechanics: Int	ng problems	Duration (H) 4			
Practical 1	Part I Introdu Use of Discret Use of CAE To Nodal u Part II Fundan truss ele	action to Com CAE in Prod ization metho application so ools- Pre-pro inknowns and nentals of fin ements, bean	Detail Desc nputer Aided Eng uct development od commonly use oftware and diffe cessor, Solver an d shape function ite elements, app n elements, consta	ed Syllabus: cription ineering (CAE) and its applicati d (FEM) for CA rent available so d Post-Processo (Quadratic func blication to solid ant strain triang	ons to engineeri E. ftware r. ion) mechanics: Int e (CST).	ng problems	Duration (H) 4			
Practical 1 2	Part I Introdu Use of Discret Use of CAE To Nodal u Part II Fundant truss ele Meshin	action to Com CAE in Prod ization metho application so ools- Pre-pro unknowns and mentals of fin ements, beam g Techniques	Detail Desc puter Aided Eng uct development od commonly use oftware and diffe cessor, Solver an d shape function ite elements, app n elements, consta s: Discretization	ed Syllabus: cription ineering (CAE) and its applicati d (FEM) for CA rent available so d Post-Processo (Quadratic func blication to solid ant strain triangl of a Structure, 1	ons to engineeri .E. ftware r. tion) mechanics: Int e (CST). D, 2D and 3D e	ng problems roduction to bar, lement Meshing,	Duration (H) 4			
Practical 1 2	Part I Introdu Use of Discret Use of CAE T Nodal u Part II Fundan truss ele Meshin Use of	action to Com CAE in Prod ization metho application so ools- Pre-pro inknowns and mentals of fin ements, beam g Techniques Symmetry, 1	Detail Desc puter Aided Eng uct development od commonly use oftware and diffe cessor, Solver an d shape function ite elements, app n elements, consta s: Discretization Mesh quality (Sl	ed Syllabus: cription ineering (CAE) and its applicati d (FEM) for CA rent available so d Post-Processo (Quadratic func blication to solid ant strain triangl of a Structure, 1 sewness, orthog	ons to engineeri E. ftware r. ion) mechanics: Int e (CST). D, 2D and 3D e onal quality, As	ng problems roduction to bar, lement Meshing, spect ratio, etc.),	Duration (H) 4			
Practical 1 2	Part I Introdu Use of J Discret Use of J CAE To Nodal u Part II Fundan truss ele Meshin Use of Mesh in	action to Com CAE in Prod ization metho application so ools- Pre-pro inknowns and mentals of fin ements, beam g Techniques Symmetry, 1 ndependent to	Detail Desc Description Descri	ed Syllabus: cription ineering (CAE) and its applicati d (FEM) for CA rent available so d Post-Processo (Quadratic func blication to solid ant strain triangl of a Structure, 1 cewness, orthog	ons to engineeri E. ftware r. ion) mechanics: Int e (CST). D, 2D and 3D e onal quality, As	ng problems roduction to bar, lement Meshing, spect ratio, etc.),	Duration (H) 4 4			
Practical 1 2 3	Part I Introdu Use of J Discret Use of J CAE T Nodal u Part II Fundant truss ele Meshint Use of Mesh in ID Bart	action to Com CAE in Prod ization metho application so ools- Pre-pro inknowns and mentals of fin ements, beam g Techniques Symmetry, 1 ndependent te Element – S	Detail Desc Description Descri	ed Syllabus: cription ineering (CAE) and its applicati d (FEM) for CA rent available so d Post-Processo (Quadratic func blication to solid ant strain triangl of a Structure, 1 sewness, orthog	ons to engineeri E. ftware r. ion) mechanics: Int e (CST). D, 2D and 3D e onal quality, As	ng problems roduction to bar, lement Meshing, spect ratio, etc.),	Duration (H) 4 4 4			
Practical 1 2 3	Part I Introdu Use of Use of Use of CAE To CAE To Nodal u Part II Fundant truss ele Meshint Use of Mesh in 1D Bar Truss A	action to Com CAE in Prod ization metho application se ools- Pre-pro inknowns and mentals of fin ements, beam g Techniques Symmetry, 1 ndependent te Element – S Analysis usin	Detail Description Detail Description Description Detail Description Detail Description De	ed Syllabus: cription ineering (CAE) and its applicati d (FEM) for CA rent available so d Post-Processo (Quadratic func olication to solid ant strain triangl of a Structure, 1 cewness, orthog	ons to engineeri E. ftware r. ion) mechanics: Int e (CST). D, 2D and 3D e onal quality, As	ng problems roduction to bar, lement Meshing, spect ratio, etc.),	Duration (H) 4 4 4 4 4			
Practical 1 2 3 4	Part I Introdu Use of Use of O Discret Use of O CAE To Nodal u Part II Fundan truss ele Meshin Use of Mesh in ID Bar Truss A Therm	action to Com CAE in Prod ization metho application so ools- Pre-pro inknowns and mentals of fin ements, beam g Techniques Symmetry, 1 ndependent to Element – S Analysis using al Analysis –	Detail Description	ed Syllabus: cription ineering (CAE) and its applicati d (FEM) for CA rent available so d Post-Processo (Quadratic func blication to solid ant strain triangl of a Structure, 1 cewness, orthog Analysis	ons to engineeri E. ftware r. ion) mechanics: Int e (CST). D, 2D and 3D e onal quality, As	ng problems roduction to bar, lement Meshing, spect ratio, etc.),	Duration (H) 4 4 4 4 4 4 4			
Practical 1 2 3 4	Part I Introdu Use of 4 Discret Use of 4 CAE T Nodal 4 Part II Fundan truss ele Meshin Use of Mesh in 1D Bar Truss A Therm Couple	action to Com CAE in Prod ization metho application so ools- Pre-pro inknowns and nentals of fin ements, bean ig Techniques Symmetry, I ndependent te Element – S Analysis using al Analysis – (d	Detail Description	ed Syllabus: cription ineering (CAE) and its applicati d (FEM) for CA rent available so d Post-Processo (Quadratic func olication to solid ant strain triangl of a Structure, 1 cewness, orthog Analysis	ons to engineeri E. ftware r. ion) mechanics: Int e (CST). D, 2D and 3D e onal quality, As	ng problems roduction to bar, lement Meshing, spect ratio, etc.),	Duration (H) 4 4 4 4 4 4 4			
Practical 1 2 3 4 5	Part I Introdu Use of J Discret Use of J CAE To Nodal u Part II Fundan truss ele Meshin Use of Mesh in ID Bar Truss A Couple Modal	action to Com CAE in Prod ization metho application se ools- Pre-pro inknowns and nentals of fin ements, bean g Techniques Symmetry, I ndependent te Element – S Analysis usin ial Analysis – (Analysis – S	Detail Desc Description Descri	ed Syllabus: cription ineering (CAE) and its applicati d (FEM) for CA rent available so d Post-Processo (Quadratic func blication to solid ant strain triangl of a Structure, 1 cewness, orthog Analysis	ons to engineeri E. ftware r. ion) mechanics: Int e (CST). D, 2D and 3D e onal quality, As	ng problems roduction to bar, lement Meshing, spect ratio, etc.), beam, etc.	Duration (H) 4 4 4 4 4 4 4 4			
Practical 1 2 3 4 5	Part I Introdu Use of 4 Discret Use of 4 CAE To CAE To Nodal 4 Part II Fundant truss ele Meshin Use of Mesh in 1D Bar Truss A Therm Couple Modal Analys	action to Com CAE in Prod ization metho application so ools- Pre-pro inknowns and mentals of fin ements, beam g Techniques Symmetry, 1 ndependent te Element – S Analysis using al Analysis – S is of Machino	Detail Desc Description Descri	ed Syllabus: cription ineering (CAE) and its applicati d (FEM) for CA rent available so d Post-Processo (Quadratic func blication to solid ant strain triangl of a Structure, 1 cewness, orthog Analysis rmal) em, simply supp ng 3D Elements	ons to engineeri E. ftware r. ion) mechanics: Int e (CST). D, 2D and 3D e onal quality, As orted/Cantilever -Part I	ng problems roduction to bar, lement Meshing, pect ratio, etc.), beam, etc.	Duration (H) 4 4 4 4 4 4 4 4 4			
Practical 1 2 3 4 5	Part I Introdu Use of Use of CAE To CAE To Nodal u Part II Fundant truss ele Meshint Use of Mesh in 1D Bart Truss A Therma Couple Modal Analys Analys	action to Com CAE in Prod ization metho application so ools- Pre-pro inknowns and mentals of fin ements, beam g Techniques Symmetry, 1 ndependent te Element – S Analysis using al Analysis – S d Analysis – S is of Machino	Detail Desc puter Aided Eng uct development od commonly use oftware and diffe cessor, Solver an d shape function ite elements, consta s: Discretization of Mesh quality (Sh est. dructural Linear A g 1D Element - Static Analysis (Structural + Theo pring -Mass syste e Component usin e Component usin	ed Syllabus: cription ineering (CAE) and its applicati d (FEM) for CA rent available so d Post-Processo (Quadratic function of a Structure, 1 cewness, orthog Analysis rmal) em, simply supp ng 3D Elements ng 3D Elements	ons to engineeri E. ftware r. ion) mechanics: Int e (CST). D, 2D and 3D e onal quality, As orted/Cantilever -Part I : Part II	ng problems roduction to bar, lement Meshing, spect ratio, etc.), beam, etc.	Duration (H) 4 4 4 4 4 4 4 4 4			
Practical 1 2 3 4 5 6	Part I Introdu Use of Discret Use of CAE To Nodal u Part II Fundan truss ele Meshin Use of Mesh in 1D Bar Truss A Therm Couple Modal Analys Present	action to Com CAE in Prod ization metho application se ools- Pre-pro inknowns and mentals of fin ements, beam g Techniques Symmetry, 1 ndependent te Element – S Analysis usin al Analysis – d Analysis – S is of Machine tation on ac	Detail Desc Description Descri	ed Syllabus: cription ineering (CAE) and its applicati d (FEM) for CA rent available so d Post-Processo (Quadratic func blication to solid ant strain triangl of a Structure, 1 cewness, orthog Analysis rmal) em, simply supp ng 3D Elements tions of FEA,	ons to engineeri E. ftware r. ion) mechanics: Int e (CST). D, 2D and 3D e onal quality, As orted/Cantilever -Part I Part II NVH, CFD,	ng problems roduction to bar, lement Meshing, pect ratio, etc.), beam, etc. Crash, Fatigue,	Duration (H) 4 4 4 4 4 4 4 4 4 4 4			
Practical 1 2 3 4 5 6	Part I Introdu Use of Use of CAE To CAE To Nodal u Part II Fundan truss ele Meshin Use of Mesh in Truss A Therm Couple Modal Analys Present Manufa	action to Com CAE in Prod ization metho application so ools- Pre-pro inknowns and nentals of fin ements, bean ig Techniques Symmetry, I ndependent to Element – S Analysis using al Analysis – (Analysis – S is of Machine tation on ac acturing, etc.	Detail Desc puter Aided Eng uct development of commonly use oftware and diffe cessor, Solver an d shape function ite elements, consta s: Discretization of Mesh quality (Sl est. tructural Linear A g 1D Element - Static Analysis (Structural + Then pring -Mass syste e Component usin dvanced applica	ed Syllabus: cription ineering (CAE) and its applicati d (FEM) for CA rent available so d Post-Processo (Quadratic func olication to solid ant strain triangl of a Structure, 1 acwness, orthog Analysis rmal) em, simply supp ng 3D Elements tions of FEA,	ons to engineeri E. ftware r. ion) mechanics: Int e (CST). D, 2D and 3D e onal quality, As onal quality, As orted/Cantilever -Part I : Part II NVH, CFD,	ng problems roduction to bar, lement Meshing, pect ratio, etc.), beam, etc. Crash, Fatigue,	Duration (H) 4 4 4 4 4 4 4 4 4 4 4 4			

1. Gokhale N. S., Deshpande S. S., Bedekar S. V. and Thite A. N., Practical Finite Element Analysis, Finite to Infinite, Pune, 1st Edition, 2008

2. The Finite Element Method and Applications in Engineering Using ANSYS® by Madenci, Erdogan, Guven, Ibrahim (Springer) Seshu P., —Text book of Finite Element Analysisl, PHI Learning Private Ltd., New Delhi, 2010.

Progr	am:	B. Tech. (All Bra	nches)			Semeste	er : V					
Cours	se : Professional Development Training-I (MC-I) Code : BHM5917											
		Teaching Scheme	:		Eval	uation Scheme	e					
Le	ecture	Practical	Tutorial	Credit	СЕ	MTE	ЕТЕ	Total				
	3	-	-	-	-	-	-	-				
Cours This co a. b. Cours After 1 1.	e Objectiv ourse aims To enhar To impro e Outcome earning the Having a Having o	es: at enabling the stud nce the logical reaso ove the overall profe es: Students will be course, the student adaptive thinking and critical thinking and	ents oning skills of the stu essional developmen able to s will be: d adaptability throu innovative skills	udents and imp nt of students. gh various Qu	prove the prob	blem-solving al	pilities.					
3.	 Having critical unifold and innovative skins Having interest in lifelong learning & developing verbal competencies in the students. 											
	Detailed Syllabus:											
Unit	Description Duration (H)											
1.	Modern I Profit los median, p and Mixtu	Maths s, Ratio & Proporti permutation & comb ures, Simple Interes	on, LCM & HCF, 7 vination, Probability t and Compound Int	Fime speed an , Pipe & syste erest.	d Distance, A ms, Mixture v	verage, Mean, alidation, Alle	mode, gations	6				
2.	Algebra Linear eq Geometr Triangles	uations, Quadratic e y , Polygons (question	equations, Triplets. as on Area Perimete	r).				6				
3.	Mensura Cube cub Trigonon Number Statistics	tion oids cone cylinder s netry System	phere (questions on	volume surfa	ce Area)			6				
4.	Logical F Clocks a formation Game-Ba	Reasoning nd Calendar, Dire , Coding and Deco sed Aptitude.	ction sense, Family ding, Number Serie	y tree, Syllog es and Letter S	gism, Seating Series, Rankir	arrangement, ag and Arrange	Team ements,	6				
5.	Data International Data Char	e rpretation ts, Data tables, Bar,	Pie, Line graphs, V	enn diagram.				6				
6.	Verbal Ability & Reading ComprehensionSubject-Verb Agreement, Articles and Other Determiners, Prepositions, Tenses, Parts of Speech, Active and Passive Voice, Direct and Indirect Speech, Error Spotting and Sentence Correction, Sentence Completion, Synonyms and Antonyms, Reading Comprehension, Para Jumbles.6											
	Total 36											
Refere 1. 2. 3.	ence Books Arun Sh ETHNU R S Agg Delhi.	: arma, Quantitative A S, Aptimithra, 2013 arwal, Quantitative	Aptitude, 2016, 7 th E , 1 st Edition, McGrav Aptitude For Comp	Edition, McGr w-Hill Educat etitive Examin	aw Hill Educa ion Pvt.Ltd. nations, 2017,	tion Pvt. Ltd. 3 rd Edition, S.	Chand Pu	ublishing,				

 4. M. Tyra, Quicker Maths, 2018, 5th edition, 2018, BSC publishing company Pvt. Lt.
 ** Students should get a passing grade if they will clear at least two online aptitude tests and achieve minimum criteria of attendance.

Program:	B. Tech. (All bi	ranches)			Semester: V	7			
Course :	Environmental Sciences (AUDIT-II) Semester: V Code :BHM9961								
	Itse : Environmental Sciences (AUDI1-II) Code :BHM9961 Teaching Scheme Evaluation Scheme								
Lecture	Tutorial	Credit	Hours	IE	MTE	ЕТЕ	Total		
1	-	-	1	-	-	-	-		
Prior knov	vledge :Nil								
Course Ob 1. To ana 2. To 3. To 4. To and	jectives: gain an understand lyze various conser examine biotic and understand the valu provide compreher control.	ing on the concep rvation methods for abiotic factors w ue of biodiversity nsive overview of	ts and strategie or renewable ar ithin an ecosyst and identify cu environmental	s related to s ad non-renew tem and to id rrent efforts pollution and	ustainable devel- vable resources. entify energy flo for its conservat l technology ass	opment and ide ow in ecosyster ion at national ociated with m	entify and n. and local level ionitoring		
Course Ou After comp 1. Der the 2. Dis 3. Ider 4. Ana	tcomes: letion of this cours nonstrate an integr role of organism ir tinguish between re ntify key threats to alyze the impact of	e, the students wi ative approach to a energy transfer i enewable and non biodiversity and environmental po	Il be able to, environmental n different ecos -renewable reso develop approp bilution and the Detailed Syl	issues with a system. ources and ar riate policy c science behi	focus on sustain nalyze consumpt options for it's co nd those probler	nability and ide ion of resource onservation. ns and potentia	entify es 11 solutions.		
Unit			Descriptio)n			Duration (H)		
1.	Multidisciplinary Need for Public a Natural Resourc associated problem individual in const Ecosystems: Con	y nature of envir wareness, es: Renewable an ms a) Forest b) W vervation of natura	onmental stud d non- renewab ater c) Mineral al resources, Us	ies: Definition ble resources: d) Food e) L e of resource	on, scope and im Natural resourc and f) Energy, F s for sustainable	portance, es and Role of an lifestyle.	3		
2.	consumers and de chains, food webs ecosystem, Aquat	ecomposer, Energ s and ecological p ic ecosystem.	gy flow in the e pyramids, Chara	ecosystem, E acteristic fea	tures, Case stud	ssion, Food y on Forest	3		
3.	Biodiversity and ecosystem diversi consumptive use, national and local to biodiversity, Co	its conservation ty, Biogeographic productive use, so levels, India as a onservation of bio	: Introduction – cally classification ocial, ethical, ac mega-diversity odiversity, Case	Definition: ion of India, esthetic value nation, Hots study on any	genetic, species Value of biodive es, Biodiversity a spots of biodiver y one Hotspot of	and ersity: at global, rsity, Threats biodiversity.	3		
4.	Environmental F pollution: a. Air b management, Rele Issues and the En problems related t ideas for creating	Pollution: Definiti b. Water c. Soil d. evance of environ nvironment : Fron to energy ,Water c public environme	ion, Cause, effe Noise e. Therm mental ethics fo m Unsustainabl conservation, Ir ental awareness.	ects and contr nal f. Nuclear or environme e to Sustaina npact of Clin	rol measures of c hazards, Solid v ental protection, ble development nate change, Inne	lifferent waste Social t,Urban ovative	3		
						Total	12		
Text Bool 1. Cu Jai Jai 2. Ag 81 Reference 1. Bł	ss: unningham, W.P. C ico Publications Ho garwal, K.C, —Env 89153021 Books: aruchaErach —T	Cooper, T.H. Gorh puse, 1 st edition, 20 vironmental Biolo	ani, E & Hepw 000, ISBN-13: 9 gyl, Nidhi Publ	orth, M.T., – 978-8172247 lishers, 2 nd ec	–Environmental /867 lition ,2008, ISB	Encyclopedial SN-13978-	l, N-		
1. D	8188204064	ie Biourversity Of	india, mapin	r uonsning r		on, 20021, ISD	-11-		



Program	n: B. Tech.	(Mechanical)				Semester : VI	[
Course	: Numeric	rical Methods and Optimization (PCC) Code : BME6413								
	Tea	ching Schem	e			Evaluation S	Scheme			
Lectur	e Practical	Tutorial	Credit	CE	MTE	ETE	PR	Total		
2	2		3	20	30	50	25	125		
Prior k a. b. c.	nowledge of: System of linea Partial differen Problem solvin are essential	ar equations, tiation g and program	nming							
Cours	e Objectives:									
Stu 1.	dents are expect Effectively use	ted to study, Numerical Te	echniques for so	lving compl	ex Mechanica	l engineering pr	oblems			
2.	 Develop logical sequencing for solution procedure. Optimize the solution for different real-life problems with available constraints. 									
5. Cours	3. Optimize the solution for different real-life problems with available constraints.									
The St	Course Outcomes: The Students will be able to									
1.	Use appropriat	e Numerical N	fethods to solve	e complex m	echanical eng	ineering probler	ns.			
2.	Formulate alg	orithms and p	rogramming.							
3.	Compare the s	system's behav	viour for the exp	perimental d	ata.					
4.	Generate solut	tions for real-l	ife problems us	ing optimiza	tion technique	es				
			D	etailed Syll	abus:			Duration		
Unit			I	Description				(H)		
	Solution of Lin	ear algebraic	equations	ston Donhao	n mathad					
1	Simultaneous e	auon: Disection constions: Ga	uss Elimination	n Method w	ith Partial pi	voting Gauss-S	eidel method	6		
	and Thomas alg	orithm for Tri	-diagonal Matri	X.	in runn pr	oung, ouuss s	chuch methou	Ū		
	Numerical Inte	gration: Trap	ezoidal rule, Si	mpson's 1/3 ¹	rd Rule, Simps	on's 3/8 th Rule.				
	Curve Fitting	and Regression	on Analysis							
	Curve Fitting:	Least square	technique- Str	aight line, P	ower equatio	n, Exponential	equation and	<i>.</i>		
2.	Quadratic equat	ion. Avgist Nopli	and regression	multi roor	agaion analys	ia Lagrongo'a	Internalation	6		
	Newton's Forwa	arysis: Nominard interpolation	lear regression	, munti tegr	ession analys	is, Lagrange's	interpolation,			
	Solution of Diff	ferential Equ	ations							
	Ordinary Diffe	rential Equat	ions [ODE]: E	uler Method	, Modified Eu	ler Method, Rur	nge-Kutta 2 nd			
3.	order and 4 th ord	ler method.					0	6		
	Partial Differe	ntial Equatio	ns [PDE]: Fini	te difference	e method, Sin	nple Laplace m	ethod, PDEs-			
	Parabolic explic	it solution.								
4	Optimization	ontimization	Classification	Constrain	ad ontimizati	on: Craphical	and Simplay			
4.	method (limited	to two var	iables) Nonlin	, Constraint ear Ontimiz	vation Mode	n Optimization	Techniques	6		
	(theoretical treat	tment only)		car Optimiz			reeninques			
	(<i>J</i>					Total	24		
Textbo	extbook:									
1.	Steven C. Chapi	ra, Raymond H	P. Canale, Nume	erical Metho	ds for Engine	ers, McGraw-Hi	ll Higher Educ	ation, 2010		
2.	2. Dr. B. S. Garewal, Numerical Methods in Engineering and Science, Khanna Publishers, 2013									
3.	5. Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, Tata Mc-Graw Hill Publishing 2022									
4	4. Rao V. Dukkipati, Applied Numerical Methods using Matlab, New Age International Publishers, 2020									
Referer	eferences:									
1.	Gerald and Whe	atley, Applied	l Numerical An	alysis, Pears	on Education,	2003				
2.	E. Balagurusam	y, Numerical 1	Methods, Tata M	McGraw Hill	l, 2017					
3.	P. Thangaraj, Co	omputer Orien	ted Numerical	Methods, Pro	entice Hall Ind	lia, 2008				
4.	S. S. Sastry, Inti	oductory Met	hods of Numeri	cal Analysis	. Prentice Hal	1 India, 2012				

Practicals:

Complete all assignments in MATLAB software

- 1. Program on Roots of Equation (Validation using a suitable solver, anyone per student)
- a) Bisection Method, b) Newton Raphson method
- 2. Program on Simultaneous Equations (Validation using a suitable solver, anyone per student)
 a) Gauss Elimination Method, b) Thomas algorithm for tridiagonal matrix, c) Gauss-Seidel method.
- 3. Program on Numerical Integration(Validation using a suitable solver, anyone per student)
 a) Trapezoidal rule, b) Simpson's Rules (1/3rd, 3/8th) [In one program only]
- Program on Curve Fitting using Least square technique (Validation using a suitable solver, anyone per student t)
 - a) Straight line, b) Power equation, c) Exponential equation, d) Quadratic equation
- 5. Program on Interpolation(Validation using a suitable solver, anyone per student)
 - a) Lagrange's Interpolation, b) Newton's Forward interpolation,
- 6. Program on ODE(Validation using a suitable solver, anyone per student)
 a) Euler Method, b) Runge-Kutta Methods- fourth-order, c) Simultaneous equations. (Runge-Kutta second-order: *One-step only*).
- 7. **Program on PDE**(Validation using a suitable solver, anyone per student): Laplace equation
- 8. Demonstration of optimization technique using suitable solver.

NOTE:

- 1. Solver is compulsory for all above programs and compared with the actual solution.
- 2. Manual solution for each problem.
- 3. Algorithms and Flowcharts are compulsory for all programs.

GUIDELINES TO CONDUCT PRACTICAL EXAMINATION

Anyone program from each set A & B with flowchart and solver: Duration: 2 hrs.

Set A: (Weightage – 60 %)

a) Simultaneous Equation, b) Partial Differential Equation (Laplace equation with solver) c) Interpolation: Lagrange's interpolation, Newton's Forward interpolation (Anyone)

Set B: (Weightage – 40 %)

a) Roots of Equations, b) Curve Fitting, c) Ordinary Differential Equations, d) Integration

Progra	m: B. Tech. (Me	echanical)				Semester	: VI		
Course	: Mechatronic	es (PCC)				Code : BN	ME6414		
	Teaching	Scheme			I	Evaluation	Scheme		
Lectu	re Practical	Tutorial	Credit	IE	MTE	ЕТЕ	OR		Total
3	2	-	4	20	30	50	25		125
Prior k	nowledge of:			•	•		•		
a. b	Applied Mathematic	CS hanical Maasu	romont						
υ.	are essential	nameai wieasu	lement						
Course	Objectives:								
After co	ompletion of the cour	se, students wi	ll have adequ	ate backgrou	und, concept	ual clarity a	and knowled	lge of	
interdis	ciplinary principles re	elated to:							
1.	To understand the pri	inciples of elec	trical actuator	rs and its sel	ection accor	ding to the	applications		
2.	To study the data acq	uisition system	n and its vario	ous compone	ents.				
3.	To understand the dif	ferent control	systems, mod	leling and ar	alysis of me	chanical sy	stem.		
4. 5 '	To study the basics o	f fluid power s	ystems and its	s application	15 nmina				
J.	Outcomes:	is of the FLC s	ystern and rac	uder program	lilling.				
After le	arning the course, the	e students will	be able to:						
1.	SELECT appropriat	te electrical act	uator for any	mechatroni	cs sy <mark>ste</mark> m.				
2.	UTILIZE the conce	pt of DAQ and	signal proces	ssing to inte	rfa <mark>ce any s</mark> ei	nsor to acqu	ire the data.		
3.	DETERMINE the t	ransfer functio	n and PREDI	CT the stabi	lity of the m	echanical s	ystem.		
4.	IDENTIFY and AP	PLY the basics	fluid power	components	to CREATE	E the hydrau	ilic /pneuma	tic cire	cuits.
5.	DESIGN and DEVI	ELOP a ladder	programming	g for mechai	nical application	tions.			
6.	DESIGN and ANA	LYSE the PID	controller for	r mechanical	system.			20	
	1	A	Deta	ailed Syllab	us:		12	3)	D 4
Units			Des	scription				6	Duration (H)
1	Electrical Actuat motors : induction motors and its app	ors: Classifica motor; Specia lications; elect	tion of actuat l purpose mo ro-mechanica	ors; DC mo tors : Steppe al solenoid.	tors: PMDC er motor and	and BLDC servo moto	; or; Selection	AC 1 of	6
2	Data Acquisition System; Sampling (4 bit Successive DAC); Basics of L	& Control Sy , Aliasing, San Approximatic Labview; Nume	stem: Introduction of the second seco	uction to DA circuit, Qua (); Digital-to	AQ, Componentization; A co-Analog co	nents of a D nalog-to-di onverters (4 OS Free	ata Acquisit gital conver bit R2R t	tion ters ype	6
3	Mathematical Ma Closed loop; Conc Transfer Function Analysis using Ro	odelling & Ar cept of Transfe based modeli outh Hurwitz C	alysis: Introc r Function, Bl ng of Mechar riterion; Num	luction to co lock Diagram nical system pericals.	ontrol systen m & Reducti a; Concept o	ns, need, Ty ion principl of Poles & 1	ypes- Open es; Numeric Zeros, Stabi	and als; lity	6
4	Analysis using Routh Hurwitz Criterion; Numericals.Introduction to Fluid Power: Basics of fluid power, Fluid power system components: Hydraulic Gear Pump; Reciprocating air compressor Linear and rotary actuators (Single acting and double acting cylinder, air motor); Direction control valves, Pressure control valve; Flow control valve, proportional valve; Standard Symbols of fluid power components; Industrial applications.6								
5	Programmable Specifications of Timers, Counters;	Logic Contro PLC; Ladder I PLC program	ller (PLC) Logic program ning; and its	: Introduct nming for d mechatronic	tion to PLO ifferent type application	C, Archite s of logic g ns.	cture of Pl gates; Latchi	LC;	6
6	PID control: Intr Derivative (D) co Numericals.	roduction to control actions;	ontrollers; Ne PI, PD and F	ed for cont PID control	rol; Proport systems in j	ional (P), l parallel for	Integral (I) m; PID tuni	and ng;	6
							Т	otal	36

Text Books:

- William Bolton, Mechatronics: Electronics Control Systems in Mechanical and Electrical Engineering, 6th Ed, 2019
- K.P. Ramchandran, G.K. Vijyaraghavan, M.S. Balasundaram, Mechatronics: Integrated Mechanical Electronic Systems, Willey Publication, 2008
- 3. Esposito A, Fluid Power with application, Prentice Hall
- 4. Majumdar S.R, Oil Hydraulic system- Principle and maintenance, Tata McGraw Hill
- 5. Majumdar S.R, Pneumatics Systems Principles and Maintenance, Tata McGraw Hill
- 6. Stewart H. L, Hydraulics and Pneumatics , Taraporewala Publication

Reference Books:

- 1. Alciatore and Histand, Introduction to Mechatronics and Measurement Systems, 5th Ed, 2019
- 2. Bishop (Editor), Mechatronics An Introduction CRC 2006
- 3. Mahalik, Mechatronics Principles, concepts and applications, Tata Mc-Graw Hill publication, New Delhi
- 4. C.D.Johnson, Process Control Instrumentation Technology, Prentice Hall, New Delhi 5. Bolton, Programmable Logic Controller, 4th Ed, Newnes, 2006
- 5. Bolton, Programmable Logic Controller, 4th Ed, Newnes, 2006
- 6. Pipenger J.J, Industrial Hydraulics, McGraw Hill
- 7. Pinches, Industrial Fluid Power, Prentice Hall
- 8. Yeaple, Fluid Power Design Handbook
- 9. Andrew A. Parr, Hydraulics and Pneumatics, Elsevier Science and Technology Books
- 10. ISO 1219, Fluid Systems and components, Graphic Symbols

e-sources:

- 1. https://www.elprocus.com/what-is-a-biosensor-types-of-biosensors-and-applications/
- 2. https://www.elprocus.com/color-sensor-working-and-applications/
- 3. https://www.youtube.com/watch?v=kbjCGGTXqUo&ab_channel=Controlengineering
- 4. https://youtu.be/clTA0pONnMs?list=PLHMDN3JFtE5wEz95H2XuzRaafK3fUsaki
- 5. https://nptel.ac.in/content/storage2/courses/108105063/pdf/L12(SS)%20(IA&C)%20((EE)NPTEL).pdf
- 6. https://nptel.ac.in/content/storage2/courses/112104158/lecture5.pdf

Term Work:

The Term work shall consist of completion of Practical and Self-learning study. Oral examination shall be based on the term work undertaken during the semester. Any eight experiments out of the following:

- 1. Demonstration of speed control of BLDC motor using PWM.
- 2. Experiment on interfacing of suitable sensor with DAQ and LabView.
- 3. Experiment on measurement of displacement/deformation using DAQ and LabView
- 4. Design and Develop LabView programme for measurement of any parameter.
- 5. Modeling and analysis of mechanical system and its verification using MATLAB/SIMULINK software.
- 6. Speed control of pneumatic cylinder using meter-in and meter-out circuit
- 7. Ladder logic simulation using suitable software for logic gates.
- 8. Automatic reciprocation of double acting pneumatic cylinder using PLC ladder programming
- 9. PID control of mechanical system using suitable simulation software and its experimental verification
- 10. Design and develop any mechatronics application using software / hardware.
- 11. Demonstration of any one real life mechatronics system application

	B. Tech. (Me	chanical)			Semester : VI		
Course :	Design Engi	neering Lab (P	CC)		Code : BME6415	;	
	Teaching sch	eme		Eva	luation Scheme		
Lecture	Practical	Tutorial	Credit	IE	TW	OR	Total
	2	-	1	-	25	25	50
Prior know	ledge of:						
a. b	Engineering M	lechanics,					
0. c.	Strength of Ma	terials.					
d.	CAMD I & II	,					
e.	Machine Desig	gn,					
f.	Kinematics &	Theory of Mach	nines,				
g.	Dynamics of M	lachinery					
Course Ob	iectives:						
After compl	etion of the cou	urse, students w	ill have adequate	background, con	ceptual clarity and k	nowledge of	of
1.	To enable stud	ent, select mate	rials and to desig	n internal engine	components.		
2.	To introduce st	tudent to optime	um design and us	e optimization m	ethods to design mec	hanical con	mponents.
3.	To enable stud	ent to design m	achine tool gearb	OX.			
4.	To enable stud	ent to design m	aterial handling s	ystems			
5.	To enable stud	ent to design cy	linders and press	ure vessels and to	use IS code		
Course Out	tcomes:		/				
After learnin	ng the course, t	he students will	be able to:	ro vossols machi	tool goor boxos n	notorial han	dling systems
1.	etc. for the spe	cifications state	d/formulated	ie vesseis, macini	le tool geal boxes, li		uning systems,
2.	Handle system	level projects f	from concept to p	roduct.			
3.	Understand the	e difference bety	ween component	level design and	system level design		
-			Contents	of Term Work <mark>:</mark>	X		
			Descrip			1 1 1 1 1	T
The term	work shall incl			tion			Duration (H)
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TY B Tech (Mechanical Engineering), PCCoE Pune

Assignments	 A group of 4-5 students will study these topics and submit a report and give a presentation containing minimum 8-10 slides. 1. Design of principal parts of I C Engine using thermal considerations. (Dissimilar metals performance under elevated temperatures) (Analytical/ Numerical thermal analysis using simulation tools) 2. Design for manufacture and assembly for Cylinder Block of I C Engines. 3. Case study on Statistical Considerations in design. 4. Case study on Ergonomic design modifications (Preferably using the Design software). 	4
	Total	24
D.C		

Reference Books:

- 1. Design Data- P.S.G. College of Technology, Coimbatore, Printed in 2017
- Bhandari, V. B. Machine Design data book, Tata McGraw Hill Publication Co. Ltd, 5th edition 2017 2.
- I.S. 2825: Code for unfired pressure vessels. 3.
- Shigley J. E. and Mischke C.R., —Mechanical Engineering Designl, McGraw Hill Pub. Co, 11th edition 2020 4.
- M. F. Spotts, Design of Machine Elements Prentice Hall Inc, 8th edition 2019 5.
- Black P.H. and O. Eugene Adams, -Machine Design McGraw Hill Book Co. Inc. 6.
- 7. Johnson R.C., —Mechanical Design Synthesis with Optimization Applications, Von Nostrand Reynold Pub.
- S.K. Basu and D. K. Pal, -Design of Machine Tools, Oxford and IBH Pub Co, 6th edition 2018 8.
- 9. Rudenko, Material Handling Equipment, M.I.R. publishers, Moscow
- 10. P. Kannaiah , Design of Transmission systems , SCIETCH Publications Pvt Ltd, 2nd edition 2015.
- 11. Pandy, N. C. and Shah, C. S., Elements of Machine Design, Charotar Publishing House.
- 12. Mulani, I. G., -Belt Conveyors
- 13. Singiresu S. Rao, Engineering Optimization: Theory and Practice, John Wiley & Sons, 5th edition 2019
- 14. Joshi's Process Equipment Design, by V V Mahajani and S B Umargi, Mc-Millan, 5th eedition 2016

Course: Non - Conventional Energy Systems (PEC-III) Code : BME6503A Teaching Scheme Evaluation Scheme Leture Fractical Bour Credit IE MTE ETF Total 3 3 3 20 30 50 100 Principso of Heat Transfer .	Progra	m: B. Tecl	. (Mechanical)			Semes	ter : VI	
Teaching Scheme Evaluation Scheme Lecture Practical Hour Credit IE MTE ETE Total 3 3 20 30 50 100 7 To Knowledge of: a. Fundmental concepts and laws/governing equations of Engineering Thermodynamics, fluid mechanics. Princ Knowledge of: a. Fundmental concepts and laws/governing equestions of Engineering Thermodynamics, fluid mechanics. b Principes of Heat Transfer Contents of Electrical Engineering are essential Objectives: 1. To provide a fundmental understanding of: • Wind power devices systems and their performance characteristics • Wind power devices systems characteristics • Wind power devices systems and their performance characteristics 3. To anderstand issues in the utilization and economic viability of renewable-powered devices and systems Coursectours: 1. Estimate solar radiation on a tiled surface. 2. Determine the fundamental performance of characteristics of solar thermal and photovoltaic energy generation. 2. Estimate the operation of geothermal and tidal power plants and determine their financial viability. 1. To differentiate various ovators of biomass energy conversion systems and determine their financial viability. 1	Course	e: Non - C	Conventional En	ergy Systems (PI	EC-III)	Code :	BME6503A	
Lecture Practical Hour Credit IE MTE ETE Total 3 3 3 20 30 50 100 70rio Knowledge of: a. Fundamental concepts and laws/governing equations of Engineering Thermodynamics, fluid mechanics. b. Principles of Heat Transfer c. Elements of Electrical Engineering are essential Objectives: 100 100 Objectives: 1 To provide a fundamental understanding of: 6 6 6 6 2. To be able to understand the application of these technologies to real-world requirements. 7 100 7 5 100 100 100 100 2. To be able to understand the application of these technologies to real-world requirements. 3 To dufferentiate world the application of these technologies to real-world requirements. 3 To dufferentiate world the application of these technologies to real-world requirements. 4 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 <td< th=""><th></th><th>Τe</th><th>aching Scheme</th><th></th><th>, </th><th>Evaluatio</th><th>n Scheme</th><th></th></td<>		Τe	aching Scheme		, 	Evaluatio	n Scheme	
3 1 100 100 3 3 3 30 50 100 Prior Knowledge of: a. Fundamental concepts and laws/governing equations of Engineering Thermodynamics, fluid mechanics. b. Principles of Heat Transfer c. Fidements of Electrical Engineering are essential Objectives: . To provide a fundamental understanding of: . Fidements of Electrical Engineering are essential Objectives: . Solar thermal and Photovoltaic energy systems and their performance characteristics . . Wind power devices systems and their performance characteristics . . . To understand issues in the utilization and economic viability of renewable-powered devices and systems . Course Outcomes: To understand bapte to . . 1 Estimate solar radiation on a tilted surface. . . 2. Determine the fundamental performance of characteristics of solar thermal and photovoltaic energy generation. . 3. To differentiate various routes of biomass energy conversion systems and demonstrate their operation. . 4. To differentiate various routes of biomaste energy installed capacity. Solar- Earth Geometry, fafotty labus	Lectu	re Practica	l Hour	Credit	IE	MTE	ЕТЕ	Total
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a. Fundamental concepts and laws/governing equations of Engineering Thermodynamics, fluid mechanics. b. Principles of Heat Transfer c. Elements of Electrical Engineering are essential Objectives: To provide a fundamental understanding of: Solar thermal and Photovoltaic energy systems and their performance characteristics Wind power devices systems and their performance characteristics Gothermal and Tidal power generation scheme To be able to understand the application of these technologies to real-world requirements To ounderstand issues in the utilization and economic viability of renewable-powered devices and systems Course Outcomes: The students should be able to Estimate solar radiation on a titled surface. Determine the fundamental performance of characteristics of solar thermal and photovoltaic energy generation. Statiants hood to able to Estimate he optential of wind resources. To differentiate various routes of biomass energy conversion systems and demonstrate their operation. Illustrate the operation of geothermal and tidal power plants and determine their financial viability. Unit Solar Energy Worldwide energy use scenario. Current renewable energy installed capacity, Solar- Earth Geometry, Extra Radiation, and Standards, Medium and high-temperature splications of Solar Thermal Energy - Concentrating collectors, classification, types and suitability. Solar thermal power generation -technologies. Storage issues and challenges in the connectalization. Solar Photovoltaic Conversion Basic Semiconductor Physics, A generic photovol	Prior 1	Knowledge of		5	20	50	50	100
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c. Elements of Electrical Engineering are essential Objectives: 1. To provide a fundamental understanding of: • 1. To provide a fundamental understanding of: • Solar thermal and Photovoltaic energy systems and their performance characteristics • Wind power devices systems and their performance characteristics • Geothermal and Tidal power generation scheme 2. To be able to understand the application of these technologies to real-world requirements 3. 3. To understand the application of these technologies to real-world requirements 3. To differentiate various rottes of biomass energy conversion systems and demonstrate their operation. 3. Estimate the potential of wind resources. 4. To differentiate various rottes of biomass energy conversion systems and demonstrate their operation. 5. Illustrate the operation of geothermal and itidal power plants and determine their financial viability. Unit Description (fi) Korate Energy Worldwide energy uses scenario, Current renewable energy installed capacity, Solar- Earth Geometry, Extraterestrial Solar Radiation, and Spectral Distribution, Earth-sun angles, observer sun angles, Tit factor, solar radiation intensity incident on tilted surface. 6 2. Low-temporture applications - Vater and air Heating, Flat Plate Collector	b.	Principles o	f Heat Transfer	0 0 1	e	e ,		
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Text Books

- 1. S.P. Sukhatme, Solar Energy Principles of thermal collection and storage, II edition, Tata McGraw Hill, New Delhi, 1996.
- 2. M.A. Greaen "Solar Cells Operating Principles, Technology, and System Applications", Prentice Hall, Inc. New Jersey, 1983
- 3. V.V. N. Kishore, Editor, Renewable Energy Engineering and Technology, A knowledge Compendium, The Energy and Resources Institute, New Delhi, 2008
- 4. G.L. Johnson ,Wind Energy Systems ,Prentice Hall, 1985

Reference Books:

- 1. J.A.Duffie and W.A.Beckman, Solar engineering of Thermal processes, II edition, John Wiley, New York, 1991.
- 2. D.Y.Goswami, F.Kreith and J.F.Kreider, Principles of Solar Engineering, Taylor and Francis, Philadelphia, 2000.
- 3. D.D.Hall and R.P.Grover, Biomass Regenerable Energy, John Wiley, New York, 1987.
- 4. Mukund R Patel, Wind and Solar Power Systems, CRC Press, 1999.
- 5. J F Manwell, J.G.McGowan, A.L.Rogers, Wind Energy Explained: Theory, Design and Application, John Wiley and Sons, May 2002.
- 6. R D Begamudre, Energy Conversion Systems, New Age International (P) Ltd., Publishers, New Delhi ,2000.

Program:	B. Tech. (Mechanical) Semester : VI									
Course :	Biomechanics an	d Biomedical En	gineering (PEC	– III)		Code : BMI	E6503I	3		
	Teachin	g Scheme	1		Evaluatio	on Scheme	I			
Lecture	Practical	Tutorial	Credit	IE	MTE	ETE		Total		
3	-	-	3	20	30	50		100		
Prior know	wledge of:	. 1) (4							
a. M b. M	letrology and Mecha	nical Measuremen	10							
c. Se	olid Mechanics									
aı	re essential									
Course O	ojectives:	_			_					
After con	npletion of the con	urse, students w	ill have adequa	te backgro	und, concep	tual clarity	and ki	nowledge of		
interdiscip	understand the basi	ary principles rela	ited to:	v the humar	ioint motior	and forces				
2.Te	discuss the fun	damentals in n	naterial science	to solve	challenges	in the bio	materi	als domain.		
3.To	b learn about some of	f the common sense	sors/transducers u	used in biom	edical field					
4.To	study the reconstruct	ction of 3D model	from medical sc	an imaging a	and its FE an	alysis.				
Course Ou	itcomes:									
After learn	ing the course, the s	tudents will be ab	le to:	alizza tha m	over the	many of a shale	tol ioir	at for morious		
1.	Demonstrate the bas	ic principles of bi	iomechanics to a	halyze the n	iovement, 10	rces at a skele	etal joli	nt for various		
2.	Demonstrate a gener	al understanding of	of the use of artif	icial materia	ls in humans	/animals.				
3.	Learn the use of vari	ous sensors/transc	lucers in medical	application	s.					
4.	Create 3D model fro	m medical scan ir	nages using softw	vare.						
5.	Analyze the mechan	ical properties in b	biological tissues	/implants/fix	ations.	200				
			Detailed Syll	abus:			5	Duration		
Unit			Description					Duration (H)		
	Fundamental of B	iomechanics: Co	ncepts of biome	chanics, Nir	e principles	for application	n of	(/		
1	biomechanics, Ana Mechanics of bone.	tomical represent Joint forces and r	tation terminolo	gy, Res <mark>po</mark> n	se of tissue	s to forces/lo	oads,	6		
	Biomaterials: Bior	naterials uses, Di	fferent biomateri	als, Selectio	on of biomat	erials, Mecha	nical			
2	and performance re-	quirements, Biom	aterials propertie	s.			19	6		
	Sensors/Transduce	ers in Biomedical	Engineering: S	train gauges	, LVDT, Loa	ad cell, Bioser	isors			
3	– Enzyme, ECG, EM	MG.	8 8	6 6				6		
	Medical imaging a	and 3D model ger	neration: Medica	l imaging te	chniques, Im	hage parameter	rs,			
4	General steps to ge	nerate 3D model f	rom scan data, li	st of comput	ing facilities	, 3D model		6		
	generation using so	itware.	ool Engineering	2D modeli	ng Rasics of	FEA Stops to	<u> </u>			
5	setup bone model.	Different loading	configurations. B	iomechanic	al analysis of	hard tissues.)	6		
	Biomedical Applic	ations: Orthonae	dics implants and	fixations. (in unui) sis or ieneral desig	n procedure.				
6	Manufacturing proc	cesses, Other appl	ications.		eneral desig	n procedure,		6		
				Sec			Total	36		
Reference	Books:		nd							
1. Duane	Knudson, Fundament	als of Biomechan	ics,2 nd Ed,Spring	er,2007						
2. Susan J 3. Gabor J	Hall, Basic Biomech Harsanyi Sensors in l	nanics, / Ed, Mco Biomedical Appli	oraw Hill, 2015	s 2000						
4. Tatsuo	Togawa.Biomedical	Sensors and Instru	uments.2 nd Ed.20	11						
E-sources										
1. https://	www.elprocus.com/v	vhat-is-a-biosenso	or-types-of-bioser	sors-and-ap	plications/					
2. https://d	onlinecourses.nptel.a	c.in/noc21_me130	0/preview	1	-					
3. https://	onlinecourses.nptel.a	c.in/noc21_me52/	/preview							
4. https://i	nptel.ac.in/courses/1	12106248								
5. https://i	archive notel ac in/co	121002/0 surses/112/105/11	2105305/							
7 https://a	notel ac in/courses	/10210605	2103303/							
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TY B Tech (Mechanical Engineering), PCCoE Pune

Progra	m: B. Tech. (Mechanical) Semester : VI										
Course	e: Hydraulics	and Pneum	atics (PEC–II	[I)		Code : BMI	E6503C				
	Teaching	Scheme			I	Evaluation Sch	ieme				
Lectu	re Practical	Tutorial	Credit	IE	MTE	ЕТЕ	PR	Total			
3			3	20	30	50		100			
Prior	knowledge of:										
a.	Fluid Mechanics	,									
b.	Basic Thermody	namics									
C	are essential										
Student	ts are expected to a	study									
1	To study govern	ing laws & s	vmbols used i	n fluid powe	· system						
2.	To study fluid p	ower application	tions	ii iiulu powe	system						
3.	To study workin	g principles	of various con	ponents use	d in hydraulic/	pneumatic sys	stems.				
4.	To select differe	nt componen	ts from the ma	anufacturers	catalogue						
5.	To study Hydrau	ilic/ Pneumat	tic circuit used	l in fluid pow	ver system						
6.	To design fluid	power system	n for different	applications.							
Course	Outcomes:										
The stu	dents will be able	to:	d nower & Su	mbolo							
1.	A nalyze the peri	Formance of t	he nump & syl	nuons.							
2.	2. Analyze the performance of the pump & accumulator.										
4.	Construct hvdra	ilic circuit di	agrams for dif	ferent indust	rial applicatio	ns					
5.	Apply knowledg	e of pneuma	tics for the con	nstruction of	a pneumatic c	ircuit					
6.	Design appropri	ate system ac	cording to the	requirement	by using man	ufacturers' cat	alogue.				
	•]	Detailed Syl	labus:			•			
Unit				Detailed Syllabus: Description							
								(H)			
	Introduction to	Fluid Powe	r					(H)			
	Introduction to Fluid power ba	Fluid Powe	r liges and limit	ations, Fluid	l power syste	ms: Compone	nts, advantages,	(H)			
	Introduction to Fluid power ba applications. Hy	Fluid Power sics, advanta draulic fluid	r liges and limit ds, Properties	ations, Fluid of fluids, s	l power syste selection of f	ms: Componentiuds, additive	nts, advantages, s, the effect of	(H)			
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1.	Introduction to Fluid power ba applications. Hy temperature and compatibility of Sources of cont	Fluid Power sics, advanta /draulic fluid d pressure the seal w	r ges and limit ds, Properties on hydraulic rith fluids. Fluid contamination	ations, Fluic of fluids, s fluid, Sea uid Conduct	l power syste selection of f. ls: Types, se ors- pipes, h Fluid conditio	ms: Component uids, additive election, prope- poses, connector	nts, advantages, s, the effect of erties, material, rs, Pipefittings, filters, strainers	(H) 6			
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5.	Pneumatics Principle of Pneumatics: Laws of compression, Comparison of Pneumatics with Hydraulic power transmissions, types of compressors, selection of compressors, compressed air distribution system, Types of filters, regulators, lubricators, mufflers, dryers, Pressure regulating valves, Direction control valves, two-way, three-way, four-way valves. Solenoid operated valves, push-button, lever control valves, two pressure valve, quick exhaust valve and time delay valves, electro-pneumatics, Pneumatic actuators-rotary & reciprocating, Air motors- radial piston, vane, axial piston, shuttle valve, Speed regulating methods, pneumatic circuits, reciprocating, cascading time delay etc.	6
6.	System Design Calculation of piston velocity, thrust under static and dynamic applications, considering friction, inertia loads, design considerations for cylinders, Selection of different components such as reservoir, various valves, actuators, filters, pumps based on a design by using manufacturer's catalogues, Design of hydraulic circuits for practical application.	6
	Total	36
Text E	Books:	
	Esposito A, Fluid Power with application, Prentice Hall, 2022	
	2. Majumdar S.R, Oil Hydraulic system- Principle and maintenance, Tata McGraw Hill, 2017	
	5. Majumdar S.K, Pneumatics Systems Principles and Maintenance, Tata McGraw Hill, 2002	
Defen	Res Bookst	
Kelere	Dinanger I. I. Industrial Hudraulies, McGray, Hill, 1080	
	Dinghas Industrial Fluid Dower, Prontice Hell, 2022	
	2. Finches, industrial Fluid Fower, Ffeinice Hall, 2022 8. F. Veanle, Eluid Power Design Handbook, CPC Press, 1005	
	A Parr Hydraulics and Pneumatics Jaico Publishing House 1993	
4	5 ISO - 1219 Fluid Systems and components Graphic Symbols	
	5. Standard Manufacturer's Catalogues	

Program	gram: B. Tech. (Mechanical) Semester: VI								
Course:	Industrial En	gineering (PE	C - III)		Code: BM	E6503D			
	Teaching	g Scheme			Evalu	ation Scheme			
Lecture	Practical	Hours	Credit	IE	MTE	ЕТЕ	Total		
3	-	3	3	20	30	50	100		
Prior k	nowledge of		1						
a. b.	Manufacturing Scie Materials Engineeri are essential	nce ng							
Course 1. 2. 3. 4. 5.	Objectives: To introduce the con To acquaint the stude To acquaint the stude To introduce the con To acquaint the stude	cepts, principle ents with variou ents with difference cepts of various ents with difference	s and framewor is productivity of ent aspects of P s cost accounting ent aspects of H	k of contents of enhancement to roduction Plan ag and financia Iuman Resource	of Industrial E echniques. ning and Cont l management e activities an	ngineering. rol and Facility Des practices as applied d Industrial Safety	ign. l in industries. ules.		
Course 1. 2. 3. 4. 5. 4. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5.	Outcomes: Apply principles of r Apply different steps Determine work cont understanding of Rat Apply/use different t Apply different tech industry.	nanagement and in method stud tent and standar ing. echniques / cont niques / conce	d evaluate prod ly/use different rd time using di acepts of produc pts of work sy	uctivity of an o Recording me fferent method ction planning vstem design a	organization/S thods to an op ls of work mea and control. and facilities o	cenario. veration. asurement including design pertinent to	developing an manufacturing		
6.	Perform break-even	analysis for inv	estment decisio	ons.					
			Detaile	d Syllabus:			Duration		
Unit			Desc	ription			(H)		
1	Introduction to In Definition and Ro systems and organi Measurement of techniques. Produc	dustrial Engin le of Industria zation structure productivity: tivity Models a	neering and Pr I Engineering, e. Factors affecti nd Index, Intro	oductivity Functions of ng the produ	management, activity, Produce the Engineering	Types of producti activity improvement and Value Analys	on 6 ent		
2	Method Study Work Study: Defin Method Study: De and exam aids, mic Applied Anthropop	nition, objective finition, object ro motion stud metry, Work-SJ	e and scope of v ive and scope of y. pace Design, an	vork-study, Hu of method stud d Seating,	uman factors in dy, work conte	n work-study. ent, activity recordi	ng 6		
3	 and exam aids, micro motion study. Applied Anthropometry, Work-Space Design, and Seating, Work Measurements Work Measurements: Definition, objectives and uses, Work measurement techniques. Work Sampling: Need, confidence levels, sample size determinations, random observation, conducting study with the simple problems. Time Study: Definition, time study equipment, selection of job, steps in time study. Breaking jobs into elements, recording information, Rating and standard rating, standard performance, scales of rating, allowances and standard time determination. Introduction to PMTS and MTM: (Numerical), Introduction to MOST. 								
4	Production Plann Introduction: Type planning. Capacity Planning Forecasting Techn trend and seasonal Introduction to Su	ing and Contr es of production , ERP: Modules iques: Causal a ity (Numerical) oply Chain Mar	ol on systems, Ne s, Master Produ and time series b, Demand Cont hagement: Basic	ed and functi action Schedule models, movi rrol strategies (c terminologies	ons of PPC, e, MRP and M ng average, ez MTO, MTA, 1 s.	Aggregate producti RP-II. xponential smoothin MTS).	on 1g,		

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		Plant Location and Layout	
		Plant Location : Need and factors influencing plant location,	
		Plant Layout: Objectives, principles, types of plant layouts, Introduction to Assembly Line	
		Balancing and Layout parameters to evaluate.	
4	5	Introduction to computer aided ergonomic analysis of workstation. Assessment of postures and	6
		identification of risks to body regions.	
		Inventory control and Management: Types of inventories, Need of inventories, terminology,	
		costs, Inventory Models: Basic production models, (with and without shortage and discount),	
		ABC, VED Analysis.	
		Losung and Human Factor in Industrial Engineering	
	6	Techniques for Evaluation of capital investments	6
	J	Human factors: Human Error Accidents and Safety Human relation in industry Performance	Ū
		appraisal, Human Factors in Systems Design	
		Total	36
Tex	t Bo	oks:	
	1.	M Mahajan, Industrial Engineering and Production Management, Dhanpat Rai and Co., 2015	
	2.	O. P. Khanna, Industrial engineering and management, Dhanpat Rai publication, 2018	
	3.	M. Telsang, Industrial Engineering and Production Management, S. Chand Publication, 2018	
Ref	eren	ce books:	
	1.	Introduction to Work Study by ILO, ISBN 978-81-204-1718-2, Oxford & IBHPublishing Company,	New Delhi,
		Second Indian Adaptation, 2008.	
	2.	H. B. Maynard, K Jell, Maynard's Industrial Engineering Hand Book, McGraw Hill Education, 2001	
	3.	R. Askin, Design and Analysis of Lean Production System, Wiley, 2001	
	4.	Zandin K.B., Most Work Measurement Systems, ISBN 0824709535, CRCPress, 2002	
	5.	Martin Murry, SAP ERP: Functionality and Technical Configuration, SAP Press, 2010	
	6.	R. Barnes, Motion and time Study design and Measurement of Work, Wiley, 2009	
	7.	R. Al-Aomar, A. Williams, O. M. Uigen 'Process Simulation using WITNESS', Wiley, 2015	
	8.	Brien Shakel, Applied Ergonomics, Hand Book, Butterworth Scientific, 1988	
	9.	R. C. Bridger, Introduction to Human factor and Ergonomics. McGraw Hill, 2017	
		· · · · · · · · · · · · · · · · · · ·	
	10.	M. Sanders and E. McCormick, Human Factor Engineering and Design, McGraw Hill, 1992	

Progra	ım:	B. Tech. (N	Mechanical)				Semeste	er: VI		
Course	e:	Design of 7	Fransmission	Systems (PE	C – III)		Code: H	BME6503	E	
	1	Teaching S	Scheme/week			E	valuation Sc	heme		
Lectu	ire	Tutorial	Practical	Credit	IE	MTE	ЕТЕ	TW	Т	otal
3		-	-	3	20	30	50	-	1	.00
Prior k	cnowle	edge:	1		•					
a.	Machi	ine Design								
b.	Kinen	natics and T	Theory of Mac	hines						
с.	Heat 7	Fransfer								
	are es	sential								
Course	e Obje	ectives: To	enable student	S						
1.	To de	sign flexible	e drives for in	dustrial applic	cations.					
2.	To de	sign automo	onve clutches	and brakes.	trassas and f	luctuating con	taat strassas			
5. 1	To de	sign the wo	rk gears for in	dustrial applie	ations	fuctuating con	lact stresses.			
5.	To an	alvze the Po	ower Slit devid	cusular applic	brid Electric	Vehicles.				
Course	e Outc	comes: The	student will b	e able to exhil	bit	v eniteres.				
1.	Ability	to design t	the flexible dri	ves for the ind	dustrial appli	cations.				
2.	Ability	to design t	the automotive	clutches and	brakes.					
3.	Ability	to design t	the helical and	bevel gears a	gainst fluctua	ating bending	stresses and c	contact stre	esses.	
4.	Ability	to design V	Worm gears us	sing IS- 1443-	1974 and the	ermal consider	ations for the	industrial	applicatio	ons.
5. 4	Ability	to design t	the constant m	esh gearboxes	s for industria	al applications				
6. 4	Ability	to analyze	the power spl	it devices use	d in HEVs.					
				I	Detailed Sylla	abus:				r
Unit	t Description								Duration (H)	
	Desig	n of Flexib	ole Drives:							
1	Desig	gn of Flat be	elts and pulley	s — Selection	n of V belts a	nd pulleys —	Selection of h	noisting wi	ire ropes	6
	and p	ulleys — D	esign of Trans	smission chair	ns and Sprock	xets.				
	Desig	gn of Clutcl	hes and Brak	es:						
2	Desig	gn of friction	n clutches for	maximum tor	que transmiss	sion based on	wear and the	mal consi	deration.	6
	Desig	gn of disc ar	nd drum brake	s						
3	Desig	n of Helica	al and Bevel (fears:	luctuating ha	nding strongth	and nitting a	tronath		6
	Desig	n of Worn	and bever gea	ars based on n	luctuating be	nunig strengti	and pluing s	uengui.		
4	Desig	n of worm	gears using IS	1443-1974 7	Chermal ratin	a				6
	Desig	m of Gearb	oves.	1775-1777, 1	i nermai ratin	5.				
5	Desig	n of consta	nt mesh single	e/ multi speed	gearboxes w	ith multiple st	ages. Gearbo	x compone	ents.	6
C	moun	tings and a	ccessories.	" mani speca	geureones m	in manipie st	uges: Geureo.	compone	, integration,	Ŭ
í.	Tran	smission sy	stems in Hyb	rid Electric V	Vehicles:					í.
6	Powe	r Split Devi	ices in HEVs,	Speed and tor	que analysis	of PSD.				6
				•	* *				Total	36
Text B	ooks:									•
1.	Desi	ign of Mach	nine Elements,	V B Bhandar	i, Tata McGı	aw Hill Publi	cation, 4 th Ed	ition 2017		
2.	Mac	hine Design	n, R S Khurmi	, J K Gupta, S	S Chand Publ	ication.				
3.	Desi	ign of Mach	nine Elements	- Sharma, Pur	ohil. Prentice	e Hall India Pu	ublication.			
4.	Mac	hine Design	n by Pandya &	Shah, Charo	tar Publishing	g.	-			
5.	Mac	hine Desigi	n Fundamenta	ls and Applica	ations, PCG	ope, PHI, EEI	5.			
Refere	nce bo	DOKS:	alan of Mooh	M.C.						
1.	Spot	to M F Da	esign of Mach	ine Flements	Prentice Hal	1 of India Priv	ata I ta Nau	Dolhi 10	83	
2.	Will	iam Orthwe	ein Machine (Component De	sign Vol I	and II Jaico P	ublising hous	e Chenna	i 1996	
4.	Mai	tra. Handbo	ok of Gear De	sign. Tata Mo	eraw-Hill, N	lew Delhi, 198	donising nous 36.	e, chenna	1,1770.	
5.	Desi	ign Data. PS	SG College of	Technology.	2006					
6.	Veh	icle Powert	rain Systems b	y Behrooz M	ashadi, David	d Crolla. A Jo	hn Wiley & S	ons, Ltd .		
7.	Aut	omobiles-F	Power trains an	nd Automobile	es–Dynamics	s by Crolla, Da	avid, A John V	Wiley &So	ons, Ltd	
8.	Aut	omotive En	ngineering Pov	vertrain, Chas	sis System a	nd Vehicle B	ody by David	A Crolla,	Elsevier	B H New
	Yorl	k, London, (Oxford.							

TY B Tech (Mechanical Engineering), PCCoE Pune

Program:	ram: B. Tech. (Mechanical) Semester: VI								
Course:	Alternativ	e Energy Sou	rces for I. C.	Engines (PI	EC- III)		Code: BM	E6503F	
	Teaching S	cheme/week			E	valuation S	cheme		
Lecture	Tutorial	Practical	Credit	IE	MTE	ETE	TW	Т	otal
3	-	-	3	20	30	50	-	1	100
Prior know	vledge:								
a. Con	nbustion in S.	I. and C. I. E	ngines						
b. Fue	I Supply syste	ems of S. I. and	d C. I. Engine	s					
Course O	viectives: To (enable student	S						
1. To g	get familiar wi	ith requiremen	ts of normal c	combustion in	n I.C. Engines				
2. To i	inderstand the	need of alterr	native fuel		U				
3. To	earn the prop	perties, produc	tion methods	, engine moo	lifications, pe	rformance a	nd emission	characte	eristics by
the	ise of various	alternative fue	els like alcoho	ols, natural ga	as, biodiesel, h	ydrogen etc	•		
Course O	itcomes: The	student will b	e able to	the requirem	ants of LCE	nginos			
1. Con 2 Apr	reciate the prop	ed of alternativ	ve fuels for I (engines in	the current en	erov scenari	0		
2. App 3. Sug	gest engine m	odification fo	r the use of a	lcohols as al	ternative fuels	and Analyz	ze the engin	e perforn	nance and
emi	ssion characte	ristics				j	8		
4. Sug	gest engine m	odification for	r the use of b	iodiesel as al	ternative fuels	s and Analy	ze the engin	e perform	mance and
emi	ssion characte	ristics							_
5. Sug	gest engine m	odification fo	r the use of n	atural gases	as alternative	fuels and A	nalyze the e	ngine per	rformance
and 6 Sug	emission char	acteristics	r tha usa of h	wdrogon as a	n altornativo	fuel and An	aluzo tho or	ngino nor	rformanco
0. Sug	emission chai	racteristics	i the use of i	iyulogeli as a		Tuel allu All	alyze the er	igine per	nonnance
dita		acteristics	1	Detailed Svll	abus:				
								T	Duration
Unit				Description					(H)
Iı	troduction:	A review of	f working p	rocess and	stages of con	nbustion of	f I.C. Engi	nes,	
1 re	quirements of	f normal comb	oustion in S.I.	and C. I. en	gine. Properti	es of differe	ent types of	fuel	6
re re	lated to their	utilization as a	un I. C. Engin	es Fuel (Rati	ng of fuel, Ign	ition temper	ature, volati	lity,	U
	alorific Value	etc.)	<u> </u>			· · · · · · · · · · · · · · · · · · ·			
IN E	fects of const	nauve rueis:	Sources of 10	sion on envir	pe of availability	lty of fossil dition of ear	th (UBHC		
$\begin{array}{c c} 2 \\ \end{array}$	O2. CO. NOX	SOx) Green	house effect.	Carbon foot i	orint and Carb	on credit cal	culations.		6
E	mission norms	s as per Bhara	t Standard up	to BS – IV					
A	Icohols: Sour	rces of Metha	anol and Etha	anol, method	ls production.	Properties	of methano	1 &	
3 et	hanol as engin	ne fuels, Engir	ne modificatio	ons required t	he use of alco	hols in I. C.	engines, Eng	gine	6
p p	erformance of	methanol/etha	anol blends w	ith gasoline.	Emulsification	n of alcohol	and diesel. I	Dual	U
ft D	el systems, er	nission charac	Pio Dissol f	blending of A	Alcohol.	:: Naamaa	ad Sumflow		
4 S	ovaheen Jatro	nha seeds) P	rocess of sepa	ration of Rio	Diesel Prope	rties Biodie	sel compare	d to	6
	iesel, and perf	formance of E	ngine with bio	diesel and D	viesel-biodiese	l blend.	ser compare	u to	U
N	atural Gas:		<u> </u>						
B	io Gas : Pro	oduction of	biogas from	municipal	wastes and c	ther source	s Composit	ion,	
P	operties of Bi	io-gas as an al	ternative fuel	for I.C. Eng	ines. Fuel syst	em modifica	ations for Us	sage	
5 0	Biogas in SI	engine & Cl	engine. Duel	fuel operation	on in C. I. Eng	gine, effect of	on performa	nce,	6
	$\mathbf{PC} \ \boldsymbol{\mathcal{S}} \ \mathbf{CNC}$	Properties of I	PG & CNG	as angina fua	le fuel meteri	na systems	combustion		
L cl	aracteristics	effect on perfe	ormance. emis	sion. cost an	d safety.	ng systems,	combustioli		
H	ydrogen: Pr	operties, Sou	irces and m	ethods of	Production of	f Hydroger	, Storage	and	
Т	ransportation	of hydroger	n. Combustio	on with hy	drogen, safe	ty aspects,	engine/veh	icle	
6 m	odifications re	equired.							6
F	uel Cells: Fue	el cells princip	ple, working,	Thermodyna	mic analysis,	Types, Fuel	cell applica	tion	
ir	automobiles,	Power rating,	and performa	ance, Layout	ot tuel cell ve	hicle.			• -
							Т	otal	36

Text Books:

- 1. Dr. S. S. Thipse, Alternative fuels: Concepts, Technologies and Developments, Jaico publications, 2011
- 2. Richard L. Bechtold Alternative Fuels Guidebook, SAE International, 2003
- 3. V. Ganesan: Internal Combustion Engines, Tata McGraw-Hill,2011

Reference books:

- 1. Donald L. Anglin; William H. Crouse, Automotive Emission Control, McGraw-Hill Publication G.L. Johnson, 2001
- 2. John B. Heywood, Internal Combustion Engine Fundamentals, Tata McGraw-Hill, 1988
- 3. M.L. Mathur and R.P. Sharma: A course in Internal combustion engines, Dhanpat Rai Publication, New Delhi,2016

Program	B. Tech. (Me	echanical)			Semester :V	I	
Course :	Mechanical	System Design (I	PEC – IV)		Code : BME	6504	
	Teach	ing Scheme				Evaluation Schem	e
Lecture	Tutorial	Practical	Credit	IE	MTE	ЕТЕ	Total
3	-	-	3	20	30	50	100
Prior kn	awledge.		-				
	Engineering 1	Mechanics					
b	Applied Math	nematics					
с	. Materials Eng	gineering					
d	l. Strength of M	Iaterials					
e	. Manufacturin	g Practices					
f	. Design of Ma	achine Elements					
g	. Kinematics a	nd Theory of Ma	chines.				
	are essential						
Course O	bjectives:						
This co	urse aims at enab	oling the students	to				
1	. To develop co	ompetency for sy	stem visualization	n and design.			
2	. To enable stu	dent to select ma	terials and to desig	gn internal eng	gine component	s.	
3	. To enable stu	dent to design cy	linders and pressu	ire vessels and	to use IS code.		
4	. To enable stu	dent to design ma	achine tool gearbo	DX.			
5	. To enable stu	dent to design ma	aterial handling sy	vstems.			
Course O	utcomes:	6	<u> </u>				
After le	arning the course	e. the students will	ll be able to:				
1	. Understand th	ne difference betw	ween component l	evel design an	d system level o	lesign.	
2	. Design variou	us mechanical sys	stems like automo	tive engine, pi	ressure vessels,	machine tool gear l	ooxes,
	material hand	lling systems, etc.	. for the specificat	tions stated/for	rmulated.	-	
3	. Handle system	m level projects fi	rom concept to pr	oduct.			
	Detailed S	Syllabus: Modul	e No I is compul	sory and any	two modules f	rom remaining	
Module			Des	cription			Duration
	Design of L C	Encino		•			(H)
	Introduction to	selection of m	aterial for L C	engine comp	onents Design	of cylinder and	
1	cylinder head	Construction of	cvlinder liners D	esign of nisto	n and niston-ni	ns rings Design	12
-	of connecting	rod. Design of	crank-shaft and	crank-pin. D	Design of flyw	heel. Design for	12
	Manufacture ar	nd assembly of IC	C Engine parts	traini pini, D		intern Deorgin for	
	Design of Unfi	ired pressure ves	ssel				
	Design of Cy	linders: Thin an	d thick cylinders	s, Lame's equ	ation, Clavarin	o's and Bernie's	
	equations, Auto	o-frettage and con	mpound cylinders				
2	Design of Unf	fired Pressure v	essel : Classificat	tion of pressu	re vessels as pe	er IS code 2825-	12
	1969, Categori	es and types of w	velded joints, Wel	d joint efficier	ncy, Stresses ind	luced in pressure	
	vessels, materia	als for pressure v	essel, Design of c	ylindrical she	lls and end clos	ures as per code,	
	Design of nozz	les and openings	in pressure vesse	ls, Types of ve	essel supports.		
	Machine Tool	Gearbox Design	1 anhana Di		tions D.	and a method at the	
2	Introduction to	machine tool ge	arboxes, Design a	and its applica	tions, Basic col	nsiderations in	10
3	and structure	diagram ray dia	a of variable spee	ed range, grap	onical represent	ation of speed	12
	deviation diagr	ulagialli, lay ula	gram, selection c	or optimum ra	iy ulagrafii, gea	unig utagrani,	
	Matarial Han	alling System De	sian				
	System concep	t hasic principles	s Classification o	f conveyors ()biectives of ma	iterial handling	
	system Unit ar	nd bulk load	s, Classification 0	r conveyors, c	sojectives of me	aoriar nanoning	
л	Belt conveyors	Selection Flat a	nd V belt from m	anufacture's c	atalogue Troug	hed belt	10
4		,					14
	conveyors. Car	pacity of convevo	r, Rubber covered	and fabric pl	y belts, belt tens	sions, Convevor	
	pulleys, belt id	pacity of conveyo lers, tension take	r, Rubber covered -up systems, Powe	and fabric pl	y belts, belt tens t of belt convey	sions, Conveyor ors for frictional	
	pulleys, belt id resistance of id	pacity of conveyo lers, tension take ller and pulleys. S	or, Rubber covered -up systems, Powe Selection of wires	and fabric plate er requirement and rope drive	y belts, belt tens t of belt conveye e from manufact	sions, Conveyor ors for frictional ture's catalogue	
	pulleys, belt id resistance of id	pacity of conveyo lers, tension take- ller and pulleys. S	or, Rubber covered -up systems, Powe Selection of wires	and fabric plate er requirement and rope drive	y belts, belt tens t of belt conveye e from manufac	sions, Conveyor ors for frictional ture's catalogue	36

- 1. Bhandari V.B. Design of Machine Elementsl, Tata McGraw Hill Pub. Co. Ltd.
- 2. Juvinal R.C, Fundamentals of Machine Components Design, Wiley, India

Reference Books

- 1. Design Data- P.S.G. College of Technology, Coimbatore, Printed in 2017
- 2. Bhandari, V. B. Machine Design data book, Tata McGraw Hill Publication Co. Ltd, 5th edition 2017
- 3. I.S. 2825: Code for unfired pressure vessels.
- 4. Shigley J. E. and Mischke C.R., -Mechanical Engineering Designl, McGraw Hill Pub. Co, 11th edition 2020
- 5. M. F. Spotts, Design of Machine Elements Prentice Hall Inc, 8th edition 2019
- 6. Black P.H. and O. Eugene Adams, -Machine Design McGraw Hill Book Co. Inc.
- 7. Johnson R.C., -Mechanical Design Synthesis with Optimization Applicationsl, Von Nostrand Reynold Pub.
- 8. S.K. Basu and D. K. Pal, -Design of Machine Tools, Oxford and IBH Pub Co, 6th edition 2018
- 9. Rudenko, Material Handling Equipment I, M.I.R. publishers, Moscow
- 10. P. Kannaiah , IDesign of Transmission systems I, SCIETCH Publications Pvt Ltd, 2nd edition 2015.
- 11. Pandy, N. C. and Shah, C. S., Elements of Machine Design, Charotar Publishing House.
- 12. Mulani, I. G., -Belt Conveyors
- 13. Singiresu S. Rao, Engineering Optimization: Theory and Practice, John Wiley & Sons, 5th edition 2019
- 14. Joshi's Process Equipment Design, by V V Mahajani and S B Umargi, Mc-Millan, 5th eedition 2016

Program:	B. Tech. (AS	5&H)		Semester : VI						
Course :	Multivariate	Data Analysis	Using R (OEC	C-III)	Code : BAS	Code : BAS6608				
	Teaching	Scheme			Evaluatio	n Scheme				
Lecture	e Practical	Tutorial	Credit	IE	MTE	ETE	Total			
3	-	-	3	20	30*	50*	100			
Prior Kno	owledge of									
a. L b. L	pescriptive Statistic	CS .								
c P	Prohability	•								
a	re essential									
Course O	bjectives:									
This co	urse aims at enablin	ng the students	to learn mult	ivariate data co	ollection, visualized	zation, and prep	rocessing			
techniques	s for data science.									
Course O	utcomes:	•	-hl- +							
1. A	ang the course, the s	sing methods in	R and generate	e quality data fo	r analysis.					
2. I	mplement R package	es and related fu	unctions to data	science to anal	yze multivariate	data.				
3. A	pply different data v	visualization tec	hniques to und	erstand the mult	tivariate data.					
4. A	nalyze the multivari	ate data using d	lependent analy	vsis methods usi	ng the R.					
5. A 6 D	Develop a model for I	Prediction and I	Decision Makin	ig for a data set	ising the K.					
0. 1			Detailed	Svllabus:						
				2			Duration			
Unit	Description									
	Data Wrangling:	Understanding	the multivaria	ate data, Stand	lardizing Variab	les, Accessing				
1.	Databases with R Software, Merging multiple data sources into a single dataset for analysis,									
	Dealing with Missing values, dealing with extreme outliers in data, discrepancies or removing.									
	Multivariate Data	and Multivaria	ate Analysis : (Calculating Sum	mary Statistics f	for Multivariate				
2.	Data: Means and V	ariances Per G	roup, Between	-groups Variand	ce and Within-g	roups Variance	6			
	for a Variable, Bety Calculating Correlat	ween-groups Co	ovariance and ariate Data. The	Within-groups	Covariance for	I'wo Variables,	-			
	Multiveriete Dete	Viguelization is	n D Software	Coomotrio pr		licuoli.				
	EXAMPLE 1 INTERPORT OF A SOLUTION OF A SOLUTIONO OF A SOLU									
3	Stick figures, Star p	plots, Color icon	ns, Pixel-orien	ted techniques:	Query-independ	ent techniques:	6			
5.	visualize the entire	dataset, Query	y-dependent te	chniques: visua	alize a subset o	f data that are	Ŭ			
	relevant to the conte	ext of a specific	user query, Hie	erarchical techni	ques, Hybrid tec	hniques				
	Dependent Analysi	s: Multiple line	ar regression, C	Conjoint Analys	is, Multiple Disc	riminant				
4.	Analysis, Linear Pro	bability Analys	sis, Multivariate	e analysis of var	iance (MANOV	A), Canonical	6			
	Correlation Analysis	s, Structural Equ	uation Modelin	g						
	Independent Analy	sis: Factor Ana	lysis: Factor ar	alysis model, T	he k-factor analy	vsis model,				
5.	Estimating the parameters in the k-factor analysis model. Cluster Analysis: Cluster analysis, K-									
	Correspondence Ana	alysis	ing solutions g	supmenty, mu	tionnensional Se	anns,				
	Multidimensional S	Scaling: Models	s for proximity	data, Spatial mo	odels for proxim	ities:				
	Multidimensional sc	aling, Classical	multidimensio	nal scaling, Nor	n-metric multidii	nensional				
6.	scaling.	-4 A 1 1	adia di d	Diamination (D			6			
	by the Discriminant	IL ANALYSIS : LO Functions A St	badings for the	Discriminant Fu	unctions, Separat	tion Achieved				
		I GINCHUID, A DI		111 () 102 114	vames scaner o	lots of the				
	Discriminant Function	ons, Allocation	Rules and Mis	classification Ra	values, Scatter p ate.	olots of the				
	Discriminant Function	ons, Allocation	Rules and Mis	classification Ra	ate.	Total	36			

Reference Books:

- 1. Montgomery and Runger, "Applied Statistics and Probability for Engineers", Wiley, India, 6 Edition, ISBN: 9788126562947.
- R. Johnson, "Probability and Statistics for Engineers", Prentice India Ltd, 8 Edition, ISBN 13:978-8120342132.
- 3. S.P.Gupta, "Statistical Methods", Papperbook publication, 43 edition, ISBN: 9788180549892, 8180549895.
- 4. Everitt and Hothorn, "Use R!" series on using R for multivariate analyses, An Introduction to Applied Multivariate Analysis with R.
- 5. Barbara G. Tabachnick, Using Multivariate Statistics (4th Edition), Allyn & Bacon; 4th edition (August 9, 2000), ISBN-10:0321056779.
- 6. Yasunori Fujikoshi, Vladimir V. Ulyanov, Ryoichi Shimizu, Multivariate Statistics: High-Dimensional and Large-Sample Approximations, John Wiley & Sons, 15-Aug-201, ISBN:0470539860

e-sources:

NPTEL Course lectures links: <u>https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-ma53</u> (Introduction to R software) <u>https://nptel.ac.in/noc/courses/noc21/SEM1/noc21-ma37</u> (Descriptive statistics using R software)

*Instead of the conventional mode of examination for MTE and ETE; Examination will be conducted using R software in the laboratory through proper invigilation.

Progra	m: B. Tech. (Ci	vil)	Semester : VI								
Course	e: Remote Sen	sing and GIS	G (OEC-III)	Code: BCI6603A							
	Teaching	Scheme		Evaluation Scheme							
Lectu	re Tutorial	Credit	Н	IE	MTE	ЕТЕ	Total				
3	-	3	3	20	30	50	100				
Prior Knowledge of: Surveying and GPS is essential.											
Course	• Objectives: After (Completing thi	is course, stud	ent will have adecu	ate background						
1.	To comprehend fu	ndamentals an	d principles of	of RS and GIS techr	niques.						
2.	To enhance stude	ents' capacity	to interpret	images and extra	ct information (of earth surface fr	om multi-				
	resolution imagery	at multi-scale	e level.	0							
3.	To develop skills o	of Image proce	essing and GI	5							
4.	To utilize RS and	GIS technique	s in Engineer	ng Geology and civ	vil engineering.						
5.	To study satelli	te image pr	rocessing, sa	tellite image into	erpretation, digi	tization and gen	eration of				
6	thematic maps in a	GIS.	1		·						
0.	1 o learn buffering	and layer anal	lysis for civil	engineering applica	tions						
	Autionalate for dame		uise, the stude								
1.	Articulate lundame	entais and prin	icipies of KS	ecnniques.							
2.	Demonstrate the ki	nowledge of re	emote sensing	and sensor charact	eristics.						
5.	Distinguish workir	ig of various s	spaces-based p	ositioning systems							
4.	Analyze the RS da	ta and image p	processing to	utilize in civil engir	neering						
5.	Explain fundament	tals and applic	cations of RS	and GIS							
6.	Acquire skills of d	ata processing	and its applie	cations using GIS							
			Deta	iled Syllabus:							
Unit			D	escription			(H)				
	Introduction to R	emote Sensing	g:								
	Definition and scope, history and development of remote sensing technology,										
	Definition and	scope, ms	tory and	development of	remote sens	ing technology,					
1.	electromagnetic rad	diation (EMR)	tory and) and electron	development of nagnetic spectrum,	remote sense EMR interaction	ing technology, with atmosphere	6				
1.	electromagnetic rad and earth surface;	diation (EMR)	tory and) and electron window, RS	development of nagnetic spectrum, S platforms, eleme	remote sense EMR interaction ents of remote s	ing technology, with atmosphere ensing for visual	6				
1.	electromagnetic rad and earth surface; interpretation viz.	diation (EMR) atmospheric tone, shape	tory and) and electron window, RS , size, patter	development of nagnetic spectrum, S platforms, eleme n, texture, shado	remote sense EMR interaction ents of remote se w and association	ing technology, with atmosphere ensing for visual on, applications in	6				
1.	electromagnetic rad and earth surface; interpretation viz. civil engineering/to	diation (EMR) atmospheric tone, shape own planning	tory and) and electror window, RS , size, patter	development of nagnetic spectrum, 5 platforms, eleme n, texture, shadov	remote sense EMR interaction ents of remote so w and association	ing technology, with atmosphere ensing for visual on, applications in	6				
1.	electromagnetic rad and earth surface; interpretation viz. civil engineering/to Remote Sensing S Types and their ch	diation (EMR) atmospheric tone, shape own planning atellites and s	tory and) and electror window, RS , size, patter Sensor Chara	development of nagnetic spectrum, S platforms, eleme rn, texture, shadow reteristics:	remote sens: EMR interaction ents of remote se w and association sor characteristic	ing technology, with atmosphere ensing for visual on, applications in	6				
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6.	C S r	GIS Data and Case Studies: GIS data types and data representation, data acquisition, geo-referencing of data, projection ystems, raster and vector data, raster to vector conversion, attribute data models and its types, emote sensing data in GIS, GIS database and database management system. Case studies:	6								
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		Total	36								
Text	book	KS:									
	1.	Principles of Remote Sensing, Panda B C, Viva Books Private Limited.									
	2.	Remote Sensing & Geographical Information System, M. Anji Reddy, BS Publications, Hyderaba	d.								
Refe	renc	e Books:									
	1.	Remote Sensing & Digital Image Processing, John R. Jensen, Department of Geography Univ	ersity of								
		South Carolina Columbia.									
	2.	Remote Sensing and Image Interpretation, Lillesand Thomas M, and Kiefer Ralph, John									

Remote Sensing and Image Interpretation, Emesand Thomas W. and Klefer Karpin
 Textbook on Remote Sensing, C. S. Agarwal and P. K. Garg, Wheeler Publishing.

Program	Program: B. Tech. (Civil Engineering) Semester : VI								
Course	: Building Serv	vices and Mai	ntenance (OE	C-III)	Code : BCI6603	B			
	Teaching	Scheme			Evaluation Sc	heme			
Lectu	re Tutorial	Credit	н	IE	MTE	ETF	E Total		
3	-	3	3	20	30	50	100		
Pre-req	uisite:								
a.	Building Planning,	and Construct	ion Materials i	s essential					
Objectiv	ves:			1		.	···· :····· 1-·:·· - ·		
After Co	To develop concepts	, student will h	ave adequate i	sackground to und	erstand and solve t	ne proble	em involving :		
1.	To learn the synchro	nization of co	nstruction activ	vities with installat	s ion of building ser	vices			
3.	To study the suitable	e electrical and	mechanical se	ervices, fire protect	tion, acoustic and s	ound	Insulations		
Outcom	es:			*					
After lea	rning the course, the	students shou	ld be able to:						
1.	Apply building servi	ces provisions		61 11					
2.	Execute the construct	tion activities	with installation	on of building serv	1Ces.	nto of hu	ildinga		
5. 4	Distinguish the Suita	ection Acoust	is well mechal	incal services for pa	articular lequileme		munigs.		
	Design the File File	eetion, reoust	Detail	ed Svllabus:					
TT			Degenin	4			Duration		
Unit			Descrip	tion			(H)		
1	Introduction to Building Services: Definitions, Objective and uses of services, Applications of services for different types building considering, Classification of building6servicesTypes of services and selection of appropriate services for given project6								
2	Building Ventilati of luminaries, Dist Types – Natural and	on: Natural an ribution of ill d Mechanical l	nd artificial lig umination, Ut Factors to be c	ghting principles a tilization factors, longitude	nd factors, Arrang Necessity of Vent sign of Ventilation	ement ilation	6		
3	Electrical Service building Technical Systems of wiring F Cleaners.	s & Mechan terms and sym Plumbing & A	ical Services bols for electr ir Conditioning	in Buildings: E ical installations ar g Air Conditioning	lectrical services ad Accessories of v Air Distribution s	in the viring, ystem,	6		
4	Fire Protection, A : Introduction, Cau building as per IS absorbent, Factors t	coustic and So ses of fire and S and NBC and NBC and be followed	bund Insulatio Effects of fir 2005, Require for noise contr	ons re, General Require ement of good A rol in residential bu	ements of Fire Res coustic, Various iilding.	sisting sound	6		
5	Water and Sanitat Water quality, Pur municipal by law arrangement of sew	ion rification and s and regulat erage systems	treatment- w ions, Rain W in housing	vater supply syste ater Harvesting	ems-distribution sy Sanitation in buil	/stems dings-	6		
6	Building Maintena	ance : Role of	maintenance i	in durability and se	erviceability of bui	ldings	6		
	uppets 0	- maintenunet	· Enterent typ	es or maintenance		Total	36		
Text Bo	oks:								
	 A text book on B Building Service National Building 	uilding Servic s S. M. Patil S g Code of Indi	es R. Udaykur eema Publicati a - 2005 Burea	nar Eswar Press, C ion, Mumbai Revis au of Indian Standa	hennai ed edition ards BIS, New Dell	ni			
Referen	ce Books:		Demois						
	 Building Constru Building Construct 	iction Dr. B. C	. Punmia Laxr	ni Publications (P) (\mathbf{P})	Ltd., New Delhi				
	 Building renair a 	nd Maintenand	re Managemer	at P. S. Gahlot CBS	S Publishers & Dist	ribution	(P) Ltd		
List of S	Software/Learning V	Vebsites	Berner				、 / =		
1	l. www.academia.e	du							
2	2. www.nptel.iitm.a	ic.in				0.4.0."			
	3. "http://en.wikipe	dia.org/w/inde	x.php?title=Du	umbwaiter_(elevate	or)&oldid=621761	813"			
	+. Categories: www 5 cpwd goy in/Unit	1.018.0Fg.111/SI/1 ts/handbook p	ioc.num ff						
6	5. http://www.civile	engineeringnev	ws.tk/2014/07/	methods-of-demol	ition-of-building.h	tml theco	ontractor.org		

TY B Tech (Mechanical Engineering), PCCoE Pune

Progra	am: B. Tech. (Civil) Semester : VI										
Course	Sourse : Smart Cities & Building Automations (OEC-IV) Code: BCI6604A										
		Teaching	Scheme			Evaluation S	cheme				
Lectu	re	Tutorial	Credit	Н	IE	MTE	ЕТЕ	Total			
3		-	3	3	20	30	50	100			
Prior F	Knowl	edge of:									
1.	Phys	ics									
2.	Math	nematics									
5 .	Prog	ramming Lang	guage								
A ftor C	ompla	ting this course	o student will	have adequate	hackground :						
Aner C	To u	nderstand the o	concept of sma	int city and ass	ociated challenges						
2	Топ	nderstand lates	st technologies	used in intelli	gent huilding						
3.	Tou	nderstand the o	concepts of Int	ernet of Thing	s and able to build Io	Γ applications					
4.	To le	earn the progra	mming and us	e of Arduino a	nd Raspberry Pi board	ds for Smart Cit	ies				
Course	Course Outcomes:										
After le	After learning the course, the students will be able:										
1.	To u	nderstand the o	concept of sma	art city and ass	ociated challenges						
2.	To u	nderstand lates	st technologies	used in intelli	gent building						
3.	To p	rogram and co	nfigure Arduir	to boards for v	arious designs.						
4.	To d	o Python prog	ramming and i	nterfacing for	Raspberry Pi.						
5.	Tod	esign fo'l' appl	ications in diff	erent domains	1 10 11 1						
				Deta	lied Syllabus:			Duration			
Unit				Des	scription			(H)			
	Intr	aduction to Sr	nart cities					(11)			
1.	Intro	duction to ci	ity planning.	Concept, Pri	nciple stakeholders.	kev trends in	n smart cities	6			
	deve	lopments	· · · · · · · · · · · · · · · · · · ·	I '	1	,		-			
	Sma	rt Cities Regu	lations								
2.	Und	erstanding sma	art cities, Glo	bal Standards	and performance be	nchmarks, Prac	ctice codes for	6			
	smar	t city developr	nent								
	Sma	rt Cities Plan	ning and Dev	elopment							
3.	Sma	rt city planni	ng and devel	lopment, Di	mension of smart c	ities, Financin	g smart cities	6			
	deve	lopment, Gove	ernance of sma	rt cities							
4	101	in Construction	on mot of Things	Chanastanisti	as of IoT Division de	sion of LoT En	national bloats	6			
4.	of Io	T Sensing Ac	stuation Basic	s of Networkir	cs of 101, Physical de	rotocols Sensor	Networks	0			
	Intro	duction to Ard	luino Program	ming	ig, communication i i	lotocols, Schsol	networks.				
5.	Integ	ration of Sense	ors and Actuat	ors with Ardu	ino for smart city appl	ications		6			
	Intr	oduction to Py	thon and Ras	spberry pi for	Smart Cities						
6.	Pyth	on programm	ing, Introduc	tion to Rasp	berry Pi, Interfacin	g Raspberry	Pi with basic	6			
	perip	herals, Implen	nentation of Io	T with Raspbe	erry Pi for Smart Citie	s and Smart Ho	mes				
							Tota	36			
Text B	ooks:										
1. Jo	Beall	(1997); "A cit	y for all: valui	ng differences	and working with div	versity"; Zed bo	oks limited, Lo	ondon (ISBN:			
	85649	-477-2).	1 1			•••••••••	2 11 1				
2. U.	N-Hat	(2007) , $U_{\rm mito}$	e and sustainat	ble urban plan	ning: a guide for mun	1 cipalities ; vo	1000000000000000000000000000000000000	Development			
	anning run M	itra: "Insights	into inclusive	arowth emr	lovment and wellbei	978-92-1-132	024-4). Springer (2013)	New Delhi			
J. A	3. Arup Mitra; "Insights into inclusive growth, employment and wellbeing in India"; Springer (2013), New Delhi (ISBN: 078 81 322 0655 2)										
4. "	4. "The Internet 'of Things: Enabling Technologies Platforms and Use Cases" (2018) by Pethuru Rai and Anunama										
 C.	C. Raman (CRC Press).										
5. "N	Aake s	ensors"(2014)	Terokarvinen	, Kemo, Karvi	nen and Villey Valtok	ari, 1 st edition,	Maker media.				
6. "I	nterne	t of Things: A	Hands-on App	oroach"(2018),	, by Arshdeep Bahga a	and Vijay Madi	setti.				
L		-			- •	-					

Reference Books

- 1. "Urban Planning and cultural identity" (2004); William J. V. Neill, Routledge, London (ISBN: 0-415-19747-3)
- 2. "Remaking the city: Social science perspective on urban design" (2015) John S. Pipkin, Mark E. La Gory, Judith R. Balu (Editors); State University of New York Press, Albany (ISBN: 0-87395-678-8)
- "Smart cities Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science (2007) Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers
- 4. "Draft Concept Note on Smart City Scheme". Government of India Ministry of Urban Development (<u>http://indiansmartcities.in/downloads/CONCEPT NOTE .12.2014 REVISED AND LATEST .pdf</u>)
- 5. "Internet of Things: A Hands-On Approach" (2018) Vijay Madisetti, Arshdeep Bahga,
- 6. "Fundamentals of Wireless Sensor Networks: Theory and Practice" (2018), Waltenegus Dargie, Christian Poellabauer,
- 7. Beginning Sensor networks with Arduino and Raspberry Pi (2013) Charles Bell, A press.

e-References

- 1. Smart City Mission Guidelines, India, <u>https://smartcities.gov.in/guidelines</u>
- 2. Smart Cities Management of Smart Urban Infrastructures by Coursera, <u>https://www.coursera.org/learn/smart-cities</u>
- 3. e-Learning Course on Smart City by edx, <u>https://www.edx.org/course/smart-city</u>

Progra	Program: B. Tech. (Civil) Semester : VI									
Course	e: Mechanic	al Electrical Plu	umbing (MEP) Systems (OEC-IV)	Code: BCI6	6604B				
	Teachi	ng Scheme			Evaluation S	cheme				
Lectu	re Tutorial	Credit	Hours	IE	MTE	ЕТЕ	Total			
3	-	3	3	20	30	50	100			
Prior H	Knowledge of:					•				
	a. Basics of air	conditioning								
	b. Basics of El	ectrical Engineer	ring							
C	c. Basics of M	echanical Engine	eering							
Course	Objectives:	rea student will	have adequate	hadround						
Alter C	1 To learn the	concept of HVA	nave adequate	e background .						
	2. To recogniz	e the technologie	es used in elect	rical services						
3. To understand the concepts of plumbing services										
	4. To learn the	fire protection s	ystem							
Course	e Outcomes:	•	-							
After le	earning the course,	the students will	l be able to:							
	1. Analyse and	design HVAC s	system							
	2. Implement t	he technologies	used in electric	cal services						
	3. Apply plum	bing services	_							
	4. Design fire	protection system	n Dete	ilad Syllabus						
			Deta	neu Synabus.			Duration			
Unit			Des	cription			(H)			
	HVAC						(11)			
	Introduction to	HVAC, Basic	Components of	of Air-Conditioning	and Refrigerat	ion machines,				
1.	Classification of	Air-Conditionin	g System , Cat	tegories of Air Conditi	ioning , Study o	of sychometric	6			
	Charts , Load	Calculation, A	ir Distribution	n System, Static Pre	ssure Calculat	ion, Hydronic				
	System, VRF/VI	RV System, Air (Conditioning C	Concepts, Ventilation s	systems.					
	Basics of Electr	ical Implementa	ations							
2	General, Codes	& Standards to b	e followed, El	ectrical equipment's a	ind its applicati	on used in the				
	installation, Me	ans of electrical	distribution f	or installation, Majo	r electrical loa	ds used in the	6			
	installation, Ele	ctrical design ca	iculations, var	lous design stages &	Sequence of ele	ectrical design				
	Flectrical Analy	rsis and Design								
3.	Major electrical	loads used in the	installation F	lectrical design calcul	lations Various	s design stages	6			
	& Sequence of e	lectrical design r	procedure.	licenteur design eureu	utions, vuitous	, design stuges	Ŭ			
	Plumbing	01								
4.	Plumbing Syste	ms, Design of	Domestic Wa	ter Supply and Dist	ribution System	m, Design of	6			
	Sanitary Drainag	e System, Draw	ings – Plumbir	ng Layouts.						
	Fire Protection	system								
5.	Introduction To	Fire Fighting,	Classification	Of Fire (Description	n), Fire Exting	uisher Types-	6			
	Using Procedure	And General M	aintenance, Fi	re Protection Systems	-1. Active 2. Pa	assive Refuge	-			
	Areas – Rules &	Regulations.								
6	Designing of fire	e alarm evetem		ESAL Code For Fire	Fighting System	am Designing				
0.	Fire Fighting F	Ivdraulic Calcu	lation For Hi	oh Rise Ruildings 1	Fire norms for	r new project	6			
	construction.	Tyuraune Calcu		gli Kise Dunuliigs, i	The norms for	new project				
-	Total 36									
Text B	ooks:					-	•			
1.	Design of Mecha	anical & Electric	al Systems. Tr	ost, Pearson Publishin	g, ISBN 978-0	-13097235-4 .				
2.	MEP Planning	Manual: Beco	me a Profes	sional Construction	Engineer: 1	(Arabmep H),	ISBN-10			
2	: 16//068930, I	SBN-13 : 9/8-1	10//06893'.	landaarran 16 A	unt 2000 h- (Sidnary Tarras N				
3.	Fucation	Construction	Datadooks) H	arucover – 16 Aug	ust 2000 by S	Sidney Levy, I	vicGraw-Hill			
1	Electrical and M	echanical Servic	es in High Righ	e Ruilding (English I	Panerback Mitt	al A K) CRS I	Publisher and			
	Distrubutor Pvt.	Ltd.	-5 m mgn Kið	Containe (Elignoli, I	- uper ouer, 19110		sononon and			

Reference Books

- 1. MEP Guide for Planning and Scheduling by Planningengineer.net
- 2. Handbook of Building Construction; Data for Architects, Designing and Construction Engineers, and Contractors by Hool George, Publisher: Nabu Press.

e-Reference

- 0 1.
- 2. nline Mechanical, Electrical and Plumbing Design Training Course by Advance Electrical Design & Engineering Institute (AEDEI) https://www.advanceelectricaldesign.com/
- 2. Revit MEP Essentials by CADD Centre, India. https://www.cloudkampus.com/clp/revit-mep-essentials
- 3. MEP Course by MEP Training Institute, India. <u>https://www.mepcentre.com/course/mep</u>
- 4. Foundation Course on Building MEP Services by MEPA (Mechanical Electrical Plumbing engineers Association) http://www.mepaworld.com/training

Program	: B. Tech. (Computer) Semester: VI											
Course:	Information S	Security (OEC-	·III)		Code: BCE6	603						
	Teaching	g Scheme			Evaluatio	on Scheme						
Lectur	re Practical	Tutorial	Credit	IE	МТЕ	ЕТЕ	Total					
3	-	-	3	20	30	50	100					
Course (Objectives:	I				1						
1.	To offer an understa	inding of princi	ple concepts, c	entral topics an	d basic approad	ches in information	n and cyber					
2	security. To make students aw	are about the b	asics and differe	ent algorithms of	f Cryptography							
2. 3.	To acquire knowledge of standard algorithms and protocols employed to provide confidentiality, integrational authenticity											
	authenticity. Outcomes:											
Course (e Outcomes: earning the course, the students should be able to:											
After lea	arning the course, the students should be able to: Identify computer and network security threats, classify the threats and develop a security model to prevent,											
	detect and recover fro	om the attacks.	antij anteads, e				, to provenu,					
2.	Propose the security	Services and M	echanisms for p	preventing the di	fferent security	attacks.						
3.	Use Symmetric key (Cryptographic T	echniques to er	crypt and decry	pt the massages	•						
4. 5.	Use Asymmetric key Cryptographic Techniques to encrypt and decrypt the massages. Use different Hash Techniques to provide the Authentication and to check the Integrity of messages in tra											
6.	Use Message Authen	tication Code to	o provide Authe	entication.								
	Detailed Syllabus:											
Unit			Descri	ption			Duration (H)					
	Security Basics						()					
	Computer Security Concepts - Need, Security Vs Privacy, Confidentiality, Integrity &											
1.	Availability (CIA), additional Security considerations, The challenges of Security, Threats, Attacks											
	Case Study: Study	v of Campus N	Security; Setwork and id	lentification of	nossible Three	ats. Attacks and						
	Assets	, or campus r			Possible 1110							
	Encryption Techn	iques										
	Basics: Symmetric	& Asymmetric	c Cipher Mode	l; Cryptography	; Cryptanalysis	and Brute-Force						
2.	Classical Encrypt	ion Technique	s - Substitution	n Techniques:	Caesar Cipher.	Mono-alphabetic	5					
	Ciphers, Poly-alpha	betic Ciphers, I	Playfair Cipher;	1	r,	r i r						
	Transposition Tech	niques: Rail Fer	nse Technique									
	Symmetric Cipher	r Structure: St	ream cinhers an	d Block Ciphers	e: Feistel Cinher	Structure						
2	Data Encryption S	standard (DES): DES Encrypt	ion; DES Decry	ption; DES Exa	mple; Strength of	-					
3.	DES;		• •		•							
	Block Cipher Mo	des of Opera	tions: Electron	ic Code Book	(ECB), Cipher	Block Chaining						
	Asymmetric Ciphe	r Feedback Mo	de (CFB), Outp	ut Feedback Mo	de (OFB), Cour	iter Mode (CTR)						
	Public-Key Crypt	tosystems: Sec	recy, authentic	ation, secrecy	& authenticati	on; applications,						
4.	requirements;						6					
	The RSA Algorith	m: Algorithm, I	Example, The so	ecurity of RSA;	ga Protocol M	Ion in the middle						
	attack;											
	Key Management	and Distributi	on									
5.	Symmetric Key Dis	stribution using	Symmetric key	Encryption, Sy	ymmetric Key I	Distribution using	6					
	asymmetric key Encryption, Distribution of Public Keys. Case Study: Introduction to X 509											
	Cryptographic Ha	sh Functions &	k Massage Aut	hentication Co	des		+					
6.	Cryptographic Ha	sh Functions:	Applications, Se	ecure Hash Algo	orithm (SHA)-5	12, MD5	7					
	Message Authentic	cation Codes (I	MAC): Require	ments, Function	s, Security of M	ACs	+					
						Total	36					

Text Books:

- William Stallings, "Cryptography and network security principles and practices", Pearson, 6th Edition, ISBN: 1. 978-93-325-1877-3
- 2. Atul Kahate, "Cryptography and Network Security", Mc Graw Hill Publication, 2nd Edition, 2008, ISBN: 978-0-07-064823-4

Reference Books:

- 1. Eoghan Casey, "Digital Evidence and Computer Crime Forensic Science, Computers and the Internet", ELSEVIER, 2011, ISBN 978-0-12-374268-1
- 2. Bernard Menezes, "Network Security and Cryptography", Cengage Learning India, 2014, ISBN No.: 8131513491
- 3. Forouzan, "Cryptography and Network Security (SIE)", Mc Graw Hill, ISBN, 007070208X, 9780070702080
- Nina Godbole, SunitBelapure, "Cyber Security", Wiley India, 2014, ISBN No.: 978-81-345-2179-1 4.

Prog	ram:	B. Tech. (Con	nputer)				Semester: VI			
Cou	rse:	Principles of	Software Engir	eering (OEC-I	II)		Code: BCE6604			
		Teaching	g Scheme			Evaluat	on Scheme			
Lect	Lecture Practical Tutorial Credit IE MTE ETE Te 3 - - 3 20 30 50 1									
3		-	-	3	20	30	50	100		
Course	e Objec	tives:					I			
The co	urse is a	aiming to impar	t conceptual cla	rity among stud	ents about.					
1.	The f	undamental pha	uses of the Softv	vare Developme	nt Life-cycle (S	DLC).				
2.	Selec	tion of an appro	opriate process r	nodel for specifi	ic software proje	ect developmen	t.			
3.	Com	prehension of m	ethods for captu	uring, specifying	g, and analyzing	software requi	rements.			
4.	Appl	ying Design prin	nciples to softw	are project deve	lopment.					
5.	Com	prehension of U	ML Diagrams f	or software proj	ect developmen	t.				
6.	6. The fundamental understanding of agile process model.									
Cour	Course Outcomes:									
After	After learning the course, the students should be able to:									
1.	Com	prehend the fun	damental phases	s of the Software	e Development I	Life-cycle (SDI	LC).			
2.	Com	pare and select a	an appropriate p	rocess model fo	r specific softwa	are project deve	elopment.			
3.	Com	prehend method	ls for capturing,	specifying, and	analyzing softw	are requiremer	its.			
4.	Appl	y Design princi	ples to software	project develop	ment.					
5.	Com	prehend UML L	Diagrams for sof	tware project de	evelopment.					
6.	Relat	e the basics of a	agile process mo	del for the deve	lopment of soft	ware projects.				
				Detailed	l Syllabus					
Unit				Descrip	otion			Duration (H)		
	Intro	luction To Soft	tware Engineer	ing						
1	Defini	tion of Softw	are, Software	Application De	omains, Softwa	are engineering	g layers, Software	6		
1.	engineering practice, The Essence of Practice, General Principles, Software development myths,									
	Manag	gement myths, (Customer myths	, Practitioner's 1	myths, Software	Development	Life-cycle.			
	The S	oftware Proces	SS							
2.	A Gei	neric Process I	Model, Defining	g a Framework	Activity, Pers	pective Proces	s Model, Waterfall	6		
	Model	, V Model, Ind	cremental Proce	ess Model, Evol	utionary Proces	ss Models-Prot	otyping, The Spiral	Ū		
	Model	, Unified Proce	ss, Phases of the	e Unified Proces	SS					
	Requi	rements Analy	vsis							
3.	Requi	rement Engine	ering, Requiren	nents engineerin	ng tasks, Estab	lishing the G	oundwork-Eliciting	6		
	Requi	rements, Collab	orative Require	ments Gathering	g, Quality Funct	tion Deployment	nt, Usage Scenarios,	-		
	Elicita	tion Work Proc	lucts, Developin	ig use cases.						
	Design	n Concepts	A 1	A			1			
4.	The d	lesign Process,	Abstraction, A	Architecture, Se	eparation of Co	oncerns, Modu	llarity, Information	6		
	Hiding	g, Refinement,	The design N	lodel, Data De	esign Elements,	, Architectural	Design Elements,			
	Interia	ice Design Elen	nents.							
5	Model	ling with UNIL	and Diagrams I	ntraduction to I	MI Use Case	Diagrama Cl	Diagrama Stata	6		
5.	abort I	ling Concepts a	liiu Diagrams, I	halloga Diagram	DML, Use Case	ingrams Dople	uss Diagrams, State	0		
		Jagrains, Activ	ny Diagrains, r	ackage Diagram	i, Component D	lagranis, Depic	byment Diagrams.			
	Agilo	Process Extra	Drogrammi	na in agila da	volonmont Ag	la softwara d	walonmant process			
6.	Model	SCRUM _	process flow	scrum roles s	crum cycle des	scription prod	uct backlog sprint	6		
	nodels, Serrow process now, serum roles, serum eyere description, product backlog, sprint									
	Total	lig meeting, spr	int backlog, spi	int execution, de	my serum meen	<u></u>		36		
Tovt D	ooke	L						50		
	Roge	r S Pressman	"Software Engi	neering _ A Pro	actitioner's Ann	roach" Pearso	n Education 7th Ed	ition ISBN		
1.	0073	55783 2010	Software Eligh	accord = A H c	wattonet s App	100011, 1 Carso	a Equation, / III EU	1000, 1001		
2	Ian se	ommerville "Sc	oftware Enginee	ring" 9th edition	n ISBN-13.978	8-0-13-703515-	1 2010			
3	Unifi	ed Modeling I	anguage User	Guide. The (2n	d Edition) (Ad	dison-Wesley	Object Technolog	v Series)		
	ISBN	:978-0-321-267	797-9, May 200	5.				, , , , , , , , , , , , , , , , ,		

Reference Books:

- 1. Carlo Ghezzi, "Fundamentals of Software Engineering", Prentice Hall India, ISBN 10: 0133056996, 2002.
- 2. Rajib Mall, "Fundamentals of Software Engineering", Prentice Hall India, ISBN 13: 978-8120348981, 2014.
- 3. Pankaj Jalote, "An Integrated Approach to Software Engineering", Springer, ISBN 13: 9788173192715, 2010.

Departi			sing			a , 				
Program	B. Tech. (Computer) Semester: VI Fundamentals of Machine Learning (OEC-IV) Code: BCE6605									
Course	Fundamentals	s of Machine L	earning (OEC-I	(v)		Code: BCE660	b			
	Teaching	g Scheme	1		Evaluatio	on Scheme				
Lecture	LecturePracticalTutorialCreditIEMTEETE33203050Prior knowledge of									
3	-	-	3	20	30	50	100			
Prior kno	wledge of									
a. E	ngineering Mathem	atics is essential	•							
Course O	bjectives: 'o introduce differen	t machine learni	ng primitives							
1. T 2. T	o introduce differen	t preprocessing	techniques to pro-	epare training a	nd testing data s	et				
3. T	o solve regression p	roblems using r	egression techni	ques.	8					
4. T	o develop skills to u	inderstand natur	e of the problem	and apply mac	hine learning alg	gorithm				
5. T	o use classification	algorithms to so	lve classification	n problems.						
6. T	'o introduce metrics	and methods for	r Evaluating Cla	ssifier Performa	ance					
Course Outcomes: After learning the course, the students should be able to:										
After learning the course, the students should be able to:										
 Distinguish different machine learning primitives. 										
2. U	se different data pre	processing tech	niques to prepar	e training and to	esting data set.					
3. A	apply data similarity	and dissimilarit	y measures for s	statistical analys	S1S.					
4. A	olve real world prob	lems using regr	ession technique		18.					
5. 5 6	Apply classification	algorithms to so	lve real world p	roblems						
0. 1			Detailed	Svllabus:						
Note: Cas	e studies mentioned	in Unit IV, Uni	t V and VI are ju	ist to get unders	standing to stude	ents, and will not b	e considered			
Unit	Description									
	Introduction to N	lachine learnin	g				(11)			
-	Introduction to	Machine learr	ning, Machine	Learning Ap	proaches-Super	vised Learning,				
1.	Unsupervised Lea	rning and Reinf	forcement Learn	ing, Important	Elements of M	achine Learning-	6			
	Data formats, Und	erfitting and Ov	erfitting, Error n	neasures, Creati	ing training and	testing datasets				
	Data Pre-Process	ing								
	Data, Information	and Knowled	ge; Attribute T	ypes: Nominal	, Binary, Ordin	al and Numeric				
2.	attributes; Data Pi	re-processing: I	Data Cleaning, I	Data integration	, Data transform	nation: Min-max	6			
	normalization, z-s	core normalizat	tion and decima	al scaling; data	reduction, Dat	a Discretization,				
	Binning technique	s for smoothing	noise.							
	Measuring Data S	Similarity and I	Dissimilarity Dr	ovimity Measu	ires for Noming	al Attributes and				
3.	Binary Attributes	Dissimilarity and I	of Numeric Dat	a: Euclidean d	istance and Ma	nhattan distance	5			
	Cosine Similarity	2100minunty (. i comerie Dat		istunee und 1914	usunee,				
	Unsupervised Lea	arning								
	Association Rules	Mining- Marke	et Basket Analys	sis, Frequent ite	m set, Associati	on Rules, Apriori				
4.	Algorithm, Genera	ting Association	n Rules from Fr	equent Item set	s; Clustering- F	K-means: Finding	6			
	optimal number of	clusters								
	Case study of ML	application: S	hopping mall ap	plication for Ma	arket Basket An	alysis.				
	Supervised Learn	ing- Regression								
5	dimensionality D	n - Linear mod	eis, A bi-dimen	isional example	e, Linear Regre	ssion and higher	6			
5.	5. dimensionality, Kegularization-Kidge, Lasso Logistic regression- Linear classification, Logistic regression									
	Case study of MI	applications.	Applications for	house price pre	diction. Share M	larket				
	Supervised Learn	ing- Classificat	tion	insuse price pre	alouon, bhure iv					
	Naïve Bayes Class	sifier, Decision	Tree Classificat	ion, K-Nearest	Neighbor Class	ifier, Metrics for				
(Evaluating Classif	ier Performanc	e, Confusion M	atrix, Evaluatir	ng the Accuracy	of a Classifier:	-			
0.	Holdout Method a	nd Cross-Valida	tion, ROC Curv	e	-		/			
	Case study of M	L applications:	Applications in	n Agriculture s	ector, Health ca	re domain using				
	analytical tools suc	ch as WEKA/KI	NIME/R/SK-Lea	urn						
						Total	36			

Text Books:

- 1. Jiawei Han, Micheline Kamber, "Data mining: concepts and techniques", Morgan Kaufmann Publisher 2012, third edition, ISBN 978-0-12-381479-1.
- 2. Giuseppe Bonaccorso, "Machine Learning Algorithms", Packt Publishing Limited 2017, ISBN-10: 1785889621, ISBN-13: 978-1785889622.

Reference Books:

- 1. EthemAlpaydin, "Introduction to Machine Learning", PHI 2nd Edition-2013, ISBN 978-0-262-01243-0
- Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", Cambridge University Press, Edition 2012, ISBN-10: 1107422221; ISBN-13: 978-1107422223
- 3. Tom Mitchell "Machine Learning" McGraw Hill Publication 1997, ISBN: 0070428077 9780070428072
- 4. AurélienGéron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", O'Reilly Media, Inc. publisher 2017, ISBN: 9781491962299.
- 5. Ian H. Witten and Eibe Frank, "Data Mining: Practical Machine Learning Tools and Techniques", Second Edition, Morgan Kaufmann Publishers 2005, ISBN: 0-12-088407-0.

Web references:

- 1. http://myweb.sabanciuniv.edu/rdehkharghani/files/2016/02/The-Morgan-Kaufmann-Series-in-Data-Management-Systems-Jiawei-Han-Micheline-Kamber-Jian-Pei-Data-Mining.-Concepts-and-Techniques-3rd-Edition-Morgan-Kaufmann-2011.pdf
- 2. https://balasahebtarle.files.wordpress.com/2020/01/machine-learning-algorithms_text-book.pdf
- http://www.academia.dk/BiologiskAntropologi/Epidemiologi/DataMining/Witten_and_Frank_DataMining_Weka_ 2nd_Ed_2005.pdf
- 4. http://scikit-learn.org/stable/datasets/
- 5. https://scikit-learn.org/stable/modules/model_evaluation.html
- 6. https://www.kaggle.com/datasets

Program:	B. Tech. (Con	Semester: V	er: VI						
Course:	JAVA Progra	mming (OEC-	IV)	1		Code: BCE	6606		
	Teaching	g Scheme			Evaluation	n Scheme			
Lecture	Practical	Tutorial	Credit	IE	MTE	ETE	Total		
3	-	-	3	20	30	50	100		
Prior knowle	edge of								
a. Deci	ision control strue	ctures, loop con	trol structures, a	rrays, Functions	, pointers, struc	ture and union	, searching and		
Sorti									
1. To u									
2. To u									
3. To u									
4. To apply multi-threading concepts and collection framework.									
5. Exer	mplify the usage	of packages and	implement the o	concepts of App	lets and JavaFX	•			
After learning	ones: the course the s	students should	be able to:						
1. To c	comprehend basic	: Java concepts a	and JVM archite	cture.					
2. To u	ise Object-oriente	ed programming	concepts to solv	ve real time prob	olems.				
3. To a	pply error handli	ng mechanism u	using Exceptions	s in Java.					
4. To u	ise concepts of m	ultithreading for	r synchronization	n in Java.					
5. 100	ise the string colle	ection framewor	rk for various str	ing operations.	ons				
0. 10 a		ipolicits for des		Svllobus:					
T			Detaileu c	Synabus:			Duration		
Unit			Descript	ion			(H)		
	Introduction to	Java program	ming						
1.	what is JAVA, I	History of JAVA	A, Java Virtual 1	Machine, differe	ence between JI	DK, JRE &	6		
-	JVM, Variables	and data types,	Control statemer	nts					
2	IAVA OOPs C	oncepts Fields	and Methods	Constructors	conv construct	or method	6		
2.	overloading, met	thod overriding,	static keyword,	this keyword	copy construct	si, incurod	U		
	Object-oriented	l programming	concepts II	2					
	Inheritance, Agg	gregation, Polyr	norphism, super	keyword, fina	l keyword, Abs	tract class,			
3.	Interface,								
	Exceptions: turnes of exception with examples. True eater throw and throws in LAVA, flow control in								
	types of exception with examples, Try, catch, throw and throws in JAVA, flow control in try catch finally in JAVA								
	Java Multithrea	ading							
	life cycle and st	ates of thread, t	hread scheduler,	creating thread	, creating multip	ple threads,			
	thread priorities,	synchronization	1				-		
4.	Enumerations fu	ndamentals and	example, type V	Vrappers			6		
	collection Interf	aces collection	classes workin	g with Mans A	Arrays Legacy (classes and			
	Interfaces		clusses, workin	5 min maps, 1	inajs, Deguej (chubbes und			
	Applet								
		_							
5. SWING (JFC): Introduction Difference between AWT and SWING Components hierarchy Panes							6		
	Individual Swing	riference betwee	Label IButton	ITextField ITe	extAres	lly, Falles,			
	JavaFX	55 components J	Lucer, a Duttoll,	<u>, i enti ieiti, j i t</u>					
	JavaFX Archited	cture, JavaFX I	Program Structu	re, Shapes, Eff	ects, Layout Co	omponents,			
6.	Properties and B	indings, Basic U	JI Controls, Graj	phics and Anima	ation.		6		
	Case Study:								
	10 develop real-	ume application	using java conc	cepts.					
						Total	36		

TY B Tech (Mechanical Engineering), PCCoE Pune

Text Books:

- 1. Herbert Schildt,"Java The Complete Reference", The McGraw-Hill Education, 11th Edition, 2018, 978-1260440232.
- 2. E. Balagurusamy, "Programming with Java" McGraw Hill Education India, 6th Edition, 2019, 9789353162.

Reference Books:

- 1. D.T. Editorial Services, "Java 8 Programming Black Book", Dreamtech Press India Pvt. Ltd., Paperback, 2015, 9789351197584.
- 2. Ken Arnold, James Gosling and David Holmes, "The Java Programming Language", Addison-Wesley, 4th Edition, 2005, 0321349806

Web references:

- 1. https://www.w3schools.com/java
- 2. https://www.javatpoint.com/java-tutorial
- www.spoken-tutorial.com : Free Online course of JAVA 3.

Program	am: B.Tech. (E&TC) Semester: VI													
Course:	Designing with	Raspberry Pi	(OEC-III)		Code: BET6	601								
	Teaching	Scheme			Evalua	ntion Scheme								
Lectur	e Tutorial	Credit	Hours	IE	MTE	ЕТЕ	Total							
3	-	3	3	20	30	50	100							
Prior kno	wledge of													
a. Ba	sics of Python codin	g.												
D. Ba	isics of Linux comm	couing. and												
are	e essential	and.												
Objective	es:													
1. To	1. To explain fundamentals of Raspberry pi (Rpi) and installation of OS in Rpi													
2. To	demonstrate the Py	hon programm	ing and interf	acing of sens	ors and actuators	with Rpi								
3. 10	3. To describe the Node-RED tool used in Rpi and its applications.													
After lear	ter learning the course, the students should be ableto:													
1. Ui	nderstand basic speci	fications of Ra	spberry Pi.											
2. Co	omplete Installation of	of OS in Raspbo	erry Pi.											
3. Pr	ogram and interface	Raspberry-Pi u	sing Python p	programming										
4. In	terface sensors and a	ctuators with R	pi.	~										
5.08	sign IoT based appli	cations with P	vthon program	g . nming and R	soberry Pi									
0. D	sign for based appl		Detai	led Syllabus										
Unit			Des	scription	•		Duration (H)							
	Getting started wi	th Raspberry]	Pi											
1	Basic functionality	of Raspberry F	Pi board, Phys	sical design a	nd specifications	Getting started with Raspberry Pi Regia functionality of Respherery Pi board, Physical design and specifications, CPIO Pin description								
	of Pni comparison	Basic functionality of Raspberry Pi board, Physical design and specifications, GPIO Pin description 6												
	of Kpi, comparison	of various Rpi	models, Rpi a	as mini- com	puter.	OF IO F III description	0							
	Booting Up RPi- C	of various Rpi Dperating Syst	models, Rpi a em and Linu	as mini- com x Command	puter. s	ohs/OSMC apareting	0							
2	Booting Up RPi- C Introduction of vari	of various Rpi Derating Syst ous operating size boot and basic	models, Rpi a em and Linu systems of Rp	as mini- com x Command pi, Installatio	s s n of Raspbian/No roduction to Linux	obs/OSMC operating	6							
2	Booting Up RPi- C Introduction of vari system on Rpi, first to configure Rpi, O	of various Rpi Dperating Syst ous operating s boot and basic verview of Gra	models, Rpi a em and Linu systems of Rp c configuratio phic User Into	as mini- com x Command pi, Installatio n of Rpi, Int erface (GUI)	s puter. s n of Raspbian/No roduction to Linux	obs/OSMC operating commands required	6							
2	Booting Up RPi- O Introduction of vari system on Rpi, first to configure Rpi, O Programming the	of various Rpi Operating Syst ous operating s boot and basic verview of Gra Raspberry Pi	models, Rpi a em and Linu systems of Rp c configuratio phic User Inte	as mini- com x Command bi, Installatio n of Rpi, Int erface (GUI)	nu specifications, puter. s n of Raspbian/No roduction to Linux	obs/OSMC operating commands required	6							
2	Booting Up RPi- C Introduction of vari system on Rpi, first to configure Rpi, O Programming the Introduction to P	Operating Syst Operating Syst ous operating s boot and basic verview of Gra Raspberry Pi ython program	models, Rpi a em and Linu systems of Rp c configuratio phic User Internation nming langu	as mini- com x Command bi, Installatio n of Rpi, Int erface (GUI) hage: Python	n of Raspbian/No roduction to Linux	obs/OSMC operating commands required Environment,Python	6							
2	Booting Up RPi- C Introduction of vari system on Rpi, first to configure Rpi, O Programming the Introduction to P Expressions, String	of various Rpi Operating Syst ous operating s boot and basic verview of Gra Raspberry Pi ython program s, Functions, D	models, Rpi a em and Linu systems of Rp c configuratio phic User Into nming langu ata types in p	as mini- com x Command bi, Installatio n of Rpi, Int erface (GUI) hage: Python bython, impor	n of Raspbian/No roduction to Linux n Programming ting libraries, flow	obs/OSMC operating commands required Environment,Python v control, conditional	6 6							
2	Booting Up RPi- C Introduction of vari system on Rpi, first to configure Rpi, O Programming the Introduction to P Expressions, String statement, Loops.	of various Rpi Operating Syst ous operating s boot and basic verview of Gra Raspberry Pi ython program s, Functions, D	models, Rpi a em and Linu systems of Rp c configuratio phic User Into nming langu ata types in p	as mini- com x Command bi, Installatio n of Rpi, Int erface (GUI) hage: Python bython, impor	n of Raspbian/No oduction to Linux Programming ting libraries, flow	obs/OSMC operating commands required Environment,Python v control, conditional	6 6							
2	Booting Up RPi- C Introduction of vari system on Rpi, first to configure Rpi, O Programming the Introduction to P Expressions, String statement, Loops. Sensor and Actuat Sensor interfacing:	of various Rpi Operating Syst ous operating s boot and basic verview of Gra Raspberry Pi ython program s, Functions, D or interfacing Temperature	models, Rpi a em and Linu systems of Rp c configuratio phic User Into nming langu ata types in p with Rpi and Humidit	as mini- com x Command bi, Installatio n of Rpi, Int erface (GUI) mage: Python hython, impor- ty sensor (D	n of Raspbian/No roduction to Linux Programming ting libraries, flow	obs/OSMC operating commands required Environment,Python v control, conditional	6 6							
2 3 4	Booting Up RPi- C Introduction of vari system on Rpi, first to configure Rpi, O Programming the Introduction to P Expressions, String statement, Loops. Sensor and Actuat Sensor interfacing: detection using Ult	of various Rpi Operating Syst ous operating s boot and basic verview of Gra Raspberry Pi ython program s, Functions, D or interfacing Temperature rasonic sensor.	models, Rpi a em and Linu systems of Rp c configuratio phic User Into nming langu tata types in p with Rpi and Humidit	as mini- com x Command bi, Installatio n of Rpi, Int erface (GUI) hage: Python hython, impor- ty sensor (D	n of Raspbian/No roduction to Linux n Programming ting libraries, flow HT11), PIR Mor	obs/OSMC operating commands required Environment,Python v control, conditional	6 6 6							
2 3 4	Booting Up RPi- C Introduction of vari system on Rpi, first to configure Rpi, O Programming the Introduction to P Expressions, String statement, Loops. Sensor and Actuat Sensor interfacing: detection using Ultr Actuator interfacing	of various Rpi Operating Syst ous operating s boot and basic verview of Gra Raspberry Pi ython program s, Functions, D or interfacing Temperature rasonic sensor. g: Electronic Ref	models, Rpi a em and Linu systems of Rp c configuratio phic User Into nming langu ata types in p with Rpi and Humidit elays, LED's,	as mini- com x Command bi, Installatio n of Rpi, Int erface (GUI) mage: Python hython, impor- ty sensor (D Buzzers, DC	n of Raspbian/No soduction to Linux Programming ting libraries, flow HT11), PIR Mor Motor, Stepper n	obs/OSMC operating commands required Environment,Python v control, conditional ion sensor, obstacle notor, Servo Motor.	6 6 6							
2 3 4	Booting Up RPi- C Introduction of vari system on Rpi, first to configure Rpi, O Programming the Introduction to P Expressions, String statement, Loops. Sensor and Actuat Sensor interfacing: detection using Ultr Actuator interfacing Getting started with	of various Rpi Operating Syst ous operating si boot and basic verview of Gra Raspberry Pi ython progran s, Functions, D or interfacing Temperature asonic sensor. g: Electronic Rea Node-RED to	models, Rpi a em and Linu systems of Rp c configuratio phic User Into nming langu ata types in p with Rpi and Humidit elays, LED's, pol on Rpi	as mini- com x Command bi, Installatio n of Rpi, Int erface (GUI) hage: Python ython, impor- ty sensor (D Buzzers, DC	n of Raspbian/No soduction to Linux Programming ting libraries, flow HT11), PIR Mor Motor, Stepper n	obs/OSMC operating commands required Environment,Python v control, conditional tion sensor, obstacle notor, Servo Motor.	6 6 6							
2 3 4 5	Booting Up RPi- C Introduction of vari system on Rpi, first to configure Rpi, O Programming the Introduction to P Expressions, String statement, Loops. Sensor and Actuat Sensor interfacing: detection using Ultr Actuator interfacing Getting started with Prerequisite for No	of various Rpi Operating Syst ous operating s boot and basic verview of Gra Raspberry Pi ython program s, Functions, D or interfacing Temperature rasonic sensor. g: Electronic Ref h Node-RED, Instal patuerle auto	models, Rpi a em and Linu systems of Rp c configuratio phic User Inter- nming langu- tata types in p with Rpi and Humidit elays, LED's, pol on Rpi ling and upgr	as mini- com x Command bi, Installatio n of Rpi, Int erface (GUI) hage: Python hython, impor- ty sensor (D Buzzers, DC rading Node-	n of Raspbian/No roduction to Linux n Programming ting libraries, flow HT11), PIR Mor Motor, Stepper n RED, Running N	obs/OSMC operating commands required Environment,Python v control, conditional ion sensor, obstacle notor, Servo Motor.	6 6 6 6							
2 3 4 5	Booting Up RPi- C Introduction of vari system on Rpi, first to configure Rpi, O Programming the Introduction to P Expressions, String statement, Loops. Sensor and Actuat Sensor interfacing: detection using Ulti Actuator interfacing Getting started with Prerequisite for No and as a service on for Node-RED add	of various Rpi Operating Syst ous operating si boot and basic verview of Gra Raspberry Pi ython program s, Functions, D or interfacing Temperature rasonic sensor. g: Electronic Ref hode-RED to de-RED, Instal network, auto- ing node_add	models, Rpi a em and Linu systems of Rp c configuratio phic User Inter- nming langu- ata types in p with Rpi and Humidit elays, LED's, pol on Rpi ling and upgr- start on boot lebug node w	as mini- com x Command bi, Installatio n of Rpi, Int erface (GUI) mage: Python hython, impor- ty sensor (D <u>Buzzers, DC</u> rading Node- , opening the vire the node	n of Raspbian/No roduction to Linux n Programming ting libraries, flow HT11), PIR Mor <u>Motor, Stepper n</u> RED, Running N editor, installation deploy the flow	obs/OSMC operating commands required Environment,Python v control, conditional tion sensor, obstacle notor, Servo Motor. ode-RED app locally n of various libraries	6 6 6 6							
2 3 4 5	Booting Up RPi- C Introduction of vari system on Rpi, first to configure Rpi, O Programming the Introduction to P Expressions, String statement, Loops. Sensor and Actuat Sensor interfacing: detection using Ulti Actuator interfacing Getting started with Prerequisite for No and as a service on for Node-RED, add Case Study based	of various Rpi Operating Syst ous operating si boot and basic verview of Gra Raspberry Pi ython program s, Functions, D or interfacing Temperature asonic sensor. g: Electronic Ref to de-RED, Instal network, auto- ing node, add co following topic	models, Rpi a em and Linu systems of Rp c configuratio phic User Inter- nming langu- tata types in p with Rpi and Humidit elays, LED's, pol on Rpi ling and upgr- start on boot lebug node, we	as mini- com x Command bi, Installatio n of Rpi, Int erface (GUI) hage: Python ython, impor- ty sensor (D Buzzers, DC rading Node- , opening the vire the nodes	n of Raspbian/No oduction to Linux Programming ting libraries, flow HT11), PIR Mor Motor, Stepper n RED, Running N editor, installation , deploy the flow.	obs/OSMC operating commands required Environment,Python v control, conditional tion sensor, obstacle notor, Servo Motor. ode-RED app locally n of various libraries	6 6 6 6							
2 3 4 5 6	Booting Up RPi- C Introduction of vari system on Rpi, first to configure Rpi, O Programming the Introduction to P Expressions, String statement, Loops. Sensor and Actuat Sensor interfacing: detection using Ultr Actuator interfacing Getting started witt Prerequisite for No and as a service on for Node-RED, add Case Study based Home Automation	of various Rpi Operating Syst ous operating s boot and basic verview of Gra Raspberry Pi ython program s, Functions, D or interfacing Temperature rasonic sensor. g: Electronic Ref de-RED, Instal network, auto- ing node, add c following topic , Smart City,	models, Rpi a em and Linu systems of Rp c configuratio phic User Inter- nming langu- tata types in p with Rpi and Humidit elays, LED's, pol on Rpi ling and upgr- start on boot debug node, w cs Smart Farm	as mini- com x Command bi, Installatio n of Rpi, Int erface (GUI) hage: Python hython, impor- ty sensor (D <u>Buzzers, DC</u> rading Node- rading Node- ing, Smart	n of Raspbian/No roduction to Linux n Programming ting libraries, flow HT11), PIR Mor Motor, Stepper n RED, Running N editor, installation deploy the flow.	obs/OSMC operating commands required Environment,Python v control, conditional ion sensor, obstacle notor, Servo Motor. ode-RED app locally n of various libraries lealth and Lifestyle,	6 6 6 6 6							
2 3 4 5 6	Booting Up RPi- C Introduction of vari system on Rpi, first to configure Rpi, O Programming the Introduction to P Expressions, String statement, Loops. Sensor and Actuat Sensor interfacing: detection using Ulta Actuator interfacing Getting started with Prerequisite for No and as a service on for Node-RED, add Case Study based Home Automation Pollution Monitorir	of various Rpi Operating Syst ous operating solution boot and basic verview of Gra Raspberry Pi ython program s, Functions, D or interfacing Temperature rasonic sensor. g: Electronic Ref de-RED, Instal network, auto- ing node, add co following topic , Smart City, g system	models, Rpi a em and Linu systems of Rp c configuratio phic User Inter- nming langu- ata types in p with Rpi and Humidit elays, LED's, pol on Rpi ling and upgr- start on boot lebug node, w cs Smart Farm	as mini- com x Command pi, Installatio n of Rpi, Int erface (GUI) tage: Python tython, impor ty sensor (D Buzzers, DC rading Node- , opening the vire the nodes ing, Smart	n of Raspbian/No roduction to Linux n Programming ting libraries, flow HT11), PIR Mor Motor, Stepper n RED, Running N editor, installation , deploy the flow.	obs/OSMC operating commands required Environment,Python v control, conditional ion sensor, obstacle notor, Servo Motor. ode-RED app locally n of various libraries fealth and Lifestyle,	6 6 6 6 6							

Text Books:

- 1. Gary Mitnick,"Raspberry Pi 3: An Introduction to using Python Scratch, javascript and more", Createspace Independent publishing Platform 2017.
- 2. Tim Cox, "Raspberry Pi for python program cookbook" Packet Publishing Limited, 2 nd edition, 2016
- John C. Shovic, "Raspberry Pi IoT Projects", Apress Berkeley CA, 2016 3.

Reference Books:

- 1. Sean McManus, Mike Cook, "Raspberry Pi for Dummies",
- Maik Schmidt, "Raspberry Pi: A Quick-Start Guide", The pragmatic programmers, LLC, 2012 2.
- 3.
- Simon Monk,"Programming the Raspberry Pi", 2nd Edition, McGraw Hill publications, 2012 Matt Richardson,"Getting started with Raspberry pi", 3rd Edition, Make community, LLC 2016 Derek Molloy,"Exploring Raspberry pi", 1st Edition, Wiley, 2016 4.
- 5.

MOOCs Courses:

- 1. https://onlinecourses.nptel.ac.in/noc20_cs66/preview
- 2. https://onlinecourses.nptel.ac.in/noc22_cs74/preview

Program:	B. Tech. (E&T	B. Tech. (E&TC) Semester: VI									
Course:	Designing with	Arduino plat	form (OEC-	IV)	Code: BET	6603					
	Teaching	Scheme			Evalu	ation Scheme					
Lecture	e Tutorial	Credit	Hours	IE	MTE	ETE	Total				
3	-	3	3	20	30	50	100				
Prior know	wledge of										
a.	Basic Programmin	ng Fundament	als is essentia	ıl							
Objective	5: To malza studenta	arriana of the	Andrino mlotf	omo in tomos	of the physical h	and and librarias a	nd the IDE				
1.	(Integrated Devel	opment Enviro	onment)	orm in terms	of the physical b	oard and noraries a	nd the IDE				
2.	Explain how to pr	ototype circui	ts with a brea	dboard.							
3.	Making students a	aware of the A	rduino progra	amming lang	uage and IDE.						
4.	Introducing Proto	type circuits a	nd connect pe	eripherals to	the Arduino.						
Outcomes: After learning the course, the students should be ableto: 1 Understand of features of Arduino board											
 Understand of features of Arduino board. Apply Arduino board programming concepts. 											
3.	Design and imple	ment Digital a	nd analog In	out /Output c	ontrols using Arc	luino					
4.	Measure and anal	yze the Realtin	me parameter	s using Ardu	ino.						
5.	Design Object det	tection using A	Arduino.		A						
0.	Realize Sensing S	ound and dist	ance measure Detai	ment using	•						
			Deta		•		Duration				
Unit			Dese	cription			(H)				
	UNIT -1 KNOWI	NG YOUR A	RDIUNO:								
1	Introduction, getting to know the Arduino Uno: Atmega328P, USB, Shields, getting to know the Arduino Uno: Pins nower clock Using the digital output pins. Using the digital input										
1	the Arduino Uno: Pins, power, clock, Using the digital output pins, Using the digital input pins Using the analog output pins Using the analog input pins. Introduction: Serial (UART)										
	communications, I	² C (TWI) com	munications,	SPI commu	nications						
	UNIT -2 ARDUI	NO IDE AND	PROGRAM	IMING CO	NCEPTS.						
	An introduction to	the Arduino	IDE: Getting	and installir	g the Arduino II	DE and uploading a	L				
2	An introduction to	uino. Arduino pro	gramming []	Inderstand th	e basic parts of	an Arduino sketch	6				
	An introduction to Arduino programming, Understand the basic parts of an Arduino sketch, custom functions Creating custom functions and the return keyword. Using variables.										
	constants, Introduc	ction to contro	l structures: 7	The "if"," wh	ile", "For"," Swi	tch" statement					
	UNIT 3: ARDUI	NO PROGRA	MMING HA	ANDS ON							
2	Digital input/outpu	it - how to rea	d the state of	a button con	trol an LED, Ar	alog input/ output					
5	(color) LED Wiri	ng the RGB I	ED RGB L	ED: creating	colors using a l	ibrary to control at	0				
	RGB LED with PV	WM.	220, ROD 21	D. creating	corors, using a		I.				
	UNIT 4: MEASU	RING LIGH	T,COLOR A	ND TEMP	ERATURE WIT	'H ARDUINO					
4	Using Ultra -viole	et light sensor	, RGB color	sensor,DH7	22 sensor to me	easure temperature	6				
	and numidity, prog	gram and conn		$\frac{10}{10}$	DIECT DETE						
	INFRARED MO	TION SENS	AUUELEKA)R.	mon, u	DJECI DEID	CIION WITH					
5	Introduction to det	tecting acceler	ation with th	e ADXL335	Plugging the A	DXL335 directly in	6				
	the Arduino, and	detect its orig	entation, A d	lemonstration	of using the P	IR sensor with the					
	Arduino			CE							
	Introduction to the	e ultrasonic d	istance senso	i CE 17 Wiring ar	d understanding	Trigger and Echo					
6	and calculating dis	tance.	istunee sense	., ,,	a anderstunding	Tigger and Leno	6				
	Introduction to the	f the analog sound									
	sensor and the digi	ital sound sens	or.			787 · 1					
						Total	36				

Progra	am:	n: B. Tech. (E&TC) Semester: VI								
Cours	e:	Basics of Auton	notive Electro	nics (OEC-I	II)		Code	: BET6602		
		Teaching	Scheme				Evalu	ation Scheme		
Lect	ture	Tutorial	Credit	Hours	IE	MT	E	ЕТЕ]	Fotal
3		-	3	3	20	30		50		100
Prior	know	ledge of: Electrica	al and Electron	ics is essentia	al.			•		
Object	tives:									
1.	To ii	troduce Electroni	cs Control Uni	t(ECU) used	in Automoti	ve applicat	tions.			
2.	Toe	xplain processing	principle of se	nsors and act	uators used 1	n automoti	ve			
J. Outeo	mog	xpiore role of elec	uome systems	III Active all	iu passive sai	ety system	18.			
After 1	earnir	g the course, the s	students should	be ableto:						
1.	Unde	erstand the import	ance of electro	nics system i	in automotive	e design.				
2.	Desi	gn signal processi	ng for sensors	and actuators	S.	U				
3.	Desi	gn vehicle motion	control system	ns.						
4.	Comprehend algorithms used in Engine Control System.									
5.	Real	ize role of electron	nics in Active a	and passive s	afety systems	s mia Encin	Contr	al in automatic		tions
0.	Use		onents, subsyst	Dote	ics of Electro		Contr		ve applica	tions.
				Deu	aneu Synabu	13.				Duration
Unit				Des	scription					(H)
	Aut	omotive Systems	Overview: Au	itomotive vel	hicle technol	ogy, Prese	nt trend	ls in automobil	es with	
1	emp	hasis on increasin	g role of electr	ronics and so	oftware, Over	view of ty	pical a	utomotive subs	systems	5
	and	components, Body	y, Chassis, and	Powertrain H	Electronics				. 1	
	Sens	sors :Basic senso	r arrangement	, Types of s	sensors such	as oxyge	n sense	ors, Crankshaf	t angle	
	Oxv	$\sigma_{en} (O2/EGO)$	Air mass flow	sensors Th	rottle positic	on sensor	Strain	Gauge MAP	sensor	
2	Mag	netic Reluctance	Position Sens	sor, Hall eff	ect Position	Sensor, E	Ingine	Coolant Temp	berature	8
	(EC	Γ) Sensor, Piezoel	ectric Knock S	Sensor.		,	0	ľ		_
	Actu	iators :								
	Sole	noids, Stepper Mo	otors, Relays, F	Fuel Injector,	EGR Actuat	or, Ignitior	n Syster	m		
	Veh	icle Motion Cont	rol System F	Digital Cruis	a Control S	vetom Di	aital S	nood Sonsor	Throttla	
3	Acti	lator Digital Cru	ise Control co	nfiguration	Cruise Cont	rol Electro	nics (I	Digital only)	Antilock	5
	Bral	ke System (ABS)		, iniguration,	cruise com			Bigitai oliiy), i	minoek	
4	Eng	ine Control Syst	em: Algorithm	ns for engine	control inclu	uding open	loop a	and closed loop	o control	7
4	syste	em, Electronic ign	ition, EGR for	exhaust emi	ssion control					/
_	Acti	ve and passive	safety system	s: Body elec	ctronics inclu	uding ligh	ting co	ntrol, Remote	keyless	6
5	entry	y, Immobilizers,	Electronic ins	strument clu	sters and da	ashboard e	electror	nics, Antilock	braking	-
	Syste			1.5 A						
	Fut Alte	ure Automotive I rnative Fuel Engi	hectronic Sys	tems: nd Hybrid ve	phicles Fuel	cell nowe	red car	s Collision As	voidance	
6	Rada	ar warning System	ns. Low tire r	ressure warr	ning system.	Voice Re	cogniti	on Cell Phone	dialing.	5
	Adv	anced Cruise Con	trol, Stability A	Augmentation	n, Automatic	driving Co	ontrol		ананы <u>в</u> ,	
									Total	36
Text B	Books	:						th		
1. W	illiam	B. Ribbens, "Und	lerstanding Au	tomotive Ele	ectronics- An	Engineeri	ng Pers	pective", 7 th ec	lition, Bu	tterworth-
$2 R_{c}$	ennem	ann Publications,	2017. potive Electror	vice Handboo	k" Mc Grau	7 Hill 100	0			
2. Kt 3. oli	versc	heid . "Autosar Co	ompendium. Pa	art 1: Applica	ation & RTE'	² . Create S	, pace In	dependent Pub	lishing Pl	atform, 2015
Refere	ence E	Books:	, 1 (, 010000 5	p uee 11			
1.	Rober	t Bosch, "Automo	otive Hand Boo	ok", 10th edit	tion, Wiley P	ublications	5, 2018			
2.	Kienc	ke, Uwe, Nielsen	& Lars, "Auto	motive Conti	rol Systems f	or Engine,	Drivel	ine and Vehicle	e", Secon	d edition,
	Spring	ger Publication, 20)05.			1.51	• ~	the st		р :
3.	John l	H. Kershaw, James	S D. Haldermai	n, "Automotiv	ve Electrical a	and Electro	onic Sy	stems", 5""Edit	10n, Pears	on Prentice
1	nall, 1	2007 //autosartutorials.c	rom/							
5	https:/	//www.udemy.cor	n/course/learn-	autosar-from	-scratch/					

TY B Tech (Mechanical Engineering), PCCoE Pune

Text Books:

- 1. Arduino-Based Embedded Systems : By Rajesh Singh, Anita Gehlot, Bhupendra Singh, and Sushabhan Choudhury.
- 2. Arduino Made Simple by Ashwin Pajankar

Reference Books:

- 1. Exploring Arduino: Tools and Techniques for Engineering Wizardry 1st Edition, by <u>Jeremy Blu</u>m , SBN-13: 978-1118549360, ISBN-10: 1118549368
- 2. https://www.arduino.cc/en/Tutorial/HomePage

Program:	B. Tech. (E&TC))			Semester:	Semester: VI						
Course:	Communication	Protocols for e	e-Vehicle (OEC	C-IV)	Code: BE	Г6604						
	Teaching	Scheme			Evaluatio	on Scheme						
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total					
3	-	3	3	20	30	50	100					
Prior know	vledge of											
a. Au b. Co	itomotive Electronics											
are	e essential											
Course Ob	jectives:											
1. To	1. To introduce the students to basics of Automotive Communication Technologies. 2. To learn the basics of EVs, including EV Components, architecture and energy management											
2. To	2. To learn the basics of EVs, including EV Components, architecture and energy management.											
4. To	evaluate the impact of	f EVs in Conne	ected Mobility a	and Autonomou	ıs Mobility							
Course Ou	itcomes:											
On complet	tion of the course, lear	ner will be able	to-									
1. III	ustrate the EV Compo-	nents and contr	olling units.	& their need i	n e-Mobility bi	isiness						
3. Ur	iderstand the fundame	ntals of EVSE	Communication	l a then need h		15111035						
4. Re	ealize with Charging C	Communication	in EVs									
5. Ap	pply the knowledge of	e-Mobility thro	ough Indian Roa	admap Perspect	tive to various	applications						
			Detailed Syl	labus:								
Unit			Descriptio	n			Duration (H)					
	EV Basics											
1	Overview of EVs	and challenge	es, architecture	e of EVs, EV	/ market and	promotion, wer_transfer	6					
	(conductive and wir	eless), wireless	power transfer		neurunn or po	wei transfer						
	EV Components		-									
2	Battery Managemen	nt System (BM	IS), BLDC Mo	otors, Inverter	Unit, Powertra	in Unit and	6					
	Couplers with Chas	s1s, PDU (Powe ters	er Distribution	Unit), BCM (B	ody Control M	lodule, ECU						
	EV Communicatio	n protocols										
2	Communication Sys	stem in EV (CA	AN and LIN), V	V2V, V2G and	its application	is in power	6					
5	system, power savi	ng & coordina	ated charging,	layout of pow	er converters,	E-mobility	0					
	business, electrificat	tion challenges										
	Basics of EVSE EV	SE Power Mo	t (EVSE) dule selection a	nd technical sn	ecification Sel	ection of						
4	EVSE Communicat	ion Protocol (P	LC / Ethernet /	Modbus/ CAN	Module), com	munication	6					
	gateway, Specificati	ion of open cha	rge point protoc	col.								
	Connectors and Ch	narging Comm	unication	de Calentina e								
5	types of E v chargin	and application	is. Selection of	AC and DC ch	arger type.	ommon	6					
	Communication Inte	erface between	charger and CM	4S.	<i>8 9 1 1</i>							
	e-Mobility	a										
6	CCS (Combined Autonomous Mobil	Charging Syst lity e-Mobility	tem), CHAdeN Indian Roadi	MO, Tesla, C man Perspectiv	Connected Mo	of EVs in	6					
	smart grid, social di	mensions of EV	/s.	nup i enspectiv	e, integration							
						Total	36					
Text Books	S:											
1.	William B. Ribbens	, "Understandir	ng Automotive	Electronics", E	lseiver,2012							
2.	Jack Erjavec, Jeff A	rias, "Alternate	Fuel Technolo	gy-Electric, Hy	/brid & Fuel C	ell Vehicles", (Cengage,					
	2012											

Reference Books:

- 1. Wireless Communications Principles and Practice; by Theodore S Rappaport, Pearson Education Pte. Ltd., Delhi
- 2. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2010.
- 3. Hybrid Electric Vehicle System Modeling and Control Wei Liu, General Motors, USA, John Wiley & Sons, Inc., 2017.
- 4. Hybrid Electric Vehicles Teresa Donateo, Published by ExLi4EvA, 2017
- 5. Electric and Hybrid Vehicles Power Sources, Models, Sustainability, Infrastructure and the Market Gianfranco Pistoia Consultant, Rome, Italy, Elsevier Publications, 2017.
- 6. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, Mehrdad EhsaniYimin Gao Stefano Longo Kambiz M. Ebrahimi, Taylor & Francis Group, LLC, 2018.
- 7. Tom Denton, "Automotive Electricals / Electronics System and Components", 3rd Edition, 2004.

NPTEL Online Courses / MOOCs

- NPTELcourse on Fundamentals of Electric vehicles: Technology & Economics, IIT Madras, Prof. Ashok Jhunjhunwala Prof. Prabhjot Kaur Prof. Kaushal Kumar Jha Prof. L Kannan <u>https://nptel.ac.in/courses/108106170</u>
- 2. NPTEL course onElectric Vehicles Part 1, IIT Delhi, Prof. Amit Jain https://nptel.ac.in/courses/108102121
- 3. NPTEL Archives on Electricvehicles and renewable energy, IIT Madras https://archive.nptel.ac.in/courses/108/106/108106182/
- 4. Electric Vehicles Comprehensive Course, Udemy.com https://www.udemy.com/course/electric-vehicles-comprehensive-course/

Progra	am: B. Tech. (IT)		Semester : VI									
Cours	e: Web Technolo	gy (OEC-III)	Code: BIT6601									
	Teachi	ing Scheme			Evaluat	on Scheme	ī					
Lect	ure Practical	Tutorial	Credit	CE	MTE	ETE	Total					
3 3 20 30							100					
Prior	knowledge of:	-										
a. h	Computer Fundamenta	ils										
υ.	are essential.	Iguage										
Cours	e Objectives:											
1. 2. 3. 4.	To write a valid stand hyperlinks, images, 1 To use CSS to imple positioning of elemen To demonstrate techn To learn the concepts functions, and closur	dards-conformant I ists, tables, and for ment a variety of p nts niques for improvir s commonly used in es.	HTML document ms resentation effec ng the accessibili n dynamic langu	t involving a ts in HTML ty of an HTI age program	and XML docu and tocu ML document ming, such as i	ent types, including ments, including ntrospection, hig	ling g explicit her-order					
Cours	e Outcomes:	students will be ab	le to:									
Alter I	Develop Static and E	Students will be ab	ising technologie	s like HTM	L. CSS. Bootstr	an.						
2.	Test and debug Javas	Script web applicat	ions.		_,,	- F -						
3.	Develop a mobile we	bsite using JQuery	Mobile.									
4.	Develop web applica	tions with Front E	nd & Back End	l'echnologies	8.							
5. 6.	Build Responsive W	eb application usin	nguages. 9 Angular Types	script								
0.	Build Responsive W	ee appreation asin		, enpe								
			Detailed Sylla	adus:			Duration					
Unit			Description				(H)					
	HTML: Getting start	ed with HTML,	Why HTML, Ta	ags and Ele	ments, Attribut	es, Properties,						
	Headings list, Links,	Tables, Images,	HTML Form, M	Iedia (Audio	o, Video), Sen	antic HTML5						
1.	CSS: Types of CSS	. How to use CSS	S. Properties. Cl	asses. Child	-Class (Nested	CSS). Colors.	6					
	Text, Background, B	order, Margin, Pa	dding, Positioni	ng (flex, gri	id, inline, bloc	$\Delta \Delta \Delta D $						
	Transition.	_	Transition									
•	BOOTSTRAP: , CSS	BOOTSTRAP: , CSS over Bootstrap, How to Use Bootstrap, Bootstrap Grid System, Bootstrap										
2.	Loopononitio Loototroi	over Bootstrap, He	ow to Use Boots	trap, Bootstr	ap Grid System	, Bootstrap	(
	a Cross Platform W3	over Bootstrap, Ho Classes, Bootstra C: What is W3C	ow to Use Boots p Components (i How W3C handl	trap, Bootstr .e., Button, T	ap Grid System Fable, List, etc. Web Technolo	, Bootstrap ,Bootstrap as	6					
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Text Books:

- 1. Ralph Moseley & M. T. Savaliya, "Developing Web Applications", Wiley publications, ISBN 13: 978812653867
- 2. Jeremy McPeak& Paul Wilton," Beginning JavaScript", Wrox Publication, ISBN-13: 978-0470525937

Reference Books:

- 1. Steven Holzner,"HTML Black Book", Dremtech press.
- 2. Web Technologies, Black Book, Dreamtech Press
- 3. Web Applications: Concepts and Real World Design, Knuckles, Wiley-India
- 4. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel Pearson.

Progra	m:	B. Tech. (IT)		Semester : VI							
Course	e :	Mobile Applic	ation Developme	Code : BIT6602							
		Teaching	g Scheme		Evaluation Scheme						
Lec	ture	Practical	Tutorial	Credit	IE	MTE	ETE	Total			
	3	-	-	3	20	30	50	100			
Prior k	or knowledge of :										
a.	Java pr	ogramming langu	uage is essential.								
	e Objecti	ves:	number in davalo	nmant anviranma	nt						
1.	To develop problem solving skills with mobile applications										
3.	3. To develop competency for the design, coding and debugging for mobile app development.										
4.	To buil	d the programmi	ng skills using 'A	ndroid Programm	ing Langua	ge.	L				
Course	e Outcon	nes:									
After le	earning th	ne course, the stud	dents will be able	to:	_						
1.	Explor	e the android env	ironment for mob	ile application de	velopment.						
2.	Apply	event nandling sk	alls for problem's	orving in real life	application	s. A one for solvi	ng problems				
3. 4.	Identif	v file handling me	echanism in andro	oid environment.	appropria	e one for solvi	ing problems.				
5.	Develo	p database and da	atabase control pr	ogramming logic	al construct	s of Android la	anguage for proble	em solving.			
6.	Descril	be significant and	lroid services and	their usage in so	lving real li	fe problems.		-			
				Detailed Syllab	ous:			1			
Unit				Description				Duration			
	Unit 1	Introduction to A	ndroid Operating	System				(H)			
	Androi	d OS design and	l Features – Andr	oid development	framework	SDK feature	s Installing and				
	running applications on Android Studio. Creating AVDs. Types of Android applications Rest										
1.	practices in Android programming, Android tools.										
	Android application components - Android Manifest file, Externalizing resources like values,										
	themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration										
	Unit 2	Android Usor Int	cation, Activities,	Activity lifecycl	e,						
	Measu	rements – Device	e and nixel densit	v independent me	easuring uni	ts Lavouts –	Linear Relative				
	Grid an	d Table Layouts	etc.		usunng un	is, Eujouis					
	User In	terface (UI) Con	nponents – Editab	le and non-edital	ole TextVie	ws, Buttons, R	adio and Toggle				
2.	Button	s, Checkboxes, S	pinners, Dialog ar	nd pickers etc				6			
	Event Handling – Handling clicks or changes of various UI components.Fragments – Creating										
	tragments, Litecycle of tragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions interfacing between fragments and Activities										
	and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities.										
	Unit-3	Intents and Broad	dcasts								
	Intent -	- Using intents to	a launch Activitie	s, Explicitly start	ing new Ac	tivity, Implicit	Intents, Passing				
_	data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to										
3.	send SMS										
	Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding										
	and using intents received within an Activity Notifications – Creating and Displaying notifications. Displaying Toasts										
	Unit-4	Persistent Storag	e		, , , , , , , , , , , , , , , , , , , ,						
4	Files -	Using application	n specific folders	and files, creating	g files, read	ing data from	iles, listing	6			
	conten	s of a directory S	Shared Preference	s – Creating share	ed preferenc	es, saving and	retrieving data	U			
	using S	hared Preference	2								
	Unit-5	Jnit-5 Database									
5.	retrievi	ntroduction to SQLite database, creating and opening a database, creating tables, inserting									
	retrieve and update)										
	Unit 6	Android services	1								
6.	Introdu	ction of android	services and its lit	fecycle. Location	Services,T	pes of Service	es, Best	6			
	practic	es- Performance,	Testing, Privacy,	Security etc. Dep	loyment of	Application.					
							Total	36			

Text Books:

- 1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012
- 2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013 **Reference Books:**
 - Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013 1.
 - Android Application Development Black Book Pradeep Kothari, KLSI, Dreamtech Press. 2.

Reference URL:

- 1. <u>https://www.javatpoint.com/android-service-tutorial</u>
- 2. https://developer.android.com/guide/components/services

Program	m:	B.Tech. (All	branches)		Semester: VI						
Course	:	Project Man	nagement (HSN	AC-VI)	Code: BHM6114						
		Teaching	Scheme			Evaluation	Scheme				
Lec	ture	Practical	Tutorial	Credit	IE	MTE	ETE	Total			
2	2	-	-	2	20	-	30	50			
Prior knowledge of - None											
Course	Objectiv	es:	Idanta								
	Underst	at enabling stu and the import	ance and proce	dure of project	management						
1.	Know t	he kev compo	onents of project	ct managemen	t including pro	iect integration.	project scope n	nanagement.			
	project time and cost management.										
3.	Recogni	ze issues in a 1	realistic project	scenario.							
Course	Outcom	es:									
After le	arning the	e course, the st	udents will be a	able to							
1.	Develor	and the conce	pt and importa-	of project mar	nanagement.						
2. 3.	Plan and	d execut e busi	ness ideas in th	e form of a pro	viect						
4.	Monito	r and manage	risk in project i	management.	J						
Detaile	d Syllabu										
Unit				Descript	tion			Duration (H)			
1.	Introduction to Project Management: Concepts and Characteristics of Project, Importance of Project Management, Types of Projects, Understanding the Phases in the Lifecycle of Projects and their Significance, Different types of Projects: Industrial, Telecommunication, Research and more, Project Selection Methods							6			
2.	Clarify Definin Project Budgeti	ing the Proje g the "Why" a Planning and ng Techniques	ect Scope, Incl and "What", O Communication s.	uding Tasks rganizational I ns Managemen	and Costs: - F nfluences, Proj at, Work Breako	Forms of Project ect Cost and Tim lown Structure (V	Organization, ne Estimation, WBS), Capital	6			
3.	Planning and Execution of Project: Developing a Mission, Vision, Goals, importance of adequate Project Planning, Network Scheduling: Critical Path Method, Project Evaluation; Review Technique – Planning and Scheduling of Activity Networks -Assumptions in PERT Modeling – Time-cost Trade-offs – Linear Programming and Network Flow Formulations – PERT/CPM, HRM issues in project management, Quality Circle, Failures of Project Core Study: Failure of Enror Project (Pafinerias in Maharashta)							6			
4.	Project Conflict Technic	Monitoring Management ues and Tools	and Risk Man , Risk Matrix A Used in Projec	agement: Bui Analysis, Strate t Management	lding a Suitable gies to Manage	e Monitoring; Co e Risks, an Overv	ontrol System, iew of Useful	6			
							Total	24			
Text Bo	ooks: Josenh F	Jeagney. Fund	amentals of Pro	piect Managem	ent. American N	Management Asso	ciation, 2012				
Referen	ice Book	<u>.</u>		Jeeenagen							
1.	Erik W	Larson, Cliffor	rd Gray, Rohit J	loshi; Project N	/lanagement-Th	e managerial proc	cess, MacGraw	Hill			
	Publicat	ion, 2021	-	·	-						
2.	Punmia,	Project Mana	gement with CF	PM /PERT, Laz	xmi Publication	s, 2001					
3.	Robert I	L Kimmons, Pi	roject Managem	nent Basics, Ta	ylor & Francis	Ltd, 2018					
4.	N. D. V	ohra, Quantitat	tive Techniques	in Manageme	nt, Tata McGrav	w Hill Book Co. I	Ltd.				
e-sourc	es:										
1. 2.	https://w https://w	ww.youtube.c	com/watch?v=R com/watch?v=W	jOA7AxOVj8 V2EdffbwgcM	<u>&list=PLLy_2il</u> &list=PL3MO6	UCG87AUusGVc 7NH2XxIRneBX	2wsXvRZ4zlbt A3yA1RacZQI	o <mark>KUu</mark> uX7Y1			
3.	https://w	ww.youtube.c	com/watch?v=R	QNZWCl6eX	l&list=PLBd76	GK9sWTwVXm9	FIVHOTXXbC	Y2vZR8z			

Progra	am: B Tech (All Branches) Semester: VI											
Course	:	Financial M	anagement (H	ISMC-VI)	Code: BHM6115							
		Teaching	Scheme		Evaluation Scheme							
Lect	ure	Practical	Tutorial	Credit	IE	MTE	ETE	Total				
2		-	-	2	20	-	30	50				
Prior k	Prior knowledge of											
a.	Basic	Financial Liter	acy									
Course	Object	ives:										
I his co	urse ann	is at enabling s	students					:				
1.	10 dev	conital invostr	standing of day	y-to-day working	ig capital decis	ions; and also I	longer-term deal	ing, involving				
2	To im	prove students	' understandin	and faising long	g-term mance.	concept and the	role of finance	in the current				
۷.	compe	titive husiness	scenario	g of the time va	nue of money e	concept and the		in the current				
Course	Outco	nes.	sechario.									
After le	arning t	he course, the	students will b	e able to								
1.	Under	stand the basi	cs of financial	management ar	nd its terms and	concepts						
2.	Under	stand financia	al markets and	the role of finar	icial institution	s						
3.	Analy	se financial sta	tements and re	ad documents a	and books of ac	counts.						
4.	Devel	p knowledge	of capital budg	eting; its alloca	tion, managem	ent and funding	g.					
		x 0	1 0	Detailed	Syllabus:							
Unit				Descript	ion			Duration (H)				
	Intro	duction to Fin	ancial Manag	ement- Concep	t of Business F	inance, Goals	& Objectives					
1.	of the	Firm, Modern	Approaches to	Financial Man	agement, Finar	cial Planning	- Principles	6				
	and St	eps in Financia	al Planning.		-	-	-					
	Finan	cial Markets,	Institutions a	nd instruments	s: Introductions	s to Financial N	/larkets –					
	Nature	e – Functions, I	Financial Instr	uments, Commo	odity Markets,	Sources of fina	ncing -					
2.	Shares	s, Debentures, '	Term Loans, L	ease & Hire, Pu	urchase, Retain	ed Earnings, P	ublic	6				
	Depos	sits, Bonds (Ty	pes, Features &	& Utility), Intro	duction; Bank I	Finance, Trade	Credit &					
	Bills I	Discounting, In	terest Rates									
	Time	Value of Mon	ey: Cash Flow	, Time Line, St	ream of Cash F	low, Annuities	, Perpetuties	-				
3.	Need	and Importance	e of Capital Bu	dgeting, Differ	ent Techniques	of Evaluating	the Project on	6				
	the Ba	isis of Payback	Period, NPV,	IRR, ROI, PPP		1.0						
	Finan	cial Statemen	t Analysis: Re	ading Financial	Statements Pu	rpose and Part	ies involved,					
4.	Finan	of A polyation of	S, Balance Snee	et, Profit and Lo	oss Statement, C	Lash Flow State	ement, Assets,	6				
	10018	of Analysis of	Financial Stat	ements, Compa	rative Statemer	its, Katio analy	\$15					
T 1 D	Ļ						Total	24				
Text Bo	ooks:					11						
1.	Prasan	ina Chandra, Fi	inancial Manag	gement, Tata M	cGraw Hill, 20	11						
Referen	ice Boo	ks:										
1.	Agraw	al M R, Financ	cial Manageme	ent, Garima Pub	lications, Jaipu	ır, 2021						
2.	Khan a	and Jain, Finan	icial Managem	ent, Tata McGr	aw Hill, 2008	T 1		017				
<i>3</i> .	Param	asivan C, Subr	amanian 1, Fii	iancial Manage	ment, New Age	e international	(L) Publishers, 2	2017				
4. 5	K. M.S.	onvastava, Fina	Monogeneration	R Doligy De-	ruon Education	Dalh 2015						
). 2	v anno	Protik Arore	a mit Einende	a rolley, Pea	Van Education	, Dem,2015	0					
0.		T TAUK, ATOTA A	min, r manela	i management,	vayu Educatio	in or muta, 202	U					
e-sourc	cs. https:/	www.voutube	com/watch?y-	-ToF2XviauIII	Wist-PIIv ?	HICG87CXV	B6fPex1SOLov	zzD5Wi				
2	https://	/www.youtube	com/watch?v-	= CCOwz Gwo	$\frac{1}{5} \frac{1}{5} \frac{1}$							
3.	https://	/www.youtube	.com/watch?v=	=OT5RdoJAkh	 Y&list=PLPiSc	ITyvDeUTeA	OGhip_ubiN3v8	logT13				

Program:		B. Tech. (A	All Programm	es)	Semester: VI					
Course:		Entrepreneu	rship Developr	nent (HSMO	C-VI)	Code: BHM6116				
		Teaching So	cheme			Evaluation	Scheme			
Lec	ture	Practical	Tutorial	Credit	IE	MTE	ЕТЕ	Total		
	2	-	-	2	20	_	30	50		
Prior k	nowledge	of : Nil	<u> </u>	-	20		50	50		
Course	Objective	es:								
This cou	urse aims a	at enabling stud	lents,							
1.	To under	stand the role a	nd importance	of entreprene	urship for econo	omic developme	nt .			
2.	To seek	necessary kno	wledge and de	evelop skills	required for or	ganizing and c	arrying out en	trepreneurial		
3	To deve	lon the ability t	o analyse and u	nderstand bu	siness situations	in which entrer	reneurs act			
Course		s:	s unuryse unu u		siness situations		fieldens det.			
After lea	arning the	course, the stud	dents will be ab	le to						
1.	Identify	entrepreneursh	ip as an opportu	inity						
2.	Identify	the business op	portunities that	suit aspirant	entrepreneurs					
4.	Use the s	support systems	to zero down o	on the busines	ss ideas					
5.	Develop	comprehensive	business plans.	Detailed 6						
-				Detailed S	oynabus:			Duration		
Unit				Descripti	ion			(H)		
	Concep	t and Scope:	Meaning, Chal	lenges and M	Aisconceptions	Related to Entr	repreneurship	(/		
	with Inc	lian Context, N	AcClelland's N	eed Achieve	ment Theory, E	ntrepreneurship	as a Career,			
1.	Traits	of Successful	Entrepreneur	, Types of	f Entrepreneur	(proprietary,	partnership,	6		
	collaboration etc), Entrepreneur v/s Intrapreneur, Factors Affecting Entrepreneurship, Types of									
	Enterpri	ses and their Fe	atures: Manufa	cturing, Serv	ice and Trading					
	Entreni	eneurial Onno	rtunities and l	Process Sele	rtion: Concept of	of Business Opr	ortunity			
	How to	Generate Busi	ness Ideas? Ide	entification of	of Ideal and Via	able Business C	Opportunities,			
2	Challen	ges in the Sele	ction of Busin	ess Opportu	nities, Business	Opportunities	Identification	6		
2.	Process,	Required Lice	nses, Approvals	s and Experti	se, Business Val	lue Chain, Diffe	erent Sections	U		
	of the I	Business Value	Chain for Po	tential Oppo	rtunities, Under	standing Produ	ct Costs and			
	D peration	ons Costs; Lega	Aspects.	ising Conita	1 Vantura Car	vital Angol In	vastors Saad			
	Funding	Role of Go	vernment in	Promoting	n, venture Cap Entrepreneurshir	nial, Aliger III o in India St	art-up India			
	Atmanirbhar Bharat. Make in India. Assistance to an Entrepreneur Industrial park Special									
3.	Economic Zone, MSME Act, MSME Policy in India, Financial Assistance to MSME, Various							6		
	Government Schemes - PMEGP, CGTMSE, PMKVY, Mudra Loan, Incubation, Role of									
	Incubati	on Centers, Sup	oport from Incu	bation Center	rs					
	Busines	s Plan: Busin	ess Plan, Cont	tents of Bus	iness Plan: Ex	ecutive Summa	ry, Business			
4.	Concept, Business Strategy, Management Summary, Marketing Plan, Operations Plan,							6		
	Rusiness Plans Fail?									
							T T T	24		
							1 otal	24		
Text Bo	ooks:				_					
1.	C. B. Gup	ta and N. P. Sri	nivasan, Entrep	oreneurial De	velopment, Sulta	an Chand & Sor	ns, New Delhi,	2008		
Referen	ice Books	: Entre la	del Dece 1	ut Dura to D						
	Dr. Kadh	ia, Entrepreneui		in, Prasana P	uonsners, Chenr	1a1, 2007.	00 <i>5</i>			
2.	S.S.Khar	ika, Entreprene	uriai Developm	ent, Sultan C	nanu & Co., Lto	i., New Delhi 20	JUD 17			
3.	Stevenso	n, H. Perspectr	ve on entreprene	eursnip. Bost	on: Harvard Bus	siness Press, 200	JI			
e-sourc	es: https://w	ww.entrenreng	ir com/							
1. 2	http://det	gov in/scientif	ic_programme/*	_d_tdb htm						
2. 2	https://usi	vw voutube co	m/	<u>-u-iu0.111111</u>						
э.	https://www.youtube.com/									

D		• •				G 4 V	T				
Program:	B. Tech. (Mecha	3. Tech. (Mechanical) Semester : VI									
Course :	Computational Fluid Dynamics (PFC-IV) Code : BME6										
	Teaching Sch	eme/week	Γ		Evaluatio	on Scheme					
Lecture	Practical	Credit	Hours	IE	MTE	ETE	Total				
	2 2										
Prior knowle	Prior knowledge of:										
a. Funda	mental of Thermal	Engineering, F	iuid Mechanic	is and Heat Π	TATIA etc. is re	nematics.					
	s on experience on e			ike CAIVID, C		commended.					
1. To cre	eate an awareness o	f CFD among s	students								
2. Studer	nts should be able t	o model fluid /	heat transfer p	problems and	apply fundamer	ntal conservatio	n principles				
3. To pre	epare the students for	or further gradu	late studies inv	volving CFD a	analysis and its	applications					
4. To pro	epare the students for	or career in ind	ustry in CAE 1	using software	e tools.						
Outcomes:	should be able to:										
1. Use su	uitable modern tool	s to formulate t	the problem								
2. Creat	e high quality grids	and interprete	the correctnes	s of numerica	l results with pl	nysics.					
3. Analy	ze the model fluid	flow and heat t	ransfer proble	ms and apply	relevant bound	ary conditions.					
4. Apply	the various numer	ical techniques	for approximation	ate results.							
5. Evalu	ate and Solve flow	v problems an	d heat transfer	r by analyzin	g the results of	otained from co	omputational				
metho	od.		Detailed Se	llabua							
			Detailed Sy	nabus:			Duration				
Unit			Descript	it Description							
	Introduction to Computational fluid dynamics:										
1 I	ntroduction to Co	mputational f	uid dynamics		COED :		()				
1	 Mat is Composition CFD analysis r 	mputational fl utational Fluid	uid dynamics Dynamics (C	FD)? Signific	cance of CFD i	n the industry.	()				
1	 ntroduction to Co What is Comp CFD analysis p Introduction to 	mputational fl utational Fluid process: Prepro any suitable so	luid dynamics Dynamics (C cessing, Solve oftware tool fo	: FD)? Signific r and Post pro r CFD analysi	cance of CFD i ocessing. is.	n the industry.	4				
1	 ntroduction to Co What is Comp CFD analysis p Introduction to Introduction to 	mputational fl utational Fluid rocess: Prepro any suitable so Boundary con	luid dynamics Dynamics (C cessing, Solve oftware tool fo ditions and Ini	ED)? Signific r and Post pro r CFD analysi tial value con	cance of CFD i cessing. is. ditions.	n the industry.	4				
1	 ntroduction to Co What is Comp CFD analysis p Introduction to Introduction to Brief overview 	mputational flutational flutational Fluid process: Prepro any suitable so Boundary con of Navier-Stol	uid dynamics Dynamics (C cessing, Solve oftware tool fo ditions and Ini kes equation	FD)? Signific r and Post pro r CFD analysi tial value con	cance of CFD i ocessing. is. ditions.	n the industry.	4				
1	ntroduction to Co • What is Comp CFD analysis p • Introduction to • Introduction to • Brief overview • Concept of Fin • Overview of th	mputational fl utational Fluid process: Prepro any suitable so Boundary con of Navier-Stol ite Difference	luid dynamics Dynamics (C cessing, Solve oftware tool fo ditions and Ini kes equation Method (FDM	FD)? Signific r and Post pro r CFD analysi tial value con) and Finite V	cance of CFD i ocessing. is. ditions. Volume Method	n the industry. (FVM)	4				
1 I 2	 ntroduction to Co What is Comp CFD analysis p Introduction to Introduction to Brief overview Concept of Fin Overview of the angle of the second secon	mputational fluid orocess: Prepro any suitable so Boundary con of Navier-Stol ite Difference in a ANSYS soft ction Ansys	luid dynamics Dynamics (C cessing, Solver oftware tool fo ditions and Ini kes equation <u>Method (FDM</u> ware tool Workbench,	FD)? Signific r and Post pro r CFD analysi tial value con) and Finite V Geometry, N	cance of CFD i ocessing. is. ditions. <u>'olume Method</u> feshing, Fluen	n the industry. (FVM) tt solver,	4				
1 I 2	 ntroduction to Co What is Comp CFD analysis p Introduction to Introduction to Brief overview Concept of Fin Overview of th a) Introdu Probler 	mputational fl utational Fluid process: Prepro any suitable so Boundary con of Navier-Stol ite Difference 1 he ANSYS soft ction Ansys n Set up, Post-	luid dynamics Dynamics (C cessing, Solve oftware tool fo ditions and Ini kes equation <u>Method (FDM</u> ware tool Workbench, processing mo	FD)? Signific r and Post pro r CFD analysi tial value con) and Finite V Geometry, M dule.	cance of CFD i ocessing. is. ditions. <u>'olume Method</u> Meshing, Fluen	n the industry. (FVM) t solver,	4				
1 I 2	 ntroduction to Co What is Comp CFD analysis p Introduction to Introduction to Brief overview Concept of Fin Overview of th a) Introdu Probler b) Modeli Flow M 	mputational fluid rocess: Prepro any suitable so Boundary con of Navier-Stol ite Difference i the ANSYS soft ction Ansys n Set up, Post- ng: Turbulenc Iodeling	luid dynamics Dynamics (C cessing, Solver oftware tool fo ditions and Ini kes equation <u>Method (FDM</u> ware tool Workbench, processing mo e modeling,	FD)? Signific r and Post pro r CFD analysi tial value con) and Finite V Geometry, M dule. Heat Transfe	cance of CFD i ocessing. is. ditions. <u>Yolume Method</u> Meshing, Fluen er Modeling,	n the industry. (FVM) tt solver, Transient	4				
1 I 2	ntroduction to Co • What is Comp CFD analysis p • Introduction to • Introduction to • Brief overview • Concept of Fin • Overview of th a) Introdu Probler b) Modeli Flow M • Discretization:	mputational fluid rocess: Prepro any suitable so Boundary con of Navier-Stol ite Difference in the ANSYS soft ction Ansys n Set up, Post- ng: Turbulenc Iodeling 1D, 2D and 3	luid dynamics Dynamics (C cessing, Solve oftware tool fo ditions and Ini kes equation <u>Method (FDM</u> ware tool Workbench, processing mo e modeling, 3D element M	FD)? Signific r and Post pro r CFD analysi tial value con) and Finite V Geometry, M dule. Heat Transfe	cance of CFD i ocessing. is. ditions. Volume Method Meshing, Fluen er Modeling, of Symmetry, M	n the industry. (FVM) tt solver, Transient Mesh quality.	4				
1 I 2 3	 ntroduction to Co What is Comp CFD analysis p Introduction to Introduction to Brief overview Concept of Fin Overview of th a) Introdu Probler b) Modeli Flow M Discretization: Mesh independent 	mputational fluid process: Prepro any suitable so Boundary con of Navier-Stol ite Difference f the ANSYS soft ction Ansys n Set up, Post- ng: Turbulenc Iodeling 1D, 2D and 3 dent test.	luid dynamics Dynamics (C cessing, Solver oftware tool fo ditions and Ini kes equation <u>Method (FDM</u> ware tool Workbench, processing mo e modeling, 3D element M	FD)? Signific r and Post pro r CFD analysi tial value con) and Finite V Geometry, M dule. Heat Transfe	cance of CFD i ocessing. is. ditions. <u>Yolume Method</u> Meshing, Fluen er Modeling, of Symmetry, N	n the industry. (FVM) tt solver, Transient Mesh quality,	4				
1 I 2 3	ntroduction to Co • What is Comp CFD analysis p • Introduction to • Introduction to • Brief overview • Concept of Fin • Overview of th a) Introdu Probler b) Modeli Flow M • Discretization: Mesh independ Case Study:	mputational fluid orocess: Prepro any suitable so Boundary con of Navier-Stol ite Difference 1 he ANSYS soft ction Ansys n Set up, Post- ng: Turbulenc Iodeling 1D, 2D and 3 dent test.	luid dynamics Dynamics (C cessing, Solve oftware tool fo ditions and Ini kes equation Method (FDM Workbench, processing mo e modeling, 3D element M	FD)? Signific r and Post pro r CFD analysi tial value con) and Finite V Geometry, M dule. Heat Transfe deshing, Use of	cance of CFD i ocessing. is. ditions. <u>'olume Method</u> Meshing, Fluen er Modeling, of Symmetry, N	n the industry. (FVM) It solver, Transient Mesh quality,	4 4 4				
1 I 2 3	ntroduction to Co • What is Comp CFD analysis p • Introduction to • Introduction to • Brief overview • Concept of Fin • Overview of th a) Introdu Probler b) Modeli Flow M • Discretization: Mesh independ Case Study: a) Interna step	mputational fluid process: Prepro any suitable so Boundary con of Navier-Stol ite Difference in the ANSYS soft ction Ansys n Set up, Post- ng: Turbulenc Iodeling 1D, 2D and 3 dent test.	luid dynamics Dynamics (C cessing, Solve oftware tool fo ditions and Ini kes equation Method (FDM ware tool Workbench, processing mo e modeling, 3D element M hrough pipe,	FD)? Signific r and Post pro r CFD analysi tial value con) and Finite V Geometry, M dule. Heat Transfe leshing, Use o Forward facin	cance of CFD i ocessing. is. ditions. <u>Yolume Method</u> Meshing, Fluen er Modeling, of Symmetry, M ng step or Bac	n the industry. (FVM) tt solver, Transient Mesh quality, kward facing	4				
1 I 2 3	ntroduction to Co • What is Comp CFD analysis p • Introduction to • Introduction to • Brief overview • Concept of Fin • Overview of th a) Introdu Probler b) Modeli Flow M • Discretization: Mesh independ Case Study: a) Interna step b) Externa	mputational fluid process: Prepro any suitable so Boundary con of Navier-Stol ite Difference 1 he ANSYS soft ction Ansys n Set up, Post- ng: Turbulenc Iodeling 1D, 2D and 3 dent test.	luid dynamics Dynamics (C cessing, Solve oftware tool fo ditions and Ini kes equation <u>Method (FDM</u> ware tool Workbench, processing mo e modeling, 3D element M hrough pipe, ver Circular C	FD)? Signific r and Post pro r CFD analysi tial value con) and Finite V Geometry, M dule. Heat Transfe deshing, Use o Forward facin ylinder	cance of CFD i ocessing. is. ditions. <u>'olume Method</u> Meshing, Fluen er Modeling, of Symmetry, M ng step or Bac	n the industry. (FVM) tt solver, Transient Mesh quality, kward facing	4				
1 I 2 3 4	ntroduction to Co • What is Comp CFD analysis p • Introduction to • Introduction to • Brief overview • Concept of Fin • Overview of th a) Introdu Probler b) Modeli Flow M • Discretization: Mesh independ Case Study: a) Interna step b) Externa Aerodynamic anal	mputational fluid process: Prepro any suitable so Boundary con of Navier-Stol ite Difference in the ANSYS soft ction Ansys n Set up, Post- ng: Turbulenc Iodeling 1D, 2D and 3 dent test.	uid dynamics Dynamics (C cessing, Solve oftware tool fo ditions and Ini kes equation Method (FDM ware tool Workbench, processing mo e modeling, 3D element M hrough pipe, <u>ver Circular C</u> imensional Ah	FD)? Signific r and Post pro r CFD analysi tial value con) and Finite V Geometry, M dule. Heat Transfe leshing, Use o Forward facin ylinder med Body	cance of CFD i ocessing. is. ditions. <u>Yolume Method</u> Meshing, Fluen er Modeling, of Symmetry, M ng step or Bac	n the industry. (FVM) tt solver, Transient Mesh quality, kward facing	4 4 4 4 4				
1 I 2 3 4 5	ntroduction to Co • What is Comp CFD analysis p • Introduction to • Introduction to • Brief overview • Concept of Fin • Overview of th a) Introdu Probler b) Modeli Flow M • Discretization: Mesh independ Case Study: a) Interna step b) Externa Aerodynamic anal Solving a 2-Dime	mputational fluid process: Prepro any suitable so Boundary con of Navier-Stol ite Difference in the ANSYS soft ction Ansys in Set up, Post- ing: Turbulence Iodeling 1D, 2D and 3 dent test. I flow: Flow t al flow: Flow o hysis of an 2-D ensional Conju	uid dynamics Dynamics (C cessing, Solve oftware tool fo ditions and Ini kes equation <u>Method (FDM</u> ware tool Workbench, processing mo e modeling, 3D element M hrough pipe, <u>ver Circular C</u> imensional Ah gate Heat Tra	FD)? Signific r and Post pro r CFD analysi tial value con) and Finite V Geometry, M dule. Heat Transfe leshing, Use o Forward facin ylinder med Body nsfer Problem	cance of CFD i ocessing. is. ditions. <u>'olume Method</u> Meshing, Fluen er Modeling, of Symmetry, M ng step or Bac	n the industry. (FVM) It solver, Transient Mesh quality, kward facing	4 4 4 4 4 4 4 4 4 4 4				
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Text Books:

1. A. Sharma, Introduction to Computational Fluid Dynamics, Athena Academic and John Wiley & Sons, UK, 2017

2. J. D. Anderson, Computational Fluid Dynamics, McGraw Hill, 1995

3. T. J. Chung, Computational Fluid Dynamics, Cambridge University Press, 2010.

TY B Tech (Mechanical Engineering), PCCoE Pune

Program	m:	B. Tech. (All Bra	er : VI					
Course	:	Proficiency Development Training-II (MC-II) Code : BHM5918						
		Teaching Scheme			Eval	uation Schem	e	
Lec	ture	Practical	Tutorial	Credit	IE	MTE	ЕТЕ	Total
3	3	-	-	-	-	-	-	-
Course 1. 2. 3.	Objective This cou To enhar To impro	es: rse aims at enabling nce the logical reaso ove the overall profe	g the students oning skills of the stu essional developmer	udents and im t of students.	prove the pro	blem-solving a	bilities.	
Course After lea 1. 2. 3.	Outcome arning the Having a Having c Having i	es: Students will be course, the student adaptive thinking ar critical thinking and nterest in lifelong le	able to s will be: id adaptability throu innovative skills earning & developin	gh various Qu g verbal comp	antitative abi	lity concepts. he students.		
Unit			Detan Deso	cription				Duration (H)
1.	Modern Maths Profit loss, Ratio & Proportion, LCM & HCF, Time speed and Distance, Average, Mean, mode, median, permutation & combination, Probability, Pipe & systems, Mixture validation, Allegations and Mixtures. Simple Interest and Compound Interest							6
2.	Algebra Linear equations, Quadratic equations, Triplets. Geometry Triangles Polygons (questions on Area Perimeter)							6
3.	Mensuration Cube cuboids cone cylinder sphere (questions on volume surface Area) Trigonometry Number System							6
4.	Statistics. Logical Reasoning Clocks and Calendar, Direction sense, Family tree, Syllogism, Seating arrangement, Team formation, Coding and Decoding, Number Series and Letter Series, Ranking and Arrangements, Game-Based Aptitude.							6
5.	Data In Data ch	nterpretation arts, Data tables, B	ar, Pie, Line graphs,	Venn diagram	n.			6
6.	Verbal Ability & Reading Comprehension Subject-Verb Agreement, Articles and Other Determiners, Prepositions, Tenses, Parts of Speech, Active and Passive Voice, Direct and Indirect Speech, Error Spotting and Sentence Correction, Sentence Completion, Synonyms and Antonyms, Reading Comprehension, Para Jumbbas							6
							Total	36
Referen 1. 2. 3. 4.	ce Books Arun Sha ETHNU R S Agg Delhi. Tyra, Qu	arma, Quantitative A arma, Quantitative A S, Aptimithra, 2013 arwal, Quantitative nicker Maths, 2018,	Aptitude, 2016, 7 th E , 1 st Edition, McGrav Aptitude For Comp 5th edition, 2018, B	Edition, McGr w-Hill Educat etitive Examin SC publishin	aw Hill Educa ion Pvt.Ltd. nations, 2017 g company Pv	ation Pvt. Ltd. , 3 rd Edition, S. ^{rt.} Lt.	Chand Pul	blishing,

** Students should get a passing grade if they will clear at least two online aptitude tests and achieve minimum criteria of attendance

Program:	m: B. Tech. (All branches) Semester: VI									
Course :	Constitution of	of India (AUDI	T-III)		Code :BHM9962					
	Teaching	Scheme		Evaluation Scheme						
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total			
1	1 - 1									
Prior know	wledge: Nil									
Course Ol 1. To 2. To 3. To 4. To	 Course Objectives: 1. To enable the student to understand the importance of constitution 2. To identify individual role and ethical responsibility towards nation. 3. To understand human rights and its implications 4. To know about central and state government functionalities in India. 									
Course Ou	itcomes:									
After learn	ing the course, the	tions of the Ind	be able to:	t and get acqui	ainted with know	ledge of Const	itutional			
2. Ide Par 3. Dif 4. Con	 Understand the functions of the Indian government and get acquainted with knowledge of Constitutional Amendments. Identify and explore the basic features, modalities about Indian constitution and assessment of the Parliamentary System in India. Differentiate and relate the functioning of Indian Political system at the Central and State level. Comprehend the fundamental rights and abide the rules of the Indian constitution. 									
			Detailed S	Syllabus:						
Unit			Descri	ption			Duration (H)			
1.	Introduction to Constitution: Meaning of the constitution law and constitutionalism, making of constitution, Salient features and characteristics of the Constitution of India, Preamble, Fundamental Rights, Directive Principles of State Policy, Fundamental Duties and it's legal status. Citizenship									
2.	System of Government- Center & State level and local levelStructure and Function of Central Government, President, Vice President, Prime Minister, Cabinet, Parliament, Supreme Court of India, Judicial Review, Federal structure and distribution of legislative and financial powers between the Union and the States, local3									
3.	Judiciary: Gov States, High Co India.	vernor, Chief I ourts and other S	Minister, Cabi Subordinate Co	net, State Leg ourts,Parliamer	gislature Judicial atary Form of Go	System in overnment in	3			
4.	Constitution F Relations, Pres Functionaries, System in India	unctions: India ident's Rule, (Emergency Pro	n Federal Sys Constitutional ovisions, Asse	tem and it's c Amendments ssment of wo	haracteristics, Co and powers, C orking of the P	enter& State onstitutional arliamentary	3			
						Total	12			
Text Books: 1. Dur edit 2. Cla Cor	 Text Books: 1. Durga Das Basu, —Introduction to the Constitution of India —, Prentice Hall of India, New Delhi,24th edition, 2020, ISBN-109388548868 2. Clarendon Press, Subhash C, Kashyap, —Our Constitution: An Introduction to India's Constitution and constitutional Low NPT. 5th edition: 2014 ISBN 0781107024624 									
Reference E	Books:		. /							
1. Ma 200	civer and Page, - 07, ISBN-100333	–Society: An In 1916166	ntroduction An	alysis —, Laxı	ni Publications, 4	4th edition,	th			
2. PM edit	Bhakshi, —The tion, 2017, ISBN	e constitution of -108131262375	Indial, Univer	sal Law Publis	shing - An impri	nt of Lexis Ne	xis, 14 ¹¹			

Vision and Mission of Mechanical Department

Department Vision

To recognize for an academic excellence through skill development, innovation fine blend with quality work culture

Department Mission

To impart quality education, innovation culture, necessary skill sets and social commitment among the students to build professional carrier by establishing stateof-the-art Mechanical Engineering infrastructure and conducive learning environment.