

(An autonomous institution affiliated to RashtrasantTukadoji Maharaj Nagpur University)

B. Tech. Scheme of Examination & Syllabus 2021-22

MECHANICAL ENGINEERING

Cou	rse Code	Cours	e Name	Th	· ۱	Tu	Pr	Credits		Evaluation			
21	ME701T	Automation	In Production	3		-	-	3	C	A	ESE	Total	
	Cour	se Objectives					C ~-		<u> 3</u>	0	70	100	
To de ability in a apply basic	evelop in the v to analyze simple and to its soluti principles	e engineering students any engineering pro d logical manner an ion a few, well unders	s the blem d to tood 1. Get Bala 2. Rec mac 3. Get 4. Culti Auto 5. Get Tech	Acquainte incing And ognize fur hines and Acquainte ivate Info omated St Acquainte nnology.	ed W d Its ndan d pre ed W ormat corag ed W	Tith A Analy nenta pare ith th ion A e And Tith A	utomati /sis. ls and a CNC leconc About d Retri utomati	tion, Its Typ construction program for ept of CAD Automated eval System red Inspection	onal fea or given //CAM,C Materia m (AGV)	ategies , part. CIM,FMS, al Handl S,AS/RS PP, CAQ	Assembly N.C,CNC a SFC. ing System) Its Analys C, CMM) a	Line and D.N.C ns, is. nd Group	
Unit	Jnit I [8Hrs]												
Autor proce	nation- Def ssing in m	inition, types, reason anufacturing. Automa	s for automating, ited Flow 'Lines-	argumer Methods	nts f of v	or ar workp	nd aga bart tra	ainst autom ansport, Tr	nation. ransfer	Organiza mechani	ation and i isms, Buffe	nformation er storage.	
Analy	sis of flow li	inesGeneral terminolo	gy and analysis, ar	nalysis of	trans	sfer li	nes wi	thout storag	ge ,line	balancin	g.		
Unit	<u> </u>									- ([7Hrs]	
point, part p	Numerical Control Production Systems- Basic concepts, coordinate system and machine motion- Types of NCsystems- Point to point, straight cut and continuous path. Machine control unit and other components, .NC part programming, NC words, methods of part programming APT programming. Direct numerical control. Computer numerical control.												
Unit												[7Hrs]	
CAD/	CAM,FMS,0	CAPP Computer ai	ded manufacturing	g -Manufa	actur	ing p	lannin	g, manufac	cturing o	control;	Computer	integrated	
manu	facturing;	Flexible manufacturing	g systems -Compo	onents, T	ypes	of s	ystems	s, FMS lay	out con	figuratior	n computer	functions,	
data f	iles, system	reports, FMS benefits	S.								.		
Comp	outer aided	process planning: Re	trieval CAPP syst	tems, gen	nerati	ive C	APP s	systems, be	enefits o	of CAPP	. Shop floc	or control.	
Comp	outer Proces	ss Control.		i								[0].[=0.1	
Autor pallet AGVS board storag	nated mate trucks, AG S systems, / I AS/RS , a ge systems	rial handling & storage GVS unit-load carriers AGVS applications. Au automated item retriev , Work in process store	e-Conveyor system Vehicle guidance utomated Storage d al system, deep l age, quantitative a	ns: Autom e & Routi & Retrieva ane AS/R nalysis.	nated ing, al Sy RS -E	l Guio Traffi stem Basic	led Ve c cont -Type comp	hicle Syste rol & safet s :- Unit loa onents & s	ems -Ty ty, Syste ad AS/R special f	pes: - Dr em mana RS , mini features	iverless tra agement, A load AS/I{S of AS/RS,	ins, AGVS nalysis of 5, man on Carousel	
Autor	nated inspe	ection & Group techn	ology: - Automate	ed inspect	tion	princ	iples 8	& methods	- coord	dinate m	easuring m	nachines -	
const Introc produ	ruction, operation to G	eration & benefits; Ma Broup Technology. Gr nalysis; Machine cell c	achine vision -ima oup Technology: lesign -composite	age aquis Part famil pat conce	sition lies, ept, ty	&digi parts /pes	tigation class of cell	n, image p ification & design, ber	coding, nefits of	ng & an Opitz cl group te	alysis, inte assification chnology	rpretation, systems	
		Title	Autho	ors				dition			Publishe	r	
1.	Automatio System &	n, production CIMS	M P, Groover			Thi	rd editi	ion (20	007)	PHI Prer	ntice Hall	·	
2.	CAD/CAN	1	Zimmers & Groo	ver		Fift	h editio	on (20	(800	PIII Pear	son Educat	tion India	
Refe	rence Book	(S											
S.N		Title		Au	thor	s		Edition	1		Publishe	er	
1.	Numeri Manufa	cal Control And Com cturing	puter Aided	Rao, N I K Kundr	K Tiv ra	vari, ⁻	Г <u>1</u> 3	th edition (2	2007)	Tata M	lcGraw-Hill	Education	
2.	Compu	ter Control of Manufac	turing Systems	g Systems Koren 2005 Mcgraw Hill									

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Chairman - BoS	Dean – Academics	Date of Release	Version	2024-23	
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ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR (An autonomous institution affiliated to RashtrasantTukadoji Maharaj Nagpur University)

B. Tech. Scheme of Examination & Syllabus 2021-22

MECHANICAL ENGINEERING

SEVENTH SEMESTER

Course Code	Course Name		Th	Tu	Pr	Credits	Evaluation			
21ME701D	1ME701P Automation In Production			_	2	1	CA	ESE	Total	
ZIWE/UIP			-	-	2	I	25	25	50	
Co	ourse Objectives		Course Outcomes							
To develop in t	he engineering students the	1. R	ecogniz	e auto	matio	n, corroboi	rating these I	knowledge	with case	
ability to analy	st ha	studies on automation systems. study and analyze the material handling systems, robots and GT,								
in a simple and	logical manner and to apply	2. A	2. Able to demonstrate NC programming (Manual/APT).							
to its solution a	a few, well understood basic	3. G	3. Get acquainted with simulating program on CNC milling/ lathe.						lathe.	
principles		4. G	4. Get acquainted with working on CNC milling/ lathe							

Minimum 8 practical to be performed

Expt. No.	Title of the experiment
1	Practice Programming on APT
2	Practice Programming on Manual Part.
3	Performance, Simulation on lathe (atleast two Complex Geometric)
4	Performance, Simulation on CNC milling (atleast two Complex Geometries)
5	Performance, on CNC lathe (atleast two Complex Geometric)
6	Performance, on CNC Milling (atleast two Complex Geometric)
7	Case Study on Automated System of any Industry.
8	Performance/ Practical on Robot.
9	Part Coding and Group Technology
10	Study of FMS

Text Books

S.N	Title	Authors	Edition		Publisher
1.	Automation, production System & CIMS	M P, Groover	Third edition (20	007)	PHI Prentice Hall
2.	CAD/CAM	Zimmers & Groover	Fifth edition (20	008)	PIII Pearson Education India

S.N	Title	Authors	Edition	Publisher
1.	Numerical Control And Computer Aided Manufacturing	Rao, N K Tiwari, T K Kundra	13th edition (2007)	Tata McGraw-Hill Education
2.	Computer Control of Manufacturing Systems	Koren	2005	Mcgraw Hill

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MECHANICAL ENGINEERING

SEVENTH SEMESTER

Course Code Course Name			Th	Tu	Pr	Credits		Evaluation	
21ME702T(i)	Professional Elective - V : HVAC)	2		l _	2	CA	ESE	Total
2111127021(1)	System Design Using BIM Softwa	vare 3	-	-	3	30	70	100	
Course Objectives						Course Or	utcomes		
 To provide components, to the student To enhances students on I air distribution 	overview of the HVAC sector, Codes & standards in HVAC systems s. the analytical and design skills of the neating, refrigeration, ventilation and system design.	• • • • •	Expla standa Expla Calcu Desig Seleo	in the r ards re in and late he n ducti ct pump	most im lated to classify at load ng for l os, fans	portant conce HVAC syste chillars, AHL for given buil HVAC system and piping s	epts, compo ems. J's and desig ding vstem	nents, Codes gn AHU room	÷ &

Unit I	[7Hrs]
Introduction to HVAC systems: An Overview of HVAC System	ms, Scope of HVAC Engineering, Standards and codes used in
HVAC, Modes of heat transfer, Basic Laws for HVAC designing, stu	udy on psychrometric charts {manual and software), Psychrometric
properties	
Unit II	[9Hrs]
Chillars and AHU's: Introduction, classification, selection of chil	lar, Installation of chillars, chillar plant layout, Accessories, chillar
valves & fittings. Introduction to AHU, classification of AHU, AHU	process, accessories, AHU room design
······································	F
Unit III	[8Hrs]
Heat Load Calculation:-Methods for Heat load calculation, ma	anual heat load calculation, building survey, material survey, U-
factor, tonnage calculation, hehumidified flow rate, hourly Analysi	s Program (HAP).E20 sheet Calculation.
	5 (),
Unit IV	[9Hrs]
HVAC Ducting:- Introduction to Duct Family, classification, duct	material, installation of duct, duct joining methods, leakproof test,
acoustic insulation, Manual Duct Design, McQuay Duct Sizer, cor	stant friction method, velocity reduction method, thumb rule, sheet
metal calculation	
Unit V	[7Hrs]
	[1110]
Air Terminais: Diffusers, grills, dampers, types.	
Piping: introduction, Retrigerant Piping, insulation, piping access	sories, chiller water piping, condensor piping, drain piping, pipe
testing, sizing.	
Pumps and Fans: Pump selection, pump head calculation, selection	tion of fan, ststic pressure calculation.

Text Books:

S.N	Title	Authors	Edition	Publisher
1.	Principles of Heating, Ventilation And Air Conditioning With Worked Examples.	Nihal E Wijeysundera.	2016	World Scientific.
2.	Handbook Heating, Ventilating, And Air- Conditioning Applications.	ASHRAE	2015	ASHRAE, Atlanta, GA.
Referer	ce Books:			
S.N	Title	Authors	Edition	Publisher
	Principles of Heating, Ventilation, and Air Conditioning in Buildings	John W. Mitchell, James E. Braun	2013	John Wiley & Sons, Inc.

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B. Tech. Scheme of Examination & Syllabus 2021-22

MECHANICAL ENGINEERING

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits		Evaluation	
	Professional Elective - V : HVAC CA E		ESE	Total				
21ME702P(i)	System Design Using BIM Software (Lab)	-	-	2	1	25	25	50
	Course Objectives				Course	Outcomes		
 To provide ov Codes & stand To enhances students on distribution system 	verview of the HVAC sector, components, dards in HVAC systems to the students. the analytical and design skills of the heating, refrigeration, ventilation and air stem design.	 Pe so Pr 	erform h erform h ftware. epare e	nands- nands-	on design of H on design of I e of HVAC sy	HVAC systen HVAC syster /stem using I	n using Autoo n using Autoo Revit software	cad. desk Revit e.

LIST OF PRACTICALS

Minimum 5 practical to be performed

Experiment No.	Title of the Experiments
1	Hands-on on AutoCad interface
2	Drawing Civil layout, creating blocks, drawing line diagram of HVAC system, machine placing, duct routing
3	2-D drafting of complete HVAC system using AutoCad Software
4	Hands-on on Revit software interface
5	Creating Revit Civil layout, starting HVAC project, insert mechanical system, energy analysis using revit
6	Complete HVAC project on Revit
7	Estimation: Prepare estimation of HVAC equipment, material, prepare project quotations, bill of quantity
	using revit.

Text Books

S.N	Title	Authors	Edition	Publisher
1	Autodesk Autocad user manual	Autodesk		Autodesk
2	Autodesk Revit 2022 MEP fubdamentals	-		SDC
3	Exploring Autodesk Revit 2022 for MEP	Prof. Sham Tickoo Purdue Univ. and CADCIM Technologies	8 th	Autodesk

S.N	Title	Authors	Edition	Publisher

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Chairman - BoS	Dean – Academics	Date of Release	Version	2024-23



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MECHANICAL ENGINEERING

Course	e Code	Course Na	me	Th	Tu	Pr	Credits	E E	Evaluation	
		Professional Elective	- V. Industrial	3	-	-	3	CA	ESE	Total
21ME7	702T(ii)	Professional Elective		Ŭ			J	30	70	100
		KODOLIC	5							
		Course Objectives					Co	ourse Outcome	\$	
This cou	urse is int	ended		S	tudent	will he	able to		5	
				•	Inte	erpret t	erminolog	ies related to Ro	botics techno	ology.
To exp	lore the	evolution and principles	of robotics, class	ify 🛛 鱼	Un Un	derstar	nd various	grippers and se	nsors for rob	otics.
robotic	systems,	analyze resolution and dea	xterity, select robo	ots 🛛 鱼	Ар	ply log	ic for sele	ection of robotic	systems, ce	ell layout
based o	on usage,	examine grippers and sen	sors including typ	es	and	d its pro	ograming.			of volume
and des	and design guidelines, discuss robot cell layout programming Integrate knowledge of AI techniques in the area of robotic techniques in the area of robotic technology.						OI TODOUC			
safetv s	safety standards, and Al integration.									
Unit I										[7Hrs]
Introdu	ction to	robotics : Brief History Ba	asic Concepts of F	Robotic	s such	as De	finition F	lements of Robo	otic Systems	ie Robot
anatom	v. DOF. e	etc., Classification of Roboti	c systems such a	s work	volume	e. type	S of drive.	Associated par	ameters i.e	accuracy.
repeata	bility. Intr	oduction to Principles & Str	ategies of Automa	tion, T	ypes 8	Level	s of Auton	nations, Need of	automation,	Industrial
applicat	tions of ro	bot.								
Unit II						-				[8 Hrs]
Gripper	rs and Se	ensors for Robotics: Grip	pers for Robotics	- Types	s of Gr	ippers	and applic	cations. Sensors	for Robots -	Types of
Sensors Need fo	s used in or sensors	and vision system in the w	orking and control	of a ro	s, Cna bot	racteris	Stics of se	ensing devices,	Selections of	sensors.
Unit III			onking and control							[7 Hrs]
Drives	and Con	trol for Robotics: Drive ·	· Types of Drives		s of tra	ansmis	sion syste	ms. Actuators a	and its select	tion while
designir	ng a robo	system. Control Systems:	Types of Controlle	ers, Inti	roductio	on to cl	losed loop	control.		
	0			-						
Unit IV	<u> </u>									[7 Hrs]
Robot	Cell layo	uts and Languages for	Robotics: Rob	ot Ce	ll layo	uts, m	ultiple ro	bots and mach	nine interfac	e, other
Robotic		es Introduction to various	types such as VAI			ROS	iming, Pro	gramming Lang	uages. Gene	rations of
Unit V	Languag			., 10 01	., /,	1100				[7 Hrs]
Econor	nical trer	nds & Future aspects in R	obotics: Socio-E	conomi	ic aspe	ct of ro	botisation	Economical as	pects for rob	ot design
Safety f	or robot a	ind standards, Introduction	to Artificial Intellige	ence, A	Al techr	niques,	Need and	application of A	I, New trends	s & recent
updates	s in roboti	CS.	Ũ			•		••		
_	_									
Text Bo	ooks						· · ·			
S.N		Title	Autho	rs		Ed	ition	P	ublisher	
1.	industri	ai Kodotics	Groover.M.P.			1996		McGraw - Hill I	nternational e	eaition

2.	Introduction to Robotics	S. K. Sal	na 2	014	TATA McGraw Hills Education				
3.	Robotics and Control	R. K. Mit	tal, I. J. Nagrath 2	.003	TATA McGraw Hill Publishing Co Ltd				
Refer	Reference Books								
S.N	Title		Authors	Edition	Publisher				
1.	. Robotics Technology and Flexible Automation		Deb S R	1994	Tata McGraw Hill New Delhi				
	Robolics reciniciogy and rickible / lo	tomation	000010	1001	rata mooran rini, non Bonn,				

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MECHANICAL ENGINEERING

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits		Evaluation	
	Professional Elective –II: Industrial			2	1	CA	ESE	Total
21WE702F(II)	Robotics Lab	-	-	2	Ĩ	25	25	50
	Course Objectives				Cours	e Outcomes		
 Familiarize stu Develop practi Provide hands tasks. Cultivate profice robotic devices 	Idents with robotic systems and sensors. Ical skills in robotics and automation. Is-on experience with industrial automation Ciency in programming and controlling S.	• • •	Acquir pick ar Develo color s Desigr materia Integra automa	e profic nd plac op skills ensors n and ir al hanc ate mul- ation sy ntrol.	ciency in var e, object de s in utilizing s for automa nplement co lling. tiple compo ystems, sho	ious robotic op tection, and pa sensors such tion tasks. onveyor belt sy nents to devel wcasing skills	perations incl alletizing. as photoelec vstems for eff op complex in system int	uding tric and 'icient egration

LIST OF EXPERIMENTS

Minimum 8 practical to be performed

Exp. No.	Title of the Experiments
1	Performance based on pick and place using Dobot magician robot
2	Performance based on to detect objects in front of the photoelectric switch (Proximity Sensor).
3	Performance based on to categorize red, blue and green objects using color sensor.
4	Performance based on palletizing cubical box.
5	Performance based on mini conveyor belt for material handling.
6	Performance based on writing/drawing/laser engraving using dobot magician robot
7	Performance based on to integrate color sensor, converyour belt and robotic arm.
8	Performance based on milling operation using cartesian coordinate robot.

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Industrial Robotics	Groover.M.P.	1996.	McGraw – Hill International edition
2.	Introduction to Robotics	S. K. Saha	2014	TATA McGraw Hills Education
3.	Robotics and Control	R. K. Mittal, I. J. Nagrath	2003	TATA McGraw Hill Publishing Co Ltd

S.N	Title	Authors		Publisher	
1.	Robotics Technology and Flexible Automation	Deb S R	1994	Tata McGraw Hill, New Delhi,	
2.	Fundamentals of Robotics	Dilip Kumar Pratihar,	2019	Narosa Publishing House	

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B. Tech. Scheme of Examination & Syllabus 2021-22

MECHANICAL ENGINEERING

SEVENTH SEMESTER

Course Code	Course Name		Th	Tu	Pr	Credits		Evaluation	
21ME702T(iii)	Professional Elective-V : Finite Element		3	_	_	3	CA	ESE	Total
21WL/021(III)	Methods		3	-	-	5	30	70	100
Course Objectives					Co	ourse Outco	mes		
The objective of the course is to teach the Iden			fy the	applica	tion of	fundamenta	als of solid m	echanics for	evaluation

fundamentals of finite element method with emphasize on the underlying theory, assumption, and modeling issues as well as providing hands-on experience using finite element software for modeling & analyzing stresses, strains, deformations, natural frequencies, modal shapes, etc. for machine/structural components.	 of structural problems subjected to Point load, body force, and torsional loads. Study the application and finite elements formulation for truss. Formulate mathematical models for the solution of common engineering problems using beams, its finite element formulation and understand the load distribution. Understand the application and need of using 2D finite element to formulate simple in plane loading problem. Identify the significance and difference between the formulation and application of thermal engineering problems using 1D finite elements.
Unit I	[8Hrs]
Introduction: Theoretical background, Brief Advantages and disadvantages of FEM. Fi Coordinate systems – global, local (natural) dependent variables. Principle of Minimum Potential Energy (Rayl formulation. Shape functions – linear, propertie of stiffness matrix, Boundary conditions. FE F Point load, self-weight and torsion.	History of FEM, General FEM procedure, Applications of FEM in various fields, nite element modeling: Concept of Node, Element, (types of Finite elements), coordinate systems, Types of loads, Concept of Degrees of freedom, field and eigh-Ritz Method), mathematical formulation and application in 1D finite element es of shape functions. Assembly of global stiffness matrix and load vector, Properties Problems on 1D bar element and composite element. Finite element formulation of [7Hrs]
Truss: Introduction Plane truss, formulation assembly.	of stiffness matrix for truss, problem on truss. Axisymmetric formulation for truss
Unit III Beam:Finite Element formulation of Beams – conditions, problems on beam.	[7Hrs] Introduction, element formulation, load vector for point load, UDL & UVL, boundary
	[7Hrs]
CST: 2D CST ELEMENT: Coordinate Mappin stress problem formulation and numerical.	g Global and local coordinates. Formulation of stiffness matrix, load vector. Plane
Unit V	[7Hrs]
ThermalLoad Formulation: 1D Thermal Load Conduction using Fourier's law, Finite Element	I problem using the coefficient of Thermal expansion, 1D Steady State Heat formulation of 1D Steady-State Heat Transfer.

Text Books

ARISE & SHINE

S.N	Title	Authors	Edition	Publisher
1.	Introduction to Finite Elements in Engineering	Chandrupatla.T.R., Belegunda A	A. 4th	Pearson Education India
2.	A First Course in the Finite Element Methods	Daryl Logan	5th	Cengage Learning India Private Limited
Refe	rence Books			
S.N	Title	Authors	Edition	Publisher
1.	Practical Finite Element Analysis	Nitin S.Gokhale		Finite To Infinite

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MECHANICAL ENGINEERING

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	E	valuation	
21ME702D(iii)	Professional Elective-V Finite Element	_	_	2	1	CA	ESE	Total
2 TWL/02F(III)	Methods Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
• The objective of the course is to teach the fundamentals of finite element method with emphasize on the underlying theory, assumption, and modeling issues as well as providing hands-on experience using finite element software for modeling & analyzing stresses, strains, deformations, natural frequencies, modal shapes, etc. for machine/structural components.	 Model finite element problems using commercial software and understand the fundamental use of finite element preprocessor, solver and post-processor. Demonstrate the ability to evaluate and interpret Finite Element Analysis results for the design and evaluation of 1D finite element formulations. Understand the Finite Element Modeling aspects of 2DFinite Element problem for solving in-plane loading problems.

Practical: All the practical have to be

- 1. Static structural analysis of Axially loaded bar with 1-D finite elements.
- 2. Static structural analysis of bar under the influence of self-weight.
- 3. Static structural analysis of bar under applied torque.
- 4. Static structural analysis of 1D truss.
- 5. Static structural analysis with 2-D Plate (CST)element..
- 6. Static structural analysis of a beam under transverse loading.
- 7. 1D Steady State Heat Transfer to estimate temperature distribution within composite wall.

Text Books

ARISE & SHINE

S.N	Title	Authors	Edition	Publisher
1.	Introduction to Finite Elements in	Chandrupatla.T.R.,Belegunda A.	4 th	Pearson Education India
	Engineering	D.,		
2.	A First Course in the Finite Element Methods	Daryl Logan	5th	Cengage Learning India Private Limited

S.N	Title	Authors	Edition	Publisher
1.	Practical Finite Element Analysis	Nitin S.Gokhale		Finite To Infinite

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MECHANICAL ENGINEERING

Course	Code	Cou	irse Name		Th	Tu	Pr	Credits		Evaluatio	on	
		Professional E	lective - VI : Hea	ating					CA	ESE		Total
21ME70)3T(i)	Ventilation ar	nd Air Condition	ing	3	-	-	3 30		70		100
		S	ystems						50	100		
		Course Objective	8					Course (Dutcome	9		
5 To pr	rovide	overview of the	HVAC secto	r 🖕	Evolai	in the n	nost im		cents co	moonents Co	des 8	2
compo	onents, (Codes & standards	in HVAC system	is is	standa	ards rel	ated to	HVAC svs	tems.	inponents, oc	ues c	x
to the s	students	3.	,	•	Explai	in and	apply s	steady heat	and mois	sture transfer	proce	esses fo
3. To enh	nances t	the analytical and c	design skills of th	е	estima	ating he	at tran	sfer in build	lings		-	
studen	its on h	leating, refrigeratio	on, ventilation an	d •	Analyz	ze perfo	ormano	ce of air was	hers and	l cooling tower	s	
all uist	Indution	system design.		•	Analyz	ze and	design	air distribut	ION SYSTE	ms for HVAC		ations.
				•	applic	ations.	uesiy	ii watei uis		Systems for I	IVAC	
llnit l												7Hrel
Introduc	ction to	HVAC systems	and componen	ts: An (Overvie	w of H	IVAC	Svstems, S	Some Op	tional Design	s of	HVAC
Systems	, HVAC	system using air a	s the energy tran	sport me	dium, I	HVAC s	system	using wate	r as the e	energy transpo	ort me	edium,
HVAC sy	ystem u	using water and air	as energy trans	port me	dia, Pa	ickaged	and	unitary syst	ems, Rev	versible heat	pump	s for
heating a	and cool	ling, Overview of H\	AC Design Proc	edure, C	odes &	standa	rds for	HVAC syst	ems.			
l Init II												[9Hrs]
	Heat ar	d Moisturo Trans	sfer Processes	in Build	ings:-	Introdu	uction,	Steady Hea	at Transf	fer through Mu	ulti-La	ayered
Steady					•			•				,
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Steady I Structure Windows basemer Infiltration Unit III Direct-C plane wa Humidifie Enthalpy Unit IV Air Distr ducts, Pr characte regain m Design a Unit V Water D Friction h Design o S.N 1. 1 0. 2. 1 0. Reference	contact all, Stea or air flov contact all, Stea or air flov contact all, Stea or s, Ana or potentia ribution ressure cristics, bethod, C aspects of condition ks: Principle Condition Bandboo Conditio	allel path method, oors, Below Grade s, Heat transfer thi w rates, Estimation Transfer Process ady convection mas alysis of air washers al based model for o Systems:- Introdu loss in fittings, Tota Fan laws, Fan–Du Optimization of Ducto of air distribution system tion Systems:- Int s in pipes, Dynami Distribution System Title s of Heating, Ventilatin ning With Worked Ex ok Heating, Ventilatir ning Applications.	Isothermal plane Heat Transfer in rough surfaces a of infiltration flow es and Systems ss transfer, Simp , Efficiency and n cooling towers, A inction, Total Press al pressure loss i ct Network Intera t Systems, Air Dis stems. Froduction, Energ ic head loss in fit ns, Direct-return a tion And Air amples. ng, And Air-	e metho n Buildin at grade rates, Ma s: Revie blified Ma umber of oproach sure Dist n duct s action, D stribution y Equat tings, Pu and rever Nihal E ASHRA	d, Zon gs, Hea level, pisture w of M odel for f transfe and rar intransfe and rar citransfe and rar citransfe citransfe and rar citransfe citransfe and rar citransfe ci	e metł at trans Infiltra Transp lass Tr r Simu er units nge of c n, Press , Air Di Methoo aractel irm syst s undera.	nod, S sfer the ion in ort in E ansfer taneou (NTU) cooling sure Lo stributi ds for flow fro nic Sy istics, ems, D 20 20	teady Heat rough base Buildings, Building Stru Principles, us Heat and towers. Doss in Duct N ion Fans, A Duct System Duct System Stems, Heat System–Pu Design of pip Edition	Transfe ment wal Heating ictures, F Steady r d Mass T bwers, Ar Networks xial flow a ms, Equa a, Air diffu ad Losse mp Intera be networ	er through Fe Ils, Heat trans Ioad due to ick's law. mass diffusion Transfer, Air M nalysis of cooli , Pressure los and centrifuga al friction met Ision performa s in Hydronic action and Flo ks. Publis	nestra fer th infiltra i thro Vashing tov Vashing tov I fans i hod, nce ir Syst w Co isher c. inta, C	ations, arrough ation, [8Hrs] ugh a ers or wers, [9Hrs] traight s, Fan Static ndex, [7Hrs] tems, introl, GA.
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Chairman - BoS	Dean – Academics	Date of Release	Version	2024-23



MECHANICAL ENGINEERING

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	E	valuation	
	PE-VI Smart Manufacturing and					CA	ESE	Total
21ME703T(ii)	production system	3	-	-	3	30	70	100

Course Objectives	Course Outcomes				
1: Impart knowledge of smart manufacturing for industry 4.0 for making student innovative.	 Become Comfortable with terminology and practices in Smart Manufacturing Able to face the challenges in Industry & also contribute towards advancement. Become Active part of Industry 4.0 (Fourth Industrial Revolution) Create smart production and co-created product development concepts in planning and controlling company's operations. Design real time data analytics and software systems to support planning, scheduling and control of smart production processes and systems 				

Unit I [7Hrs] Industry 4.0 Concept, The Fourth Revolution, LEAN manufacturing, Smart and connected business perspectives, Smart factories. Unit II [7Hrs] Nine Pillars of Smart Manufacturing ,Big Data & analytics ,Autonomous Robots ,Simulation ,Universal System Integration ,IIOT -Industrial Internet of Things ,3 D Printing – Additive Manufacturing ,cloud Computing ,Augmented Reality. Unit III [7Hrs] Convergence of Nine Pillars ,Business Propositions delivered with Smart Manufacturing ,Adding Smartness to Manufacturing – Adoption & Scaling ,Economic Aspects ,Ecosystem Required for Smart Manufacturing ,Skill set Required for Smart Manufacturing ,Effects on 4 M- Man, Machine, Materials & Methods in Smart Manufacturing. Unit IV [7Hrs] Operation management strategy in industry 4.0 context, Impact of industry 4.0 on modern operation management in strategic level, Smart product and co-created design concept and tools, The design of smart production planning system and supply chain model Unit V [7Hrs] Intelligent ERP and integration of IoT, massive data analytics. Cognitive and process automation, Integrated planning system including aggregated planning, master production schedule (MPS), material requirement planning (MRP), and capacity planning (CRP) by utilizing real-time data, Advanced shop floor control **Text Books**

S. N	Title	Authors	Edition	Publisher
1.	Smart Manufacturing	Shoukat Ali	2016	LAP LAMBERT Academic
	_			Publishing
2.	Industry 4.0 Data Analytics31	Rajesh Agnihotri and	2016	CreateSpace Independent
		Samuel		Publishing Platform
3.	Operations and Supply Chain Strategy in the Industry 4.0 Era	Guilherme Frederico	2018	Independently Published,

S. N	Title	Authors	Edition	Publisher
1.	Shaping the Future of the Fourth	Klaus Schwab and	2018	Crown Publishing Group
	Industrial Revolution	Nicholas Davis		
2.	Handbook of Industry 4.0 and SMART	Diego Galar Pascual,	2018	CRC Press
	Systems,	Pasquale Daponte and		
		Uday Kumar		

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B. Tech. Scheme of Examination & Syllabus 2021-22

MECHANICAL ENGINEERING

SEVENTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
21ME702T(iii)	Brofossional Elective VI- Tool Design	2	_	_	2	CA	ESE	Total
2111127031(11)	Froiessional Elective VI- roof Design	Elective vi- Tool Design 3 -	3 -	-	3	30	70	100

Course Objectives	Course Outcomes
 Objectives of this course are : To make students aware about various types of tools. Make students well conversent with design of tools used in metal cutting process, press working operations. To make students well conversent with design of jigs and fixture. To provide awareness about forging operation die design. 	 Design tool shank for single point cutting tool, boring tool and perform calculations for multipoint cutting tool. Desing press working cutting operation dies and calculate cutting forces in press working operation. Explain press working bending, drawing operations operation, evaluate various parameters and design drawing dies. Explain and classify forging operation dies, apply various design factors for forging dies and understand design procedure for closed and open die forging. Design jigs and fixture for given component using general principles of design, location, clamping etc.

Unit I Design of single Point Cutting Tool: Design of tool shank for turning operation, Design of boring bar Form tools- Introduction, types of form tools. Multipoint cutting tools: Drills- Introduction, Types, Geometry, calculations of moment, thrust, power, MRR etc.

Milling cutters - Introduction, Types, Geometry, calculations of MRR, power, cutting time, torque, number of teeth etc.

Unit II [8Hrs] Press working (Cutting operation): Introduction, types of press tool cutting operations, tonnage of press, cutting force calculations, methods of reducing cutting forces, Types of cutting operation dies (construction and working), Design of blaking and piercing dies. Unit III [8Hrs]

Press Working (Bending& Drawing operation): Introduction and types to bending operations, calculation of blank development, spring back effect, calculation of bending force.

Press working (Drawing operation): Introduction, calculation of number of draws, drawing force, blank holdong force, design of drawing die.

Unit IV

Forging operation: Introduction, types of forging operations, various allowances in forging die, classification of forging dies, forging die design factors, Preliminary forging operation - fullering, edging, bending, drawing, flattering, blacking finishing, cutoff. Die design procedure for machine forging in closed & open die forging, materials of forging dies.

Unit	۷	
		_

[8Hrs] Jigs and Fixture: Introduction, general principles for design of jigs and fixtures, principle of location, principle for clamping, clamping devices, types of jig bushes, design of drill jig. Design of Milling Fixtures and lathe fixtures.

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Production Engineering	P.C. Sharma		S.Chand Publication
2.	Tool Design	Donaldson		Tata McGraw Hill, New Delhi
3.	Jigs and Fixtures	P.H.Joshi		Tata McGraw Hill, New Delhi

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Fundamentals of the Tool Design	ASTME		Prentice-Hall of India Private Ltd., New Delhi
2.	Manual of Jigs and Fixtures Design	Henrickson		Industrial Press Inc., New York.

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Chairman - BoS	Dean – Academics	Date of Release	Version	2024-25

[8Hrs]

[8Hrs]



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B. Tech. Scheme of Examination & Syllabus 2021-22

MECHANICAL ENGINEERING

Course	Code	Course Name		Th	Tu	Pr	Credits		Evaluation	
21MF76	10	Open Elective – III -Renewable	Energy	3	-	-	3	CA	ESE	Total
21111270		Resources		5	_		5	30	70	100
		Course Objectives					Οοι	Irse Outcor	nes	
 The non-conventional energy sources and their utilization to harness power. The students will learn the solar energy utilization with its applications. The students will also understand the various methods by which energy can be generated from wind, ocean tides, geothermal phenomenon, biogas and MHD. Will appreciate the importance of renewable energy systems 					Un of u util De use Exp Va util Ide	derstar renewa ization scribe ed for olain va olain so olain so rious s ization ntify	nding and c ible source main eleme utilization arious appli ources of sources of various m	lefine basic s of energy ents of conc of renewa cations of so energy such obtaining i ethods by	characteristics, and technologic entration type o able sources o blar energy. a as biomass a t, fuel properti- which energy	properties es for their f collectors of energy. nd biogas. es and its / can be
systems.					ger dis Exp geo pro	nerated advant plain ty ptherm blems.	I such as w ages. pes of geot al energy Magneto F	/ind, ocean, hermal ene /, operatio lydro Dynar	tides, its advar rgy, applications onal & env nic power gene	ntages and s of ironmental ration.
110:41										[7]
SolarEnergy:Introduction,solarconstant,spectraldistributionofsolarradiation, beam & diffuse radiation, solar radiation measuring instruments.Solar radiation geometry and solar angles. Solar flat plate collectors: Types of collectors, liquid flat plate collectors,										
Unit II	iealeis,	collector enciency, analysis of hat			reidesių		Juliector.			[7Hrs]
Concentr parabolic space co voltaics.	Concentric collectors: line focusing, point focusing and non focusing type,central receiver concept of power generations, compound parabolic collector, and comparison of flat &concentric collectors. Applications of solar energy to water heating, space heating, space cooling,dryingrefrigeration, distillation,pumping.Solarfurnaces,solarcookers,solarthermalelectricconversion, solar photovoltaics. Solar energy storage, solarpond.									
Biogas: -	Introdu	ction bio gas generation fixed do	me & float	ting dru	um biog	asolar	nts their co	nstructional	details raw m	aterial for
biogas pr Incinerati	roduction ion, ther	n, fuelproperties ofbiogasand utiliza mal gasification, classification of gas	tionof biog sifiers & co	as. Bio	mass: ionalde	Introdu etails,a	ction, metho oplications	odsof obtain ofgasifiers.	ingenergy from	biomass,
Unit IV	-									[7Hrs]
Windand data and electric c plants.	Oceane l energy onversio	nergy:PowerInwind,forcesonblades estimation.BasiccomponentsofWE on, openand closed cycle of OTEC,	Basicprin ECS,classi , energy fr	ciple o fication om tide	f wind ofWEC es, basi	energy Systen c princ	 conversions. Ocean iples of tida 	n, site sele energy: Int al power &co	ction considera roduction, ocea omponents of tio	tion, wind in thermal dal power
Unit V										[7Hrs]
Geothern thermalsy power ge	nal ystems,a neration	energy: Introduction,class and magmaresources,applicationsc : Introduction, principles ofMHD pov	sificationof ofgeotherm wergenerat	geothe aloperation,MH	rmalsy ational IDopen	stems, &envirc andclo	vapourdom onmental pr sedsystem	nated&liquio oblems. Ma s,poweroutp	ddominatedsyst gneto Hydro Dy utfromMHDgen	em,petro- namic erators.
Text Book	KS	PD3 / 3	1							1
S.N	_	Title			Author	:s		Edition	Publish	ner
1.	Renewa and App	ble Energy Recourses: Basic Princi blications	ple G.	N. Hwa	ırı, M.K	.Ghosa	1		Narosa public	ation
2.	Non- Co	onventional Energy Resource	es E	3.H.Kha	an				Tata McGraw	Hill
Reference	e Books		1				I			
S.N		Title	Authors Edition Publisher							
1.	Non-C	conventional Energy Sources	G.D.Rai					Khanna p	oublishers	
2.	Renev Emerg	vable Energy Sources and ing Tech.	D. P. Ko	thari				Prentice	Hall India	

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